



*Consulting Engineers,
Architects & Planners*

November 18th, 2025

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

Attention: Alisha Cull| Manager of Planning Services

**Reference: 2834103 Ontario Inc.
Application for Zoning By-Law Amendment
Roll# 49199001066
Our File 23-024**

G. Douglas Vallee Limited, acting as the authorized agent for Allan Gee, is pleased to submit this application for a Zoning By-law Amendment for Roll Number 49199001066. Please accept this package as our formal submission.

Included as part of our complete application package are the following documents:

1. Signed Zoning By-law Amendment application form;
2. Planning Justification Report prepared by G. Douglas Vallee Limited, dated November 12th, 2025;
3. Conceptual Site Plan, prepared by G. Douglas Vallee Limited, dated September 10th, 2025;
4. Functional Servicing Reports prepared by G. Douglas Vallee Limited:
 - East Sites, dated October 8th, 2025;
 - West Sites, dated November 14th, 2025;
5. Traffic Impact Study prepared by RC Spencer and Associates, dated September, 2025;
6. Stage 1 & 2 Archeological Assessment prepared by Archeological Consultants Canada, dated October 3rd, 2025;
7. Plan of Survey prepared by Jewitt and Dixon, dated January 22, 2025;
8. Pre-Consultation Meeting Notes prepared by Norfolk County, dated December 11th, 2024.

The submission has been made electronically through the 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.

Best regards,

James Canzano, BA Spec Hons.
Planning Technician
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architect and Planner

H:\Projects\2023\23-024 Railway Subdivision - Delhi Planning\JR\2025.11.12 Cover letter JC.docx



Development Application for Zoning By-law Amendment

Complete Application

The application must be completed by the owner or authorized agent. If the application is being submitted by an agent, the owner's written authorization is required. If the lands subject to this application are owned by more than one owner, the authorization of all owners is required. Submission of this application constitutes consent for authorized municipal staff to inspect the subject lands.

It is the responsibility of the applicant to research and evaluate the site and the proposal to ensure that the development will conform to the interests of the health, safety and welfare of future residents. Sufficient studies for the completion of the application should be carried out prior to submission and should be reflected in the application form.

Online Application Process

All applications must be submitted online via the County's CityView Portal. The portal can be accessed here: [Welcome - CityView Portal](#). The applicant will submit the materials required as part of a complete application. Once the County confirms receipt of a complete submission, the applicant will be contacted and provided further directions for payment options.

Pre-Consultation Meeting:

Pre-Consultation is highly recommended for Zoning By-law Amendment applications. The purpose of a Pre-Consultation meeting is to provide the applicant with an opportunity to present the proposed development, discuss potential issues, and for the Norfolk County and external agencies to identify the application requirements. The requirements, as detailed in the Pre-Consultation meeting comments, are valid for one year after the meeting date.

User Fees:

The planning application fee will be determined when the application can be deemed complete according to Norfolk County Community Planning user fees: [User Fees | Norfolk County](#)

Additional agency plan review fees may apply. Please see below for more information and forward fees directly to the applicable agency, as required:

Grand River Conservation Authority

[Plan Review fees | Grand River Conservation Authority](#)

Long Point Region Conservation Authority

[Planning Fees - Long Point Region Conservation Authority](#)



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.

Development Application Process

Norfolk County staff will circulate the complete application to adjacent landowners, public agencies, and internal departments. Planning Act decision timeframes will apply in accordance with the provisions of Section 34 of the Planning Act. Norfolk County collects personal information submitted through this form under the authority of the Municipal Freedom of Information and Protection Act. Norfolk County will use this information for the purposes indicated by this form. Questions about collecting personal information can be directed to Norfolk GIS Services at NorfolkGIS@norfolkcounty.ca.

Additional studies required for a complete application along with peer reviews may be required and shall be provided at the applicant's sole expense. In these cases, 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.

Contact Us

For additional information or assistance completing this application, please contact a Planner at 519-426-5870 or planning@norfolkcounty.ca.

Notification Sign Requirements

For public notification, Norfolk County will provide you with a sign to indicate the intent and purpose of the 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.

**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.

- Zoning By-Law Amendment – Regular
- Zoning By-Law Amendment - Major
- Zoning By-Law Amendment - Minor
- Temporary Use By-law

Property Assessment Roll Number: _____**A. Applicant Information**

Note: It is the responsibility of the owner to notify the Planner of any changes in ownership or authorized applicant within 30 days of such a change

Name of Owner _____**Address** _____**Town and Postal Code** _____**Phone Number** _____**Cell Number** _____**Email** _____**Name of Authorized Applicant** _____**Address** _____**Town and Postal Code** _____**Phone Number** _____**Cell Number** _____



Email _____

Name of Authorized 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: _____

Land acquisition date (if known): _____

Present Official Plan Designation(s): _____ Urban Residential, Commercial

Present Zoning: _____

2. Is there a site-specific provision on the subject lands?

Yes No If yes, please specify the 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.

5. If an addition to an existing building is being proposed, please explain the proposed use.

6. Please describe **all proposed** buildings or structures/additions on the subject lands.

dwelling units, A semi-detached dwelling (two dwelling units) A small scale service commercial building (803m2). Total anticipated number of dwelling units – 57

7. Are any existing buildings on the subject lands designated under the *Ontario Heritage Act* as being of cultural heritage value or interest?

Yes No

If yes, identify and provide details:

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 describe the proposed development on the subject lands:

2. Please explain why it is not possible to comply with the provisions of the Zoning By-law :

3. Have the subject land or lands within 120 metres ever been and/or currently are the subject of a Planning Act application:

- Plan of Subdivision Yes No
- Official Plan Amendment Yes No
- Zoning Bylaw, or Zoning Order Amendment Yes No
- Site Plan Yes No
- Consent/Minor Variance Yes No

If yes, indicate the application file number and the status of the application

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):

Former railway corridor

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 land use inventory showing all known former uses of the subject lands, and/or when applicable, the adjacent lands, is required.

Is the land use inventory of former land uses attached? Yes No

E. Provincial Planning Statement

1. Is the requested amendment consistent with the Provincial Planning Statement 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 Planning Statement?

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, Intake Protection Zone (IP-Z), Issue Contributing Area (ICA), please attach relevant information and approved mitigation measures from the Risk Management 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

On the subject lands or within 500 meters – distance _____

Significant Woodland

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 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	Storm Drain		
Municipal piped water	<input type="checkbox"/>	Storm sewers	<input type="checkbox"/>
Individual wells	<input type="checkbox"/>	Open ditches	<input type="checkbox"/>
Communal wells	<input type="checkbox"/>	Other (describe below):	<input type="checkbox"/>
<hr/>		<hr/>	
Other (describe below):	<input type="checkbox"/>		
<hr/>			
Sewage Treatment	Existing or proposed access to subject lands		
Municipal sewers	<input type="checkbox"/>	Municipal road	<input type="checkbox"/>
Communal system	<input type="checkbox"/>	Provincial highway	<input type="checkbox"/>
Septic tank and tile bed in good working order	<input type="checkbox"/>	Unopened road	<input type="checkbox"/>
Other (describe below):	<input type="checkbox"/>	Name of road/street: _____	
<hr/>		<hr/>	
		Other (describe below):	<input type="checkbox"/>
		<hr/>	

2. Does the application require development on privately owned and operated individual or communal septic systems, and more than 4500 litres of effluent produced per day as a result of the development being completed?

Yes No

If yes, provide (i) Servicing Options Report and (ii) hydrogeological report with submission.

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. Indicate below or on a separate attachment, the applicant's proposed strategy for consulting with the public on the request for a zoning by-law amendment.

3. 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 and an electronic version of the site plan drawings, additional plans, studies and reports will be required in addition to a sketch plan in accordance with [Ontario Regulation 545/06](#).

A sketch showing, in metric units:

- a) the boundaries and dimensions of the subject land;
- b) the location, size and type of all existing and proposed buildings and structures on the subject land, indicating their distance from the front lot line, rear lot line and side lot lines;
- c) the approximate location of all natural and artificial features (*for example, buildings, railways, roads, watercourses, drainage ditches, banks of rivers or streams, wetlands, wooded areas, wells and septic tanks*) that,
 - i. are located on the subject land and on land that is adjacent to it, and
 - ii. in the applicant's opinion, may affect the application;
- d) the current uses of land that is adjacent to the subject land;
- e) the location, width and name of any roads within or abutting the subject land, indicating whether it is an unopened road allowance, a public travelled road, a private road or a right of way;
- f) if access to the subject land will be by water only, the location of the parking and docking facilities to be used; and
- g) the location and nature of any easement affecting the subject land



The following additional plans, studies and reports, including but not limited to, **may** be required as part of a complete application submission:

- On-Site Sewage Disposal System Evaluation Form (to verify location and condition)
- Cut and Fill Plan
- Erosion and Sediment Control Plan
- Grading and Drainage Control Plan (around perimeter and within site) (existing and proposed)
- 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
- Agricultural Impact Assessment
- Geotechnical Study / Hydrogeological Review
- Minimum Distance Separation Calculations
- Noise or Vibration Study
- Record of Site Condition
- Stormwater Management Report
- Traffic Impact Study

The approval of the proposed development might be subject to additional federal or provincial legislation, municipal by-laws or other agency approvals.

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



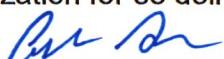
Date

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 2834103 Ontario Inc. – C/O Allan Gee 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 Scott Puillandre 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

Owner

Date

N. Declaration

I, Allan Gee

of 2834103 Ontario Inc.

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

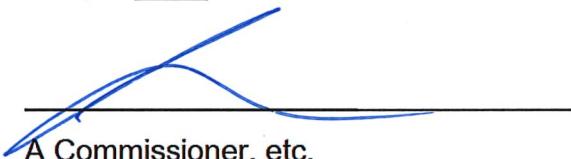
Am. Dr

Owner/Applicant Signature

In Norfolk County

This 11th day of November

A.D., 2025



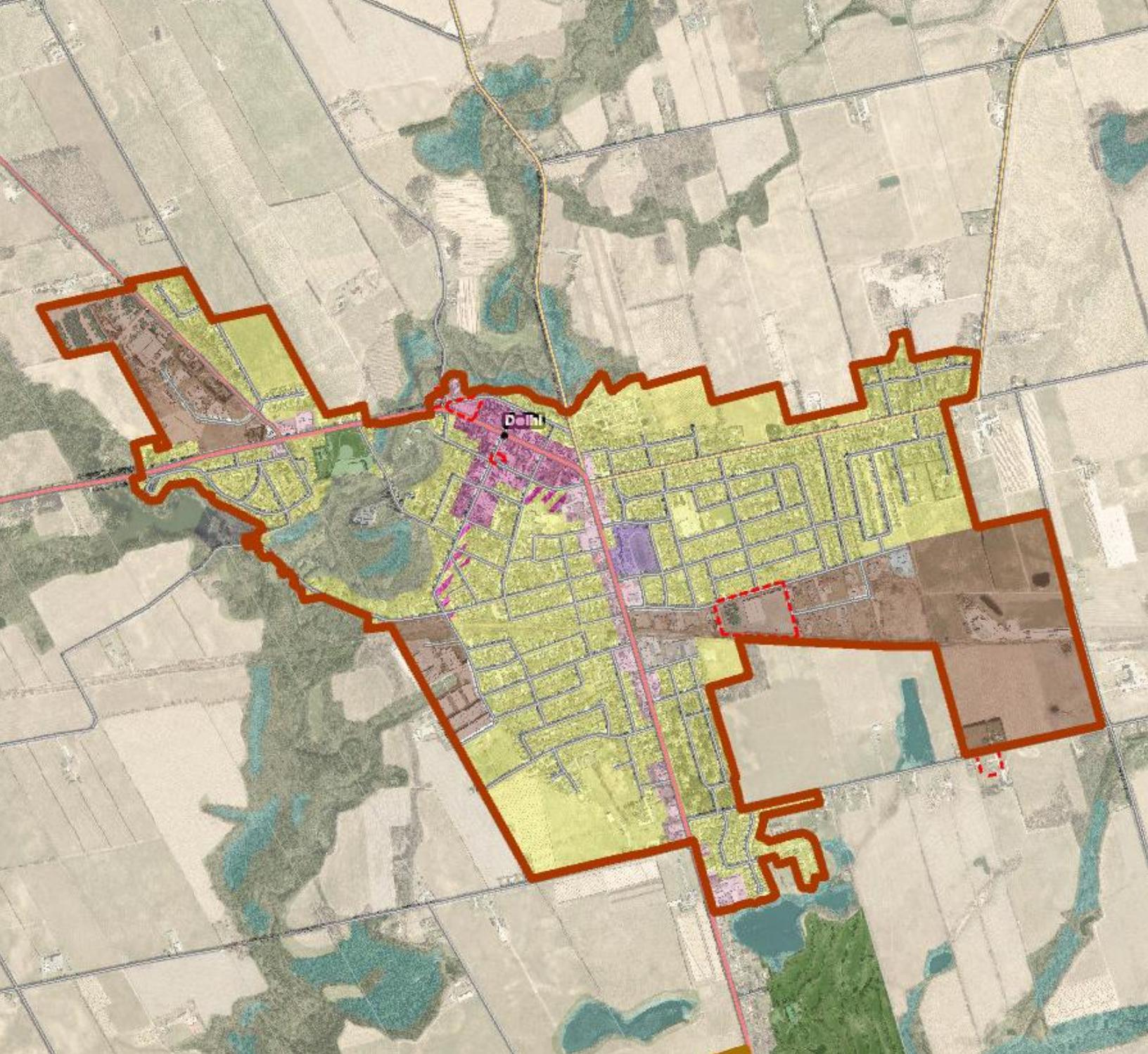
A Commissioner, etc.

JAMES JOHN CIARALLO-CANZANO,

a Commissioner, etc., Province of Ontario,

for G. Douglas Vallee Limited.

Expires February 26, 2028.



Zoning Bylaw Amendment

Railway Development, Delhi

Allan Gee Excavating

Planning Justification Report

Updated: November 10, 2025



vallee

*Consulting Engineers,
Architects & Planners*

Table of Contents

Introduction.....	3
Supporting Technical Studies	3
Development Review Summary.....	4
Site Description	5
Existing and Surrounding Land Uses	5
Development Overview.....	5
Zoning Bylaw Amendment.....	6
Policy Context	13
Planning Act	13
Provincial Interest	13
Provincial Planning Statement (2024)	14
PPS Summary	16
Norfolk County Official Plan	16
Official Plan Summary.....	17
Norfolk County Zoning By-law	17
Traffic	18
Environmental	18
Archaeological.....	19
Servicing	19
Conclusion.....	20
Appendices.....	21
Appendix A – Site Plan	
Appendix B – Planning Act Review Matrix	
Appendix C – Provincial Planning Statement 2024 Review Matrix	
Appendix D – Norfolk Official Plan Review Matrix	
Appendix E – Draft Zoning Bylaw	

Introduction

G. Douglas Vallee Limited, on behalf of 2834103 Ontario Inc. – C/O Allan Gee, is making an application to amend the Norfolk County Zoning By-law to facilitate the development of a 57-unit residential development in Delhi, in addition to applying a site-specific provision for the existing commercial zone to provide relief from parking provisions. The proposed development represents an innovative use of a former railway and would provide much-needed alternative housing forms in Norfolk County while redeveloping the existing commercial zone along James Street.

As shown in Appendix A, one zoning bylaw amendment application is being submitted for the entirety of the development lands. The proposed development will consist of the following uses upon final buildout:

- **Part 1**
 - Change the existing zone from Urban Residential Type 1A (R1-A) to Urban Residential Type 4 (R4) to permit group townhouses and semi-detached dwellings.
 - A special provision is required to permit specific zone provisions and clearly define the lot and street requirements.
 - These units will be constructed as part of a residential condominium. A future site plan and exemption from draft plan of condominium applications will be required for this part of the development.
- **Part 2**
 - Change the existing zone from Urban Residential Type 1A (R1-A) to Urban Residential Type 2 (R2) to permit a semi-detached dwelling.
 - A special provision is NOT required as all zone requirements of the R2 zone will be achieved.
 - The dwelling units will be constructed as freehold units. This part will be severed by way of consent from the balance of the subject property. Future exemption from part lot control applications will be submitted to further subdivide the dwelling units.
- **Part 3**
 - Maintain the existing Service Commercial (CS) zoning to permit a small-scale commercial use.
 - A special provision is required to permit a reduced setback for the location of the proposed parking lot.
 - The proposed commercial use will be severed by way of consent from the balance of the subject property.
- **Note: A full zoning review is provided later in this report**

Supporting Technical Studies

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

- Functional Servicing Report prepared by G. Douglas Vallee Limited, dated November 14, 2025.
- Traffic Impact Brief prepared by RC Spencer Associates Inc., dated September 2025.
- Archaeological Assessment prepared by Archaeological Consultants Canada, dated October 3, 2025.

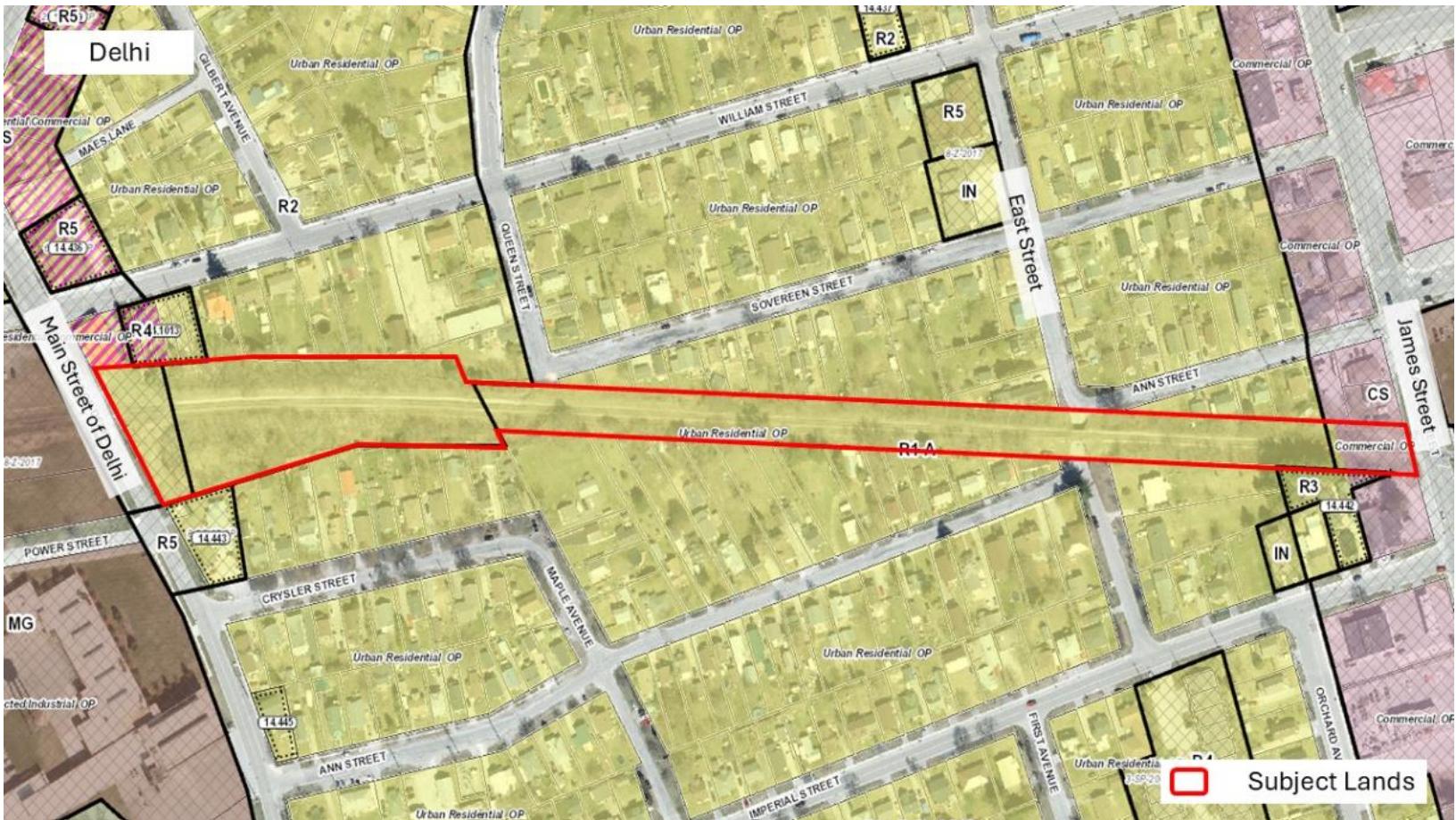


Figure 1 - Subject Lands

Development Review Summary

The proposed zoning bylaw amendment application has been reviewed against provincial and local planning regulations and policies. This application:

- Complies with the relevant sections of the Planning Act.
- Is consistent with the intent of the Provincial Policy.
- Conforms to the policies of the Norfolk County Official Plan.
- Confirms that traffic generation does not negatively impact the existing road network.
- Provides additional forms of housing encouraged by the Norfolk County Official Plan.
- Adequately controls stormwater to County standards.
- Can be provided with municipal water and wastewater services.
- Represents good planning.

Site Description

As shown on Figure 1, this unique parcel of land is a 700m long section of the former rail line in the urban area of Delhi running east-west between James Street and Main Street of Delhi. The entire development area is approximately 2.2Ha and is currently vacant. The property is bisected by East Street, however, the applicant is currently the owner of this section of the road.

The lands are primarily designated Urban Residential under the Norfolk County Official Plan and Zoned Urban Residential Type 1-A (R1-A) and Type 2 (R2) under the Norfolk County Zoning Bylaw. A small portion of the lands abutting James Street (easterly section) are designated Commercial and zoned Service Commercial (CS). The property is not located within a wellhead protection area and is not identified as containing any natural heritage features or natural hazards.

Existing and Surrounding Land Uses

As shown in Figure 1 below, the subject lands are bordered on the north and south primarily by low density residential land uses on the interior of the property. On the Easterly and Westerly extent of the property, small scale commercial uses exist along James Street and Main Street of Delhi, while low intensity industrial land uses are present on the west side of the Main Street of Delhi and east side of James Street.

Development Overview

As shown in Appendix A and Figure 2 below, the proposed development will include the following uses:

- Part 1 – A 55-unit residential condominium consisting of the following housing forms:
 - 31 group townhouse dwelling units
 - 24 semi-detached dwelling units.
- Part 2 – A semi-detach dwelling (two dwelling units)
- Part 3 - A small scale service commercial building (803m²)
- Total anticipated number of dwelling units – 57

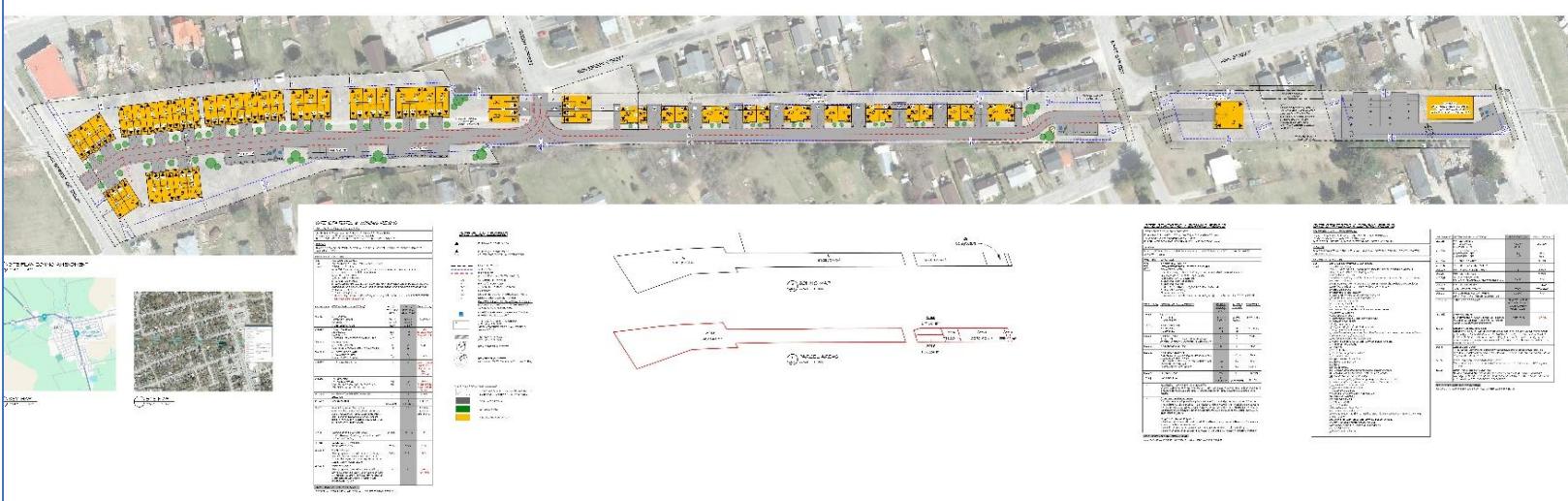


Figure 2 – Site Plan Planning Applications

There are four (4) planning applications required to facilitate the proposed development. At this time the only application being applied for is the zoning bylaw amendment.

1. Zoning Bylaw Amendment (Reviewed as part of this report)

To establish the necessary zoning provisions to implement the proposed site plan. A full zoning review of the requested site-specific provisions is provided below.

2. Consents (Future applications to be made to Norfolk County)

Two consent applications will be submitted to sever Parts 2 and 3 from the balance of the subject property. As these lands will be separate in both form and function from the residential condominium, it will simplify the development process and allow these parcels to be developed and sold individually.

3. Site Plan (Future application to be made to Norfolk County)

Individual site plan applications will be required for Part 1 and 3 to ensure a safe, functional design and control of elements of the proposed parts including elements such as servicing, stormwater, landscaping, access and hard surfaces.

4. Exemption of Draft Plan of Condominium Approval (Future application to be made to Norfolk County)

This application will be required for Part 1 to be registered as a residential condominium.

Zoning Bylaw Amendment

As outlined above, the proposed zoning bylaw amendment is required to apply the appropriate zone provisions to the subject lands to permit these forms of development. While the lands are currently designated and zoned to permit residential use, the proposed amendment would enable more efficient use of the lands through updated lot and yard provisions and to permit alternative forms of housing.

As shown in Appendix A, the following is a review of the required zone provisions for Parts 1-3.

Part 1 – R1-A to R4 with site-specific provisions			
Provision	Required	Proposed	Comments
2.88 Definitions	“LOT” shall mean a parcel of land which can be legally conveyed. Where two (2) adjoining lots are in common ownership and a main building straddles the lots, the two (2) lots are deemed to be one (1) lot for the purposes of establishing interior side yards.	In lieu of Section 2.88 the definition of a LOT shall not apply to the individual condominium units. The LOT shall be defined as the parcel of land consisting of entire condominium block. The Norfolk County Zoning By-law provisions regarding the definition of a LOT are unclear in its application to a condominium development.	Proposed Amendment The inclusion of this provision will clearly define the LOT and corresponding yard provisions. It will enhance the ability to interpret and apply the zoning bylaw at the Site Plan approvals stage.

2.93.1 Definitions	“FRONT LOT LINE” shall mean: d) In the case of a through lot, the nearer street line to the main building.	“FRONT LOT LINE” shall mean: The Lot Line abutting the Main Street of Delhi	Proposed Amendment The inclusion of this provision will clearly define the FRONT LOT LINE and corresponding yard provisions. It will enhance the ability to interpret and apply the zoning by-law at the Site Plan approvals stage.
2.93.2 Definitions	“REAR LOT LINE” shall mean: c) in the case of a <i>lot</i> having more than four (4) <i>lot lines</i> , the <i>lot line</i> farthest from and opposite to but not intersecting with the <i>front lot line</i> . [27-Z-2020]	“REAR LOT LINE” shall mean: The Lot Line abutting EAST STREET	Proposed Amendment The inclusion of this provision will clearly define the REAR LOT LINE and corresponding yard provisions. It will enhance the ability to interpret and apply the zoning by-law at the Site Plan approvals stage.
2.93.4 Definitions	“INTERIOR SIDE LOT LINE” or “INTERIOR LOT LINE” shall mean any lot line other than a lot line contiguous with a street line.	All LOT LINES except the FRONT AND REAR LOT LINES shall be defined as an INTERIOR SIDE LOT LINES.	Proposed Amendment The inclusion of this provision will clearly define all INTERIOR SIDE LOT LINES and corresponding yard provisions. It will enhance the ability to interpret and apply the zoning by-law at the Site Plan approvals stage.
3.11.2	For the purposes of this Subsection, a private condominium road servicing a condominium development shall be deemed to be an open, constructed and year-round improved street.	In lieu of Section 3.11.2, the private condominium road shall not be deemed an improved street.	Proposed Amendment The inclusion of this provision will clearly define the required yard and corresponding setback provisions for the entire condominium block. This will enhance the ability to interpret and apply the appropriate zoning bylaw provisions for individual condominium units which will assist staff and residents when considering potential

			future additions such as decks.
4.1.4b)	Parking Aisle Requirements Two-way Traffic – 7.3m	<ul style="list-style-type: none"> • 6.0m 	<p>Proposed Amendment</p> <p>The proposed reduction will allow for a more efficient use of an underutilized parcel of land. As a private condominium road the public will not be using this infrastructure. Through the site plan process the necessary turning analysis can be completed to ensure site functionality. It should be noted Norfolk aisle width is wider than many surrounding municipalities (County of Brant - 6.0m, Haldimand County - 6.5m, City of Brantford - 6.0m). Issues regarding site functionality are not anticipated.</p>
4.2.4b)	for group townhouses and apartment dwellings, no parking lot shall be located closer than 3 metres from any dwelling on the lot or of any interior lot line abutting another residential Zone	<ul style="list-style-type: none"> • 0.0m 	<p>Proposed Amendment</p> <p>Each dwelling unit has parking spaces located immediately adjacent to the building. Additionally, the parking aisle is located within 0.9m of the adjacent residential zone. The proposed reduction will allow for a more efficient use of an underutilized parcel of land. Through the site plan process the necessary buffering can be implemented to ensure adjacent residential properties are sufficiently screened.</p>
4.2.4c)	for group townhouses and apartment dwellings, no parking lot or parking space	<ul style="list-style-type: none"> • Section 4.2.4c) shall not apply 	Proposed Amendment

	shall be located between a dwelling and the street line, except for individual or tandem parking spaces leading directly to each townhouse dwelling unit		Removing this requirement will allow for a functional site design. Through the site plan process, the necessary landscaping can take place to ensure buffering from the street.
5.4.1 Permitted Uses	<ul style="list-style-type: none"> • Group townhouse • Stacked townhouse • Street Townhouse • Semi-detached, duplex, tri-ply and four-ply • Home Occupation • Accessory Residential Dwelling unit 	<ul style="list-style-type: none"> • Group townhouse • Stacked townhouse • Street Townhouse • Semi-detached, duplex, tri-ply and four-ply • Home Occupation • Accessory Residential Dwelling unit 	<p>No additional uses are being requested.</p> <p>The application of the R4 zone will facilitate the future construction of street townhouses and semi-detached dwellings.</p>
5.4.2 Zone Provisions a) minimum lot area	Group /Stacked Townhouse <ul style="list-style-type: none"> • Attached garage – 195m² • Corner lot – 195m² • Detached garage – 215m² 	<ul style="list-style-type: none"> • 18,450m² 	<p>No relief is being requested.</p> <p>Given the definition of a Lot is applied to the entire condominium block, the provision is met.</p>
b) minimum lot frontage	Group /Stacked Townhouse <ul style="list-style-type: none"> • Interior lot – 30.0m • Corner lot – 30.0m 	<p>Given the proposed definition the FRONT LOT LINE is deemed as the LOT LINE abutting The Main Street of Delhi.</p> <ul style="list-style-type: none"> • 78.0m 	<p>No relief is being requested.</p> <p>Given the front lot line abutting the Main Street of Delhi achieves the 30.0m minimum, no relief is required.</p>
c) minimum front yard	Group /Stacked Townhouse <ul style="list-style-type: none"> • Attached garage – 6.0m • Detached garage or rear yard parking – 1.5m (accessed by a rear lane) 	<ul style="list-style-type: none"> • 6.0m 	No relief is being requested.
d) minimum exterior side yard	Group /Stacked Townhouse <ul style="list-style-type: none"> • With a 6-metre front yard – 6.0m • With a 1.5-metre front yard – 1.5m 	<ul style="list-style-type: none"> • NA – there are no applicable exterior side yards as part of this development. 	No relief is being requested.
e) minimum interior side yard	Group /Stacked Townhouse <ul style="list-style-type: none"> • 3.0m 	<p>All lot lines except for the front lot line abutting the Main Street of Delhi and the rear lot line abutting James Street shall be defined as an interior side lot line. The</p>	<p>Proposed Amendment</p> <p>The proposed reduction will allow for a more efficient development pattern on the condominium block.</p>

		<p>following setback shall apply:</p> <p>Minimum interior side yard:</p> <ul style="list-style-type: none"> • When opposite the rear wall of a dwelling unit – 6.0m • When opposite the side wall of a dwelling unit – 1.2m 	<p>The proposed setbacks will provide each condominium unit with a similar rear and side yard setback as required under the parent R4 zone of the bylaw. This provision will help ensure the intent and purposes of the zoning bylaw is maintained.</p>
f) minimum rear yard	<p>Group /Stacked Townhouse</p> <ul style="list-style-type: none"> • Attached garage – 7.5m • Detached garage – 7.5m (access via a rear land including half of a lane) 	<ul style="list-style-type: none"> • 7.5m 	No relief is being requested.
g) minimum separation between townhouse dwellings	<p>Group /Stacked Townhouse</p> <ul style="list-style-type: none"> • 2.0m 	<p>Group /Stacked Townhouse</p> <ul style="list-style-type: none"> • 2.0m 	No relief is being requested.
h) maximum building height	<p>Group /Stacked Townhouse</p> <ul style="list-style-type: none"> • 11.0m 	<p>Group /Stacked Townhouse</p> <ul style="list-style-type: none"> • 11.0m 	No relief is being requested.

Part 2 – R1-A to R2			
Provision	Required	Proposed	Comments
5.2.1 Permitted Uses	<ul style="list-style-type: none"> • dwelling, single detached • dwelling, semi-detached • dwelling, duplex • bed & breakfast • day care nursery • Home Occupation • Accessory Residential Dwelling unit 	<ul style="list-style-type: none"> • dwelling, single detached • dwelling, semi-detached • dwelling, duplex • bed & breakfast • day care nursery • Home Occupation • Accessory Residential Dwelling unit 	<p>No additional uses are being requested.</p> <p>The application of the R2 zone will facilitate the future construction of a semi-detached dwelling.</p>
5.2.2 Zone Provisions	Semi-detached (per unit)	Semi-detached	No relief is being requested.
a) minimum lot area	<ul style="list-style-type: none"> • Interior lot – 255m² • Corner lot – 345m² 	<ul style="list-style-type: none"> • Interior lot – 255m² • Corner lot – 345m² 	
b) minimum lot frontage	<p>Semi-detached</p> <ul style="list-style-type: none"> • Interior lot – 8.5m • Corner lot – 11.5m 	<p>Semi-detached</p> <ul style="list-style-type: none"> • Interior lot – 8.5m • Corner lot – 11.5m 	No relief is being requested.
c) minimum front yard	<p>Semi-detached</p> <ul style="list-style-type: none"> • 6.0m 	<p>Semi-detached</p> <ul style="list-style-type: none"> • 6.0m 	No relief is being requested.

	i) except where a detached <i>private garage or parking space</i> is accessed via a <i>rear lane</i> – 3.0m	i) except where a detached <i>private garage or parking space</i> is accessed via a <i>rear lane</i> – 3.0m	
d) minimum exterior side yard	Semi-detached <ul style="list-style-type: none"> • 6.0m 	Semi-detached <ul style="list-style-type: none"> • 6.0m 	No relief is being requested.
e) minimum interior side yard	Semi-detached <ul style="list-style-type: none"> i) detached <i>private garage or parking space</i> accessed via <i>front yard</i> – 3.0m ii) detached <i>private garage or parking space</i> accessed via a <i>rear lane</i> – 1.2m iii) attached private garage – 1.2m 	Semi-detached <ul style="list-style-type: none"> i) detached <i>private garage or parking space</i> accessed via <i>front yard</i> – 3.0m ii) detached <i>private garage or parking space</i> accessed via a <i>rear lane</i> – 1.2m iii) attached private garage – 1.2m 	No relief is being requested.
f) minimum rear yard	Semi-detached <ul style="list-style-type: none"> • 7.5m 	Semi-detached <ul style="list-style-type: none"> • 7.5m 	No relief is being requested.
g) maximum building height	Street Townhouse <ul style="list-style-type: none"> • 11.0m 	Street Townhouse <ul style="list-style-type: none"> • 11.0m 	No relief is being requested.

Part 3 – CS to remain with site-specific provision			
Provision	Required	Proposed	Comments
4.2.1	All <i>parking spaces</i> shall be wholly provided on the <i>lot</i> occupied by the <i>building, structure</i> or use for which the <i>parking spaces</i> are <i>required</i> except where a <i>lot</i> has both residential and non-residential <i>Zones</i> in which case any <i>parking spaces</i> for non-residential use shall not be <i>permitted</i> on any portion of the <i>lot Zoned</i> residential.	<ul style="list-style-type: none"> • This section of the bylaw shall not apply. 	<p>Proposed Amendment</p> <p>Given the split designation and zoning of this property, this amendment is necessary to allow for development to occur on the commercial as intended by the official plan.</p> <p>Through the site plan process the necessary buffering can be implemented to ensure adjacent residential properties are sufficiently screened.</p>
4.2.4d)	For commercial or industrial properties, no parking lot	<ul style="list-style-type: none"> • 1.0m 	Proposed Amendment

	shall be located closer than 4.5m from any interior lot line abutting a residential zone		The proposed reduction will allow for a more efficient use of an underutilized parcel of commercial land. Through the site plan process the necessary buffering can be implemented to ensure adjacent residential properties are sufficiently screened.
6.3.1 Permitted Uses	<ul style="list-style-type: none"> See Section 6.3.1 of the Norfolk County Zoning Bylaw 	<ul style="list-style-type: none"> In accordance with Section 6.3.1 of the Norfolk County Zoning Bylaw 	No additional uses are being requested.
6.3.2 Zone Provisions	<ul style="list-style-type: none"> Interior Lot – 450m² Corner lot – 495m² 	<ul style="list-style-type: none"> 2,072m² 	No relief is being requested.
a) minimum lot area			
b) minimum lot frontage	<ul style="list-style-type: none"> Interior Lot – 15.0m Corner lot – 16.5m 	<ul style="list-style-type: none"> 25.5m 	No relief is being requested.
c) minimum front yard	<ul style="list-style-type: none"> 3.0m 	<ul style="list-style-type: none"> 3.0m 	No relief is being requested.
d) minimum exterior side yard	<ul style="list-style-type: none"> 3.0m 	<ul style="list-style-type: none"> NA 	No relief is being requested.
e) minimum interior side yard	<ul style="list-style-type: none"> 3.0m 	<ul style="list-style-type: none"> 3.0m 	No relief is being requested.
f) minimum rear yard	<ul style="list-style-type: none"> 9.0m 	<ul style="list-style-type: none"> 9.0m 	No relief is being requested.
g) minimum usable floor area for a dwelling unit in a non-residential building	<ul style="list-style-type: none"> 40.0m² 	<ul style="list-style-type: none"> NA 	No relief is being requested.
h) maximum building height	<ul style="list-style-type: none"> 11.0m 	<ul style="list-style-type: none"> 11.0m 	No relief is being requested.

i) maximum lot coverage	<ul style="list-style-type: none"> • 35% 	<ul style="list-style-type: none"> • 35% 	No relief is being requested.
j) Maximum usable floor area of a fruit and vegetable outlet	<ul style="list-style-type: none"> • 200m² 	<ul style="list-style-type: none"> • NA 	No relief is being requested.
k) Outdoor storage	<ul style="list-style-type: none"> • Prohibited in a front yard and within 3m of any lot line adjoining a residential zone 	<ul style="list-style-type: none"> • NA 	No relief is being requested.

Policy Context

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

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 34	Allows amendments to the Zoning Bylaw.
Section 51	Allows the application for draft plan of condominium.

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 34 of the *Planning Act* allows for the consideration of amendments to the Zoning Bylaw.

Section 34 of the Planning Act allows for the consideration of amendments to the Zoning Bylaw and is reviewed as part of this report.

Section 51(24) of the Planning Act allows for the consideration of draft plans of subdivisions / condominiums and is discussed in detail in Appendix B.

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 development will provide additional residential units, contributing to housing attainability, especially for fixed-income individuals. The design will add to the diversity of housing options and densities in the area as per provincial goals for mixed-use communities.
- **Infrastructure Capacity:** The area has sufficient infrastructure, including water and sewage, which supports the development of the proposed residential units. This aligns with the provincial requirement for municipalities to maintain a supply of serviced land.
- **Transit and Active Transportation:** The development is near public transit (200 meters to a bus stop), and in close proximity (Approx. 500m) to a number of community services in the Delhi downtown area and local schools.

Settlement Area and Land Use Compatibility (Section 2.3)

- **Infill and Intensification:** The development uses an underutilized parcel of land for residential intensification. The proposed land use is compatible with existing surrounding uses, including nearby industrial, commercial, and residential lands.
- **Industrial Proximity:** As the lands are already zoned and designated for residential purposes and the existing residential development in the area, a land use compatibility study has not been submitted with this application. As any industrial uses in the area appear to be low intensity Class I uses (warehousing and storage), and the proposed development is outside the 70m influence area required under the Ministry D-6 Guidelines, there are no anticipated compatibility issues. Should a compatibility study be

required, the necessary technical requirements can be reviewed during the site plan process to ensure any required mitigation measures are considered.

Employment Areas and Transition (Section 2.8)

- **Compatibility with Employment Uses:** As outlined above the lands are already zoned, designated and used for residential purposes in the area. As such, a land use compatibility study has not been submitted with this application. Should a compatibility study be required, the necessary technical requirements can be reviewed during the site plan process to ensure any required mitigation measures are considered.

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

- **Sustainability:** The development incorporates compact design and is transit-supportive being in close proximity to a bus stop, helping reduce greenhouse gas emissions. Local sidewalks and proximity to essential services will reduce reliance on private vehicles and encourage active transportation.

Land Use Compatibility (Section 3.5)

- **Sensitive Land Uses:** The policies focus on balancing industrial and sensitive land uses, avoiding negative impacts, and protecting long-term industrial operations. As outlined above, the lands are already zoned and designated for residential purposes and occupied by the existing residential development in the area. Accordingly, a land use compatibility study has not been submitted with this application. Should a compatibility study be required, the necessary technical requirements can be reviewed during the site plan process to ensure any required mitigation measures are considered.

Infrastructure, Sewage, and Stormwater Management (Section 3.6)

- **Efficient Use of Municipal Services:** The development will connect to existing municipal sewage and water systems, optimizing their use. Water modeling will be completed to confirm that the development can be sustained without impacting service capacity.
- **Stormwater Management:** The site design incorporates industry standard stormwater management practices for sustainable stormwater management.

Public Spaces and Active Communities (Section 3.9)

- **Recreation and Open Spaces:** The development is located near existing public recreational facilities, including area schools and associated open space. The area supports opportunities for active lifestyles, although the development itself will not directly provide new communal public spaces. The new proposed road connectivity will support community connections to existing public spaces and each unit will be provided with its own amenity space (rear yards) to help encourage active lifestyles.

PPS Summary

The proposed zoning by-law amendment for the Railway Development in Delhi aligns well with the key objectives of the Provincial Planning Statement, 2024, supporting compact infill and well-designed residential growth within an identified Urban Settlement Area. It facilitates a diverse and attainable housing supply, optimizes the use of existing municipal infrastructure, and contributes to the creation of a complete community. Its integration within an established neighbourhood and proximity to community services enhances its compatibility with the surrounding context and supports active transportation and future transit-readiness. Stormwater management servicing will be reviewed through municipal processes to ensure appropriate design, and commitments to energy efficiency will meet or exceed current standards. Collectively, these features reinforce the PPS mandate of resilient, sustainable communities and reflect responsible, long-term land use planning in Norfolk County.

Norfolk County Official Plan

The subject property is designated both Urban Residential and Commercial in accordance with Schedule “B-17” of the Norfolk County Official Plan. Several sections of the Official Plan are applicable when considering a zoning bylaw amendment to implement a residential condominium.

Summary of Goals and Objectives (Section 2.2)

The Norfolk County Official Plan sets out a forward-looking vision that supports a well-governed, economically diverse, and environmentally responsible community. The goals emphasize promoting a strong local economy, enhancing infrastructure, protecting the natural environment, and maintaining the rural and small-town character of the County. These objectives are designed to ensure a high quality of life for residents through compact, efficient development that aligns with long-term growth needs and community sustainability.

The proposed development supports these goals by offering a diverse housing mix on underutilized urban lands in Delhi. It enhances the vitality of the area through new economic opportunities along James Street, provides attainable housing geared toward seniors and fixed-income residents, and supports the efficient use of infrastructure. Through a compact design and compatibility with surrounding uses, the proposal reflects the strategic priorities of the County for a well-planned and inclusive urban community.

Section 5.3 – Housing

The proposed development introduces a mix of residential unit types, including townhouses and semi-detached dwellings, to provide more attainable housing options within Delhi. The project directly supports Official Plan policies promoting a variety of housing forms, tenures, and affordability levels. It responds to demographic trends by offering alternatives geared toward fixed-income and senior residents while making efficient use of designated urban lands that are currently vacant.

Section 5.3.1 – Residential Intensification

This proposal represents infill development on underutilized lands within the Delhi Urban Area, helping to meet the County's target of achieving at least 25% of residential growth through intensification. The proposed density of approximately 27.1 units per hectare exceeds the minimum target of 15 units/ha and aligns with the County's goals for compact urban form. Technical studies confirm that existing municipal infrastructure and the

surrounding road network can support the proposed development, and land use compatibility is addressed through layout design and anticipated landscaping measures.

Section 5.4 – Community Design

Community design principles are reflected in the proposed layout through compact lot configurations, private internal roadways, and the integration of landscaping along key street frontages. The development will enhance the visual character of the area, support safe and accessible design for future residents, and provide a built form that is sensitive to the established neighbourhood. These elements will be further refined during site plan approval, consistent with Section 5.4 policies promoting attractive, functional, and inclusive community spaces.

Section 6.4.3 – Delhi Urban Area

The subject lands are located within the Delhi Urban Area, one of Norfolk County's primary settlement areas identified for growth. The application advances the community structure framework by encouraging residential intensification within a fully serviced urban boundary. It contributes to the diversification of the local housing supply and aligns with the Plan's strategy for directing growth to areas with available infrastructure and proximity to existing amenities.

Section 7.7 – Urban Residential Designation

The development conforms with the Urban Residential land use designation, supporting policies that encourage a range of residential forms within compact neighbourhoods. The proposal maintains compatibility with adjacent uses, introduces a logical transition from residential to commercial along James Street, and supports the continued residential use of the site with appropriate setbacks, access, and density. Future site plan approval will ensure that the final design conforms with detailed urban design and development criteria established under this designation.

Official Plan Summary

The proposed zoning bylaw amendment conforms to the policies and intent of the Norfolk County Official Plan and contributes meaningfully to the County's vision for compact, efficient, and sustainable urban development. The subject lands are located within the Delhi Urban Area, a designated growth area supported by full municipal services and an established urban structure.

The development addresses the County's goals for housing diversity and affordability through the introduction of alternative housing forms, including group townhouses and small-format condominium units geared toward seniors and fixed-income households. It supports the residential intensification targets set out in Section 5.3.1 and exceeds the minimum density requirements for urban residential development.

Norfolk County Zoning By-law

The subject lands are primarily Zoned Urban Residential Type 1-A (R1-A) and Type 2 (R2) on Schedule "A22" of the Norfolk County Zoning Bylaw. A small portion of the lands abutting James Street (easterly section) are zoned Service Commercial (CS).

The proposed zoning bylaw amendment will implement the necessary zone provisions to permit this form of development while maintaining the existing commercial use along James Street. This approach supports the

mixed-use structure envisioned for Urban Areas under the Norfolk County Official Plan, particularly Sections 2.2.4.2 and 7.7.2, which encourage a balanced and efficient land use pattern in existing settlement areas. Given the irregularly shaped lot pattern, minor exemptions from the parent zone provisions have been requested to ensure a more efficient use of a vacant and underutilized parcel of land within a serviced urban area. This conforms with Section 5.3.1 of the Official Plan, which promotes residential intensification on suitable infill lands with appropriate access to services and infrastructure.

A full review of the requested special provision for Parts 1 to 3 on Appendix A has been provided above. The site-specific zone provisions will allow for a more compact and efficient use of the development lands, while ensuring a safe and functional design, consistent with the County's intent for intensification and compatible neighbourhood integration. Although site specific setbacks have been requested, the layout will achieve similar setbacks as required under the existing zoning bylaw requirements. Individual units will be provided with minimum rear and side yards similar to the existing requirements under the R4 zone. The proposed zoning bylaw amendments will allow for a more compact form of development, while ensuring intent and purpose of the zoning bylaw is maintained, and respects the surrounding context.

The proposed development will provide a variety of housing forms with associated zone categories, advancing the Official Plan's goals for housing mix and affordability as outlined in Section 5.3. Minor relief from parent zone provisions is necessary to support the condominium ownership structure, shared access design, and internal road configuration, which are all typical of infill projects in similar urban settings.

In summary, the requested zoning by-law amendment represents a modest and appropriate form of intensification that supports the County's objectives for complete communities, efficient land use, and compatible urban growth. The proposal maintains the intent and purpose of the Zoning By-law, conforms to the Official Plan's policies for intensification, and reflects good planning.

Traffic

A traffic impact study was completed by RC Spencer Associates Inc. and submitted as part of this application. The report considers several factors when assessing the proposed development, including trip generation and distribution, traffic capacity and level of service, geometric and traffic control improvements, and sightline analysis.

Weekday and weekend turning movement counts were collected at six area intersections and considered the reconstruction of East / Ann Street in their analysis. The report concludes that the development will not adversely impact current or future traffic operations and external road improvements are not required to support the proposal.

Environmental

Given the lands prior use as an active railway, a Record of Site Condition (RSC) may be required to certify the environmental condition of a property to ensure it meets specific standards for its intended land use.

It is requested that a Holding provision be applied to the subject lands and the completion of an Environmental Site Assessment (ESA) by a Qualified Person (QP) be a condition of the holding provision. This requirement will ensure the lands are safe for residential development.

Archaeological

A Stage 1 and 2 archaeological assessment was completed by Archaeological Consultants Canada on the property assessed according to the Ontario Ministry of Citizenship and Multiculturalism's 2011 Standards and Guidelines for Consultant Archaeologist. The report concludes that no artifacts or other archaeological resources were identified during the Stage 1 and 2 assessments of the property and no further archaeological assessments of the subject property are required.

Servicing

The proposed development can be fully serviced with sanitary sewers, watermains, storm sewers, and stormwater management infrastructure, as demonstrated in the Functional Servicing Report (FSR) completed by G. Douglas Vallee Limited.

Due to the unique configuration of this parcel of land, the proposed servicing approach for this development does not align with Norfolk County common servicing practices. In order to facilitate the proposed infill and intensification, we believe Norfolk County will need to support an alternative servicing design for this development as outlined in the FSR.

Modelling: Through this development application and the submission of a Functional Servicing Report, it is requested that Norfolk County's external consultant complete sanitary and watermain hydraulic modelling, as part of the approvals process, to confirm that sufficient capacity exists within the municipal system to support the proposed development.

Conclusion

The proposed Zoning Bylaw Amendment facilitates the development of a 57-unit residential development, while supporting the existing commercial land use along James Street within the Urban Area of Delhi. The proposed application will help address Norfolk County's strategic goals for intensification and housing diversification. This development aligns with the Provincial Planning Statement by optimizing land and infrastructure use, contributing to a compact, transit-supportive community, and reinforcing housing attainability and accessibility objectives.

The development meets the Norfolk County Official Plan's intent to focus growth in designated urban areas and aligns with its policies encouraging residential intensification, active transportation, and the efficient use of municipal infrastructure. Special provisions proposed under the Urban Residential Type 4 (R4) zoning enable the site to deliver a high-quality residential design while maintaining compliance with municipal and provincial planning goals and objectives.

This application proposes residential development that is both compatible with and complementary to the existing community fabric. The development aligns with Norfolk County's planning objectives and responds effectively to local housing needs.

Accordingly, it is recommended that the proposed Zoning Bylaw Amendment be approved as it represents good planning and is in the public interest.

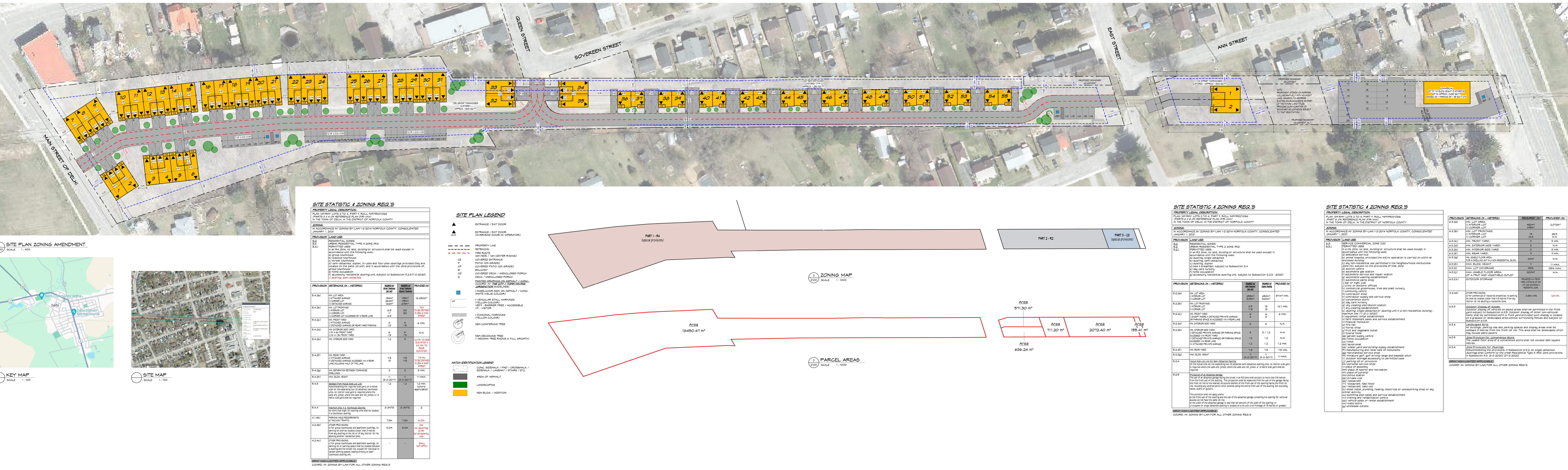
Report prepared by:



Scott Puillandre CD, RPP, MCIP, MSc.
Planner
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners

:\vallee-nas1\data\Projects\2023\23-024 Railway Subdivision - Delhi\Planning\PJR1.2025.11.10 - PJR - Final Draft.docx

Appendices



Appendix B to Planning Justification Report
Railway Condominium (23-024)

Planning Act – Compliance Table

This appendix demonstrates how the proposed application is consistent with the Planning Act, R.S.O. 1990, c. P.13

Section 2 – Provincial Interest		
Matter	Comment	
(a) the protection of ecological systems, including natural areas, features and functions;	The proposed development is located in an established urban area. There are no ecological systems located in the vicinity of the development.	✓
(b) the protection of the agricultural resources of the Province;	The proposed development is located in an established urban area. There are no impacts on agricultural resources.	✓
(c) the conservation and management of natural resources and the mineral resource base;	The proposed development is located in an established urban area on land intended for residential purposes. This application will not have impact on natural or mineral resources.	✓
(d) the conservation of features of significant architectural, cultural, historical, archaeological or scientific interest;	The proposed development is located in an established urban area on vacant land. The necessary archaeological clearance work has taken place to ensure the protection of any identified resources if required.	✓
(e) the supply, efficient use and conservation of energy and water;	The future housing development will be designed to meet Ontario Building Code requirements to implement standard energy and water conservation. Additional measures for energy conservation can be considered by the home builders.	✓
(f) the adequate provision and efficient use of communication, transportation, sewage and water services and waste management systems;	The development will utilize existing municipal infrastructure.	✓

Appendix B to Planning Justification Report
Railway Condominium (23-024)

(g) the minimization of waste;	This policy is not applicable in this instance.	✓
(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;	This development is taking place within an established urban area adjacent to existing residential development. The proposed condominium will be constructed in accordance with the necessary design requirements in accordance with County standards.	✓
(i) the adequate provision and distribution of educational, health, social, cultural and recreational facilities;	The necessary commenting agencies (school board, health unit, etc.) will be circulated as part of the approvals process. This development will help increase the Norfolk County tax base to help fund these types of facilities.	✓
(j) the adequate provision of a full range of housing, including affordable housing;	This development will provide a range of housing forms and options which are not readily available in Norfolk County.	✓
(k) the adequate provision of employment opportunities;	This policy is not applicable in this instance.	✓
(l) the protection of the financial and economic well-being of the Province and its municipalities;	This development would provide increased tax revenue to the local and provincial governments.	✓
(m) the co-ordination of planning activities of public bodies;	The applications will be circulated to all applicable public bodies and agencies for comments as determined by Norfolk County.	✓
(n) the resolution of planning conflicts involving public and private interests;	This will be achieved through the planning approvals process.	✓
(o) the protection of public health and safety;	The subject lands are not located within an area of natural hazard. The development will be designed and constructed to modern code of legislative requirements to ensure a safe community design. If required, as part of the site plan process a record of site condition can be completed to determine soil qualities.	✓
(p) the appropriate location of growth and development;	The subject lands are mainly designated residential in accordance with the Official Plan, within a serviced urban	✓

Appendix B to Planning Justification Report
Railway Condominium (23-024)

	area and immediately adjacent to existing residential development.	
(q) the promotion of development that is designed to be sustainable, to support public transit and to be oriented to pedestrians;	This development is well designed and situated to support public transit should Norfolk County. The subject lands are located within 200m of a Ride Norfolk Stop.	✓
(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;	This development provides a form of housing that will be compatible with the existing surrounding land uses and will be required to meet all County design requirements through the site plan process. This development will see a vacant underutilized abandoned railway developed with more attainable housing options to help contribute to complete communities.	✓
(s) the mitigation of greenhouse gas emissions and adaptation to a changing climate.	This development will be located within walking distance of a number of supports required for daily living, including a grocery store and other recreational and community amenities in the Delhi downtown area. The location of this development will encourage active transportation.	✓

Section 51(24) – Plan of Subdivision Approvals – Criteria		
Matter	Comments	
(24) In considering a draft plan of subdivision, regard shall be had, among other matters, to the health, safety, convenience, accessibility for persons with disabilities and welfare of the present and future inhabitants of the municipality and to,		
a) the effect of development of the proposed subdivision on matters of provincial interest as referred to in section 2;	This matter was reviewed in detail above. These applications does not conflict with provincial interests.	✓
b) whether the proposed subdivision is premature or in the public interest;	The proposed condominium is located within the urban area and will have access to full municipal services and will provide much needed housing options to Norfolk County.	✓
c) whether the plan conforms to the official plan and adjacent plans of subdivision, if any;	As demonstrated in Appendix E, this application conforms to the official plan and is a valuable use of a vacant and underutilized abandoned section of railway.	✓

Appendix B to Planning Justification Report
Railway Condominium (23-024)

d) the suitability of the land for the purposes for which it is to be subdivided;	The lands have undergone the necessary studies and a municipal review to demonstrate the lands are suitable to be subdivided. As part of the site plan review process, the necessary environmental site assessment can take place to ensure the lands are free of any contaminations.	✓
(d.1) if any affordable housing units are being proposed, the suitability of the proposed units for affordable housing;	N/A	
e) the number, width, location and proposed grades and elevations of highways, and the adequacy of them, and the highways linking the highways in the proposed subdivision with the established highway system in the vicinity and the adequacy of them;	The Ministry of Transportation will be circulated and provided with an opportunity comment to ensure their standards are met.	✓
f) the dimensions and shapes of the proposed lots;	As shown on Appendix A, the lands provide adequate space to ensure sufficient area for each dwelling and appropriate amenity space for residents.	✓
g) the restrictions or proposed restrictions, if any, on the land proposed to be subdivided or the buildings and structures proposed to be erected on it and the restrictions, if any, on adjoining land;	The necessary studies will be completed to review any potential development restrictions.	✓
h) conservation of natural resources and flood control;	The lands will be developed in a manner to incorporate current stormwater management requirements. The lands are flat, clear and not located in a flood plain.	✓
i) the adequacy of utilities and municipal services;	The necessary modelling will be completed to ensure the adequacy of municipal services.	✓
j) the adequacy of school sites;	Local school boards will be circulated as part of the application process.	✓
k) the area of land, if any, within the proposed subdivision that, exclusive of highways, is to be conveyed or dedicated for public purposes;	As a private condominium it is anticipated that no lands will be dedicated to the County.	✓
l) the extent to which the plan's design optimizes the available supply, means of supplying, efficient use and conservation of energy; and	The development will provide a mix of housing forms to ensure an efficient use of the lands. The future dwellings will be constructed to modern building code standards to ensure energy efficiency	✓

Appendix B to Planning Justification Report
Railway Condominium (23-024)

<p>m) the interrelationship between the design of the proposed plan of subdivision and site plan control matters relating to any development on the land, if the land is also located within a site plan control area designated under subsection 41 (2) of this Act or subsection 114 (2) of the <i>City of Toronto Act</i>, 2006. 1994, c. 23, s. 30; 2001, c. 32, s. 31 (2); 2006, c. 23, s. 22 (3, 4); 2016, c. 25, Sched. 4, s. 8 (2).</p>	<p>Site plan control will be applied to the proposed condominium blocks to ensure adequate and safe site design and functionality.</p>	<input checked="" type="checkbox"/>
---	--	-------------------------------------

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 of lands for increased residential units geared towards people with fixed incomes and attainability.	✓
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 consultant 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 of lands for increased residential ownership, near public transit (200m), community services and employment opportunities (approx. 500m).	✓
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.	It is intended that compact and attainable dwelling styles be provided to help people in their current abilities and incomes afford a place to live.	✓

Appendix C to Planning Justification Report
Railway Condominiums

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 provide much needed housing accommodations.	✓
b)	permitting and facilitating: <ol style="list-style-type: none"> 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 developed areas, and redevelopment, which results in a net increase in residential units in accordance with policy 2.3.1.3; 	Housing accommodations to be provided. Represents redevelopment of underutilized lands for intensified residential use within an established urban area.	✓
c)	promoting densities for new housing which efficiently use land, resources, infrastructure	The application will facilitate redevelopment that will efficiently use land, infrastructure and encourage active transportation as a result of its proximity to the downtown area of Delhi.	✓

Appendix C to Planning Justification Report
Railway Condominiums

	and public service facilities, and support the use of active transportation; and		
d)	requiring transit-supportive development and prioritizing intensification	The lands are located near a public transportation route (Within 200m of Stop D2).	✓

Section	Policy	Comments	
Chapter 2: Building Homes, Sustainable Strong and Competitive Communities			
2.3	Settlement Areas and Settlement Area Boundary Expansions		
2.3.1	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 located 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 is an efficiently designed infill development on a unique parcel of land due to its frontage, configuration and access configurations.	✓
b)	Optimize existing and planned infrastructure and public service facilities;	The development will utilize existing services and are located near (within 500m) of the downtown area of Delhi which has a number of public services available to residents.	✓
c)	Support active transportation	The lands are located near existing sidewalk connections into the heart of Delhi.	✓
d)	Are transit-supportive	The area is supported by public transit. A bus stop is located within 200m of the subject property.	✓

Appendix C to Planning Justification Report
Railway Condominiums

e)	Are freight supportive	The area is located with easy access to Highway 59 and Highway 3.	✓
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 under-utilized parcel of land.	✓
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.	✓
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			
2.9	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 a density of 27.1 units per hectare. The	✓

Appendix C to Planning Justification Report
Railway Condominiums

		condominium site itself (Part 1) will achieve a density of 31.6 units per hectare. The lands are located within 200 metres to a public transit stop and within walking distance of the downtown area of Delhi. The compact unit design will provide units at a more attainable price point and encourage walkability to employment opportunities in the downtown area.	
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 Delhi, 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 local sidewalk and road network linking the lands to near by commercial, institutional and open space opportunities. The local grocery store is within a 15-minute walk or a 2-minute drive. The proximity to a main supporting commercial destination reduces air quality impacts by reducing the distance and reliance on gasoline fueled vehicles.	✓
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.	✓

Appendix C to Planning Justification Report
Railway Condominiums

Section	Policy	Comments	
Chapter 3: Infrastructure and Facilities			
3.5	<p>Land Use Compatibility</p> <p>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.</p>		
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	As the lands are already zoned and designated for residential purposes and the existing residential development in the area, a land use compatibility study has not been submitted with this application. As any industrial uses in the area appear to be low intensity Class I uses (warehousing and storage), and the proposed development is outside the 70m influence area required under the Ministry D-6 Guidelines, there are no anticipated compatibility issues. Should a compatibility study be required, the necessary technical requirements can be reviewed during the site plan process to ensure any required mitigation measures are considered.	✓
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	As the lands are already zoned and designated for residential purposes and the existing residential development in the area, a land use compatibility study has not been submitted with this application. As any industrial uses in the area appear to be low intensity Class I uses (warehousing and storage), and the proposed development is outside the 70m influence area required under the Ministry D-6 Guidelines, there are no anticipated compatibility issues. Should a compatibility study be required, the necessary technical requirements can be	✓

Appendix C to Planning Justification Report
Railway Condominiums

		reviewed during the site plan process to ensure any required mitigation measures are considered.	
--	--	--	--

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: <ol style="list-style-type: none"> can be sustained by the water resources upon which such services rely; is feasible and financially viable over their life cycle; protects human health and safety, and the natural environment, including the quality and quantity of water; and 	<ol style="list-style-type: none"> Water modelling will be completed to ensure water is available to service the proposed development. Not applicable to the proposed development. Municipal water supplied. Quality and quantity is ensured by municipal systems. 	✓

Appendix C to Planning Justification Report
Railway Condominiums

	4. aligns with comprehensive municipal planning for these services, where applicable.	4. This is an infill development that takes advantage of previous municipal service planning.	
c)	Promote water and energy conservation and efficiency;	Dwellings will be constructed in accordance with the Ontario Building Code.	✓
d)	Integrate servicing and land use considerations	The proposed application facilitates infill development.	✓
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 quantity 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 including avoidance of placing structures within site triangles. The lands are vacant. Through the site plan process, an environmental site assessment can be completed to	✓

Appendix C to Planning Justification Report
Railway Condominiums

		ensure the lands are free of contamination or appropriate mitigation measures are taken.	
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	Underground stormwater management are proposed, which will promote infiltration to the highly permeable subsurface soil.	✓
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 an infill development on a condominium road. This policy does not apply. However, the design and location of the development will help facilitate active transportation and social interaction as the development is located within walking distance of the downtown area and community services.	✓
b)	planning and providing for the needs of persons of all ages and abilities in the	The location of the development in close proximity to the downtown area and public transportation will assist	✓

Appendix C to Planning Justification Report
Railway Condominiums

	<p>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;</p>	<p>residents of all ages and abilities in access these types of opportunities.</p>	
c)	<p>Providing opportunities for public access to shorelines; and</p>	<p>Not applicable to this development.</p>	
d)	<p>Recognizing provincial parks, conservation reserves, and other protected areas, and minimizing negative impacts on these areas</p>	<p>Not applicable to this development.</p>	

Appendix D to Planning Justification Report
Railway Condominiums

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 proposed application will help to encourage the development of a commercially zoned property along James Street. The proposed special provision will promote the establishment of new business and economic activity among existing commercial uses along this section of road. Given the unique shape of this parcel, providing adaptive zone provisions to allow the establishment of a functional parking lot will greatly assist in making the property desirable for a new business.	✓
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 utilize a vacant parcel of land with well designed buildings that will compliment and add diversity of housing choices the 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 an infilling opportunity on vacant lands. The development will be designed to ensure resident safety in an aesthetically appropriate manner. The lands are located in close proximity to a grocery store where healthy food options are available. The dwellings will be designed to accommodate people with potential physical challenges as they are geared towards seniors living.	✓
2.2.5	Upgrading and Expanding Infrastructure	The proposed development will connect to the existing municipal water, wastewater and storm water systems.	✓

Appendix D to Planning Justification Report
Railway Condominiums

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 designated urban residential and are efficiently designed in a compact form, adding to the mix of residential units and types in Delhi.	✓
--------------	--	--	---

Section	Policy	Comments	
Section 5.3 Housing			
5.3	<p>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.</p> <p>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.</p>		
c)	<p>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:</p> <ul style="list-style-type: none"> i) supporting increased residential densities in appropriate locations and a full range of housing types, adequate land supply, redevelopment and residential intensification, where practical; 	<p>The development includes a variety of housing forms including dwellings limited in size. The alternative housing options will be provided at a more attainable price point for people with fixed incomes in the form of a condominium. This allows the density to achieve approximately 27 units per hectare.</p>	✓
	<ul style="list-style-type: none"> ii) the timely provision of infrastructure in the Urban Areas; 	Municipal services already exist.	✓

Appendix D to Planning Justification Report
Railway Condominiums

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:		
	ii) infill development and residential development of vacant land or underutilized land in existing neighbourhoods; and/or	The development is on vacant underutilized urban lands adjacent to an existing neighbourhood.	✓
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 infill and intensification.	✓
d)	On lands designated Urban Residential and located outside of the Built-Up areas of Simcoe, Port Dover, Delhi, Waterford and Port Rowan, the minimum overall density of residential development shall be 15 units per hectare of developable land area. Developable land shall not include Hazard Lands, Provincially Significant Wetlands and Significant Natural Areas.	The proposed density is approximately 27 units per hectare.	✓
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.	✓

Appendix D to Planning Justification Report
Railway Condominiums

	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. It is anticipated that the proposed use will not conflict with surrounding commercial and industrial land uses given the existing residential land use in closer proximity to the existing industrial lands. If required, through the site plan process the necessary compatibility studies can be completed.	✓
	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 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.	As the lands are already zoned and designated for residential purposes and the existing residential development in the area, a land use compatibility study has not been submitted with this application. As any industrial uses in the area appear to be low intensity Class I uses (warehousing and storage), and the proposed development is outside the 70m influence area required under the Ministry D-6 Guidelines, there are no anticipated compatibility issues. Should a compatibility study be required, the necessary technical requirements can be reviewed during the site plan process to ensure any required mitigation measures are considered.	✓
h)	Small scale intensification shall be permitted in all areas designated for urban residential use, except where infrastructure is inadequate or there are significant physical constraints	The development can be supported by existing infrastructure.	✓

Appendix D to Planning Justification Report
Railway Condominiums

Section	Policy	Comments	
Section 5.4 Community Design			
5.4	<p>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.</p> <p>The following shall be the policy of the County:</p>		
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 interface with 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 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 proposed development will be designed to be in keeping with the character of the general area.	✓
	ii. shall promote efficient and cost-effective development design patterns that minimize land consumption;	This is an infill development which maximizes the use of the lands through the construction of a particular types of dwelling unit intended for people with fixed incomes.	✓
	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 or cash in lieu of trees will be provided through the site plan process and in accordance with Norfolk County design requirements.	✓

Appendix D to Planning Justification Report
Railway Condominiums

	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	This is a condominium, thus the street pattern is separate from the existing road network.	✓
	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.	✓
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 screening, and other means as appropriate. Modifications to building orientation may also be appropriate buffering measures, but not in replacement of appropriate plantings.	No impacts are anticipated. The development is subject to site plan control.	✓
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	Not applicable.	✓

Appendix D to Planning Justification Report
Railway Condominiums

	attenuation or privacy fencing will be discouraged. Wherever possible, new development will be oriented toward streets or parks.		
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.	Not applicable.	✓
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 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.	Not applicable.	✓

Appendix D to Planning Justification Report
Railway Condominiums

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.	Not applicable.	✓
l)	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 will be provided with internal lighting to help maximize surveillance.	✓
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	Following the zoning bylaw amendment, a site plan application will be submitted to the county to consider the detailed design of the site.	✓

Appendix D to Planning Justification Report
Railway Condominiums

	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.		
--	---	--	--

Section	Policy	Comments	
Section 6.4 Urban Areas			
6.4	<p>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</p> <p>The following shall be the policy of the County:</p>		
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.	✓
h)	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.	✓

Appendix D to Planning Justification Report
Railway Condominiums

Section	Policy	Comments	
Section 6.5.3 Delhi Urban Area			
6.5.3	<p>The County will support and promote the continued development of Delhi as the third largest Urban Area in the County. The Delhi Urban Area is recognized as an important urban community, employment, cultural and agricultural support centre in the County.</p> <p>The following shall be the policy of the County:</p>		
a)	The County shall support the development of a full range of housing types in the Delhi Urban Area, including affordable and special needs housing.	The development introduces additional housing types to the urban area.	✓

Appendix D to Planning Justification Report
Railway Condominiums

Section	Policy	Comments	
Section 7.7 Urban Residential Designation			
7.7	<p>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.</p> <p>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.</p>		
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".		
a)	The predominant use of land shall be a variety of urban dwelling types, including single detached dwellings, semi-detached dwellings, duplex dwellings and similar low-profile residential buildings not exceeding 2 dwelling units per lot.	Will consist of a variety of dwelling types including semi-detached and townhouses.	✓
b)	Medium density residential uses shall be permitted including triplex dwellings, fourplex dwellings, row or block townhouse dwellings, converted dwellings containing more than two dwelling units, walk-up apartments and similar medium profile residential buildings, subject to the policies of Section 7.7.2 (b) (Urban Residential Designation – Land Use Policies).	Will consist of a variety of dwelling types including semi-detached and townhouses.	✓
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.	Not applicable.	✓

Appendix D to Planning Justification Report
Railway Condominiums

7.7.2	Land Use Policies	
a)	Triplex, fourplex, townhouses, and other medium density housing forms, shall generally have a net density of between 15 and 30 uph, save and except for in the Courtland Urban Area where private servicing limitations shall determine the density of development. New medium density residential development and other uses that are similar in terms of profile, shall meet the following criteria:	The proposed density is approximately 25 units per hectare over all and 29 units per hectare for the condominium site. <input checked="" type="checkbox"/>
	i) the density, height and character of the development shall have regard to adjacent uses;	The street townhouse and semi-detached building will have a similar height and character as the surrounding residential development. The street townhouse will not exceed a 6-unit block to ensure limited massing. <input checked="" type="checkbox"/>
	ii) the height and massing of the buildings at the edge of the medium density residential development shall have regard to the height and massing of the buildings in any adjacent low density residential area and may be subject to additional setbacks, or landscaping to provide an appropriate buffer;	The street townhouse and semi-detached building will have a similar height and character as the surrounding residential development. The street townhouse will not exceed a 6-unit block to ensure limited massing. Through the site plan process appropriate buffering can be provided from the existing development. <input checked="" type="checkbox"/>
	iii) the development will be encouraged to have direct access to an arterial or collector road, where possible and appropriate;	The Main Street of Delhi is identified as a Collector Road on Schedule E-4 of the official plan <input checked="" type="checkbox"/>
	iv) the watermains and sanitary sewers shall be capable of accommodating the development, or the proponent shall commit to extending services at no cost to the County, save and except for in the Courtland Urban Area, where private septic systems shall be permitted;	The necessary servicing modelling will be completed by the County Consultant to ensure sufficient capacity exists within the municipal system. <input checked="" type="checkbox"/>
	v) the development is adequately serviced by parks and school facilities;	The development is located within 500m of both a high school and public school. The school board will be circulated on the application and can provide comments as required regarding capacity. Both schools have park and open space <input checked="" type="checkbox"/>

Appendix D to Planning Justification Report
Railway Condominiums

		capacity to serve the development. As an infill development utilizing a unique parcel of land, the provision of internal parkland is not feasible. Cash-in-lieu will be provided to assist with existing and future community parks.	
	vi) in developments incorporating walk-up apartments, block townhouse dwellings and medium-profile residential buildings, on-site recreational facilities or amenities such as playground equipment may be required;	As an infill development utilizing a unique parcel of land, the provision of internal parkland is not feasible. Cash-in-lieu will be provided to assist with existing and future community parks.	✓
	vii) the development shall be designed and landscaped, and buffering shall be provided to ensure that the visual impact of the development on adjacent uses is minimized;	These requirements can be reviewed and implemented through the site plan process.	✓
	viii) except for a triplex dwelling, fourplex dwelling or other similar small-scale developments, a report on the adequacy of the road network to accommodate the expected traffic flows, and the adequacy of water and sewer services may be required from the proponent and approved by the County; and	A traffic impact study has been completed as part of the application, and the necessary servicing modelling will be completed by the County consultant.	✓

Corporation of Norfolk County

By-Law 1-Z-2025

Being a By-Law to Amend Zoning By-Law 1-Z-2014, as amended, for property described as Railway Lots 2 and 3 and Part of Lot 33, Block 22 Registered Plan 189, Urban Area of Delhi, Norfolk County.

WHEREAS Norfolk Council is empowered to enact this By-Law, by virtue of the provisions of Section 34 and 36(1) of the *Planning Act, R.S.O. 1990, CHAPTER P.13*, as amended; and

AND WHEREAS this By-Law conforms to the Norfolk County Official Plan.

NOW THEREFORE the Council of The Corporation of Norfolk County hereby enacts as follows:

1. That Schedule A of By-Law 1-Z-2014, as amended, is hereby further amended by changing the zoning of the lands identified as Part 1, Part 2 and Part 3 of the subject lands as identified on Map A (attached to and forming part of this By-Law) to:
 - a) Part 1: Urban Residential Type 4 Zone (R4) with a Holding (H) provision and subject to Special Provision 14.XXXX;
 - b) Part 2: Urban Residential Type 2 Zone (R2) with a Holding (H);
 - c) Part 3: Service Commercial (CS) with a Holding (H) provision and subject to Special Provision 14.XXXX.
2. That Subsection 14.0 Special Provisions is hereby further amended by adding 14.XXXX as follows:

Part 1: In lieu of the corresponding provision of the Norfolk County Zoning Bylaw 1-Z-2014 as amended, the following shall apply:

- a) The LOT shall be defined as the parcel of land consisting of entire condominium block.
- b) “FRONT LOT LINE” shall mean:
 - The Lot Line abutting the Main Street of Delhi.
- c) “REAR LOT LINE” shall mean:
 - The Lot Line abutting East Street.
- d) All other LOT LINES that are not a FRONT LOT LINE or REAR LOT LINE shall be deemed an INTERIOR SIDE LOT LINE.
- e) A private condominium road shall not be deemed an improved street.
- f) The minimum required aisle width for two-way traffic – 6.0 metres.

- g) For group townhouses and apartment dwellings, all parking shall be permitted within 0.9 metres of any lot line abutting a residential zone on an adjacent lot.
- h) For group townhouses and apartment dwellings, all parking shall be permitted directly adjacent (0.0m) to a dwelling unit located on the same lot.
- i) Section 4.2.4c) Shall not apply. For group townhouses and apartment dwellings, a parking lot or parking space shall be permitted between a dwelling and the street line.
- j) Permitted uses:
 - a) Group townhouse
 - b) Stacked townhouse
 - c) Steet townhouse
 - d) Semi-detached, duplex, tri-plex, and four-plex dwellings provided they are located on the same lot with, and in accordance with the Zone provisions of, group townhouse
 - e) Home Occupation
 - f) Accessory Residential Dwelling Unit

k) Zone Provisions:

Provisions	R4 Zone
a) minimum lot area	<ul style="list-style-type: none"> • 18,000 square metres
b) minimum lot frontage	<ul style="list-style-type: none"> • 30.0 metres
c) minimum front yard (Main Street of Delhi)	<ul style="list-style-type: none"> • 6.0 metres
d) minimum exterior side yard	<ul style="list-style-type: none"> • Not applicable
e) minimum interior side yard	<ul style="list-style-type: none"> • When opposite the rear wall of a dwelling unit – 6.0 metres • When opposite the side wall of a dwelling unit – 1.2 metres
f) minimum rear yard (East Street)	<ul style="list-style-type: none"> • 7.5 metres
g) minimum separation between townhouse dwellings	<ul style="list-style-type: none"> • 2.0 metres
g) maximum building height	<ul style="list-style-type: none"> • 11.0 metres

Part 3: In lieu of the corresponding provision of the Norfolk County Zoning Bylaw 1-Z-2014 as amended, the following shall apply:

- a) Section 4.2.1 shall not apply. Parking spaces for a non-residential use shall be permitted in the residentially zone portion of the lot.

- b) For commercial property, a parking lot shall be permitted within 1.0 metres of any interior lot line abutting a residential Zone.
- c) All other provisions of the CS zone shall apply.

3. That the Holding (H) provision of this Bylaw shall be removed upon the registration of a site plan agreement or pre-servicing agreement and the completion of an Environmental Site Assessment (ESA) by a Qualified Person (QP) to the satisfaction of General Manager of Community & Development Services (or designate).

Enacted and passed this XX day of Month, 2025.

Mayor: A. Martin

County Clerk: W. Tigert

MAP A

Insert Map

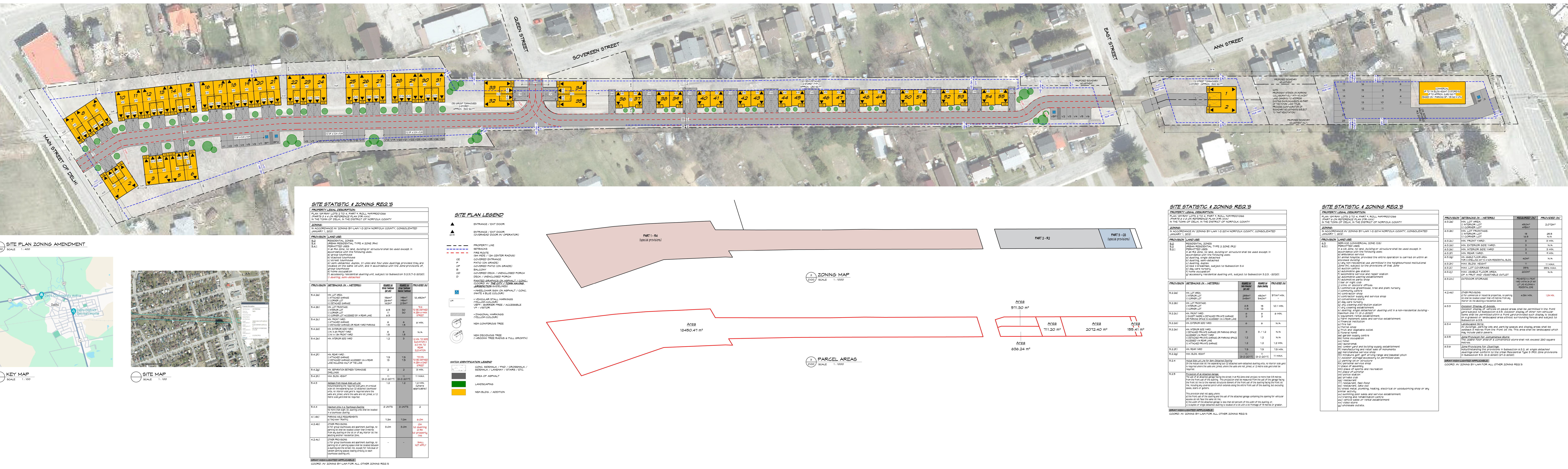
Explanation of the Purpose and Effect of By-Law -Z-2025

This By-Law affects a parcel of land described Railway Lots 2 and 3 and Part of Lot 33, Block 22 Registered Plan 189, Urban Area of Delhi, Norfolk County.

As shown on Map A, the purpose of this bylaw is to change the existing zoning of the subject lands from Urban Residential Type 2 (R2) and Urban Residential Type 1 (R1-A) to Urban Residential Type 4 (R4) on Part 1 and Urban Residential Type 2 (R2) on Part 2. The existing Service Commercial (CS) zone will be maintained on Part 3.

The proposed zoning by-law amendment will permit the construction of a residential condominium consisting of street townhouses and semi-detached dwellings on Part 1 and a semi-dwelling (two units) on Part 2. Special provision 14.XXXX will allow for specific modifications to the parent zone provisions to enable a more compact and efficient development pattern.

A Holding (H) provision has been placed on the entire subject lands to ensure no construction or work can take place until the applicant satisfies all engineering and technical requirements and completes an Environmental Site Assessment to the satisfaction of Norfolk County.





*Consulting Engineers,
Architects & Planners*

November 14, 2025

2834103 Ontario Inc.
869 Charlotteville Road 7
Simcoe, Ontario
N3Y 4K5

Attention: Allan & Jody Gee

Reference: **Functional Servicing Report**
Delhi Railway Development
Delhi, Norfolk County
Our File #23-024

Introduction

This Functional Servicing Report (FSR) has been prepared on behalf of 2834103 Ontario Inc. in support of the proposed Delhi Railway Development (the subject lands) in Delhi, Norfolk County, Ontario. The purpose of this report is to outline the functional servicing design for the development, including sanitary servicing, stormwater management, and domestic and fire water servicing. This report will be submitted to Norfolk County for review and approval.

The proposed development is located on the western side of Delhi along an abandoned railway corridor and consists of three (3) sites (Sites A, B, and C). The areas of Sites A, B, and C are 1.84 ha, 0.14 ha, and 0.25 ha, respectively. The lands are currently vacant and proposed for development with townhouses, semi-detached homes, and a commercial building. The development is bounded by the Main Street of Delhi to the west, existing residential properties to the north and south, and James Street to the east. Refer to Figure 1 for the site location.



Figure 1: Site Location

Between Sites A and B, there was an existing bridge (spanning East Street) that accommodated a single travel lane beneath it. This bridge was removed in July 2025 and will be replaced with a new two-lane roadway as part of Norfolk County's Ann Street and East Street Reconstruction project. The road construction works are expected to be completed prior to the start of construction for this development, and ownership of the area between Sites A and B will be transferred to Norfolk County.

There is also a vacant area of approximately 120 m² within the development limits between Sites B and C. This area will be subject to a boundary adjustment to accommodate the existing structures located at 30 Ann Street. An additional boundary adjustment is proposed in the northeast corner of Site A to align the parcel limits with the existing building footprint at 454 East Street, encompassing an area of approximately 180 m². The extents of both boundary adjustments are shown on the Site Plan in Appendix A.

Land Use and Design Assumptions

The subject lands are designated "Urban Residential" under the Norfolk County Official Plan. A portion of Site C, fronting James Street, is designated "Urban Commercial". Currently, the lands are zoned as "Urban Residential Type 1-A (R1-A)", "Urban Residential Type 2 (R2)", and "Service Commercial (CS)", in accordance with the Norfolk County Zoning By-law. The proposed development will be rezoned to "Urban Residential Type 4 (R4)" for Sites A and B, and "Service Commercial (CS)" for Site C, and will include the following:

- **Site A:** two-storey group townhouses (35 units) and two-storey semi-detached homes (20 units).
- **Site B:** two-storey semi-detached homes (2 units).
- **Site C:** commercial building up to 11 m in height (three storeys) with a total gross floor area of approximately 9,400 sq. ft (~870 sq. m).
- Installation of water, storm, and sanitary infrastructure to service the proposed development.
- Construction of stormwater management facilities.
- Construction of internal roadways, driveways, and parking areas.
- Installation of curbs, sidewalks, and other site features to support the overall development.

Table 1 summarizes the proposed land use and population calculations for the development. Note that the equivalent population densities are based on Norfolk County's latest engineering standards (2025).

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners

Table 1: Population Calculations

Site	Land Use	No. of Units or Site Area	Equivalent Population Density	Population
Site A	Townhouse dwellings	35 units	2.4 persons/unit	84 people
	Semi-detached dwellings	20 units	3.0 persons/unit	60 people
Site B	Semi-detached dwellings	2 units	3.0 persons/unit	6 people
Site C	Commercial building	0.25 ha	90 persons/ha	23 people
			Total	173 people

Roads and Traffic Impact

The proposed development will include the construction of internal roadways which will be constructed in accordance with Norfolk County standards and requirements. The proposed road layout is presented on the Site Plan drawing in Appendix A and is summarized as follows:

- **Site A:** construction of an internal roadway with access provided from the Main Street of Delhi, Queen Street/Sovereign Street, and East Street. Each dwelling will have its own driveway, and on-site visitor parking has been provided.
- **Site B:** construction of individual driveways with direct access from East Street.
- **Site C:** construction of an internal parking lot with access provided from James Street.

RC Spencer Associates Inc. was retained to complete a Traffic Impact Study (TIS) for the proposed development to evaluate the impacts of the new roads and intersections. Refer to the Traffic Impact Study Report, dated September 2025, for complete details.

Sanitary Servicing

Site A

Norfolk County GIS mapping and record drawings indicate there are 200 mm diameter sanitary sewers on Queen Street and Sovereign Street. Additionally, there is an existing sewage pumping station located at 441 Main Street, which is located next to the southwest corner of the development. A 525 mm diameter sanitary sewer conveys flows to the station, while a 300 mm diameter sanitary forcemain exits the station and conveys flows northerly along the Main Street of Delhi. Ultimately sewage flows are conveyed to the Delhi Wastewater Treatment Facility.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

A 200 mm diameter sanitary sewer is proposed to service Site A, and will ultimately connect to the existing sanitary infrastructure on the Main Street of Delhi. The sewer will originate at the east end of Site A and convey flows westerly along the internal roadway before exiting the site at the Main Street of Delhi. From here the sewer will extend south along the existing road centreline to connect to the existing sanitary manhole in front of the sewage pumping station. The proposed sanitary servicing layout is presented on the Servicing Plans included in Appendix A. The final alignment within the Main Street of Delhi right-of-way will be confirmed during detailed design, with consideration given to routing the sewer through the boulevard rather than along the road centreline.

Site B

Norfolk County GIS mapping and record drawings indicate there are 200 mm diameter sanitary sewers on Ann Street and East Street. As part of Norfolk County's Ann Street and East Street Reconstruction project, these sewers will be replaced, and sanitary laterals will be installed to the property line of Site B to provide servicing for the site. These infrastructure works are expected to be completed prior to construction beginning on Site B. Refer to the Servicing Plans included in Appendix A for the proposed sanitary servicing layout.

Site C

Norfolk County GIS mapping and record drawings indicate there are 375 mm diameter sanitary sewers on James Street (between Ann Street and Imperial Street). A 125 mm diameter sanitary lateral was previously installed from the 375 mm sewer to the property line of Site C. Consequently, Site C will be serviced by connecting to the existing sanitary lateral stub. The proposed sanitary servicing layout is presented on the Servicing Plans included in Appendix A.

Sanitary Design Flows

Sanitary design flows for the proposed development were calculated using the Norfolk County Design Criteria (2019) and the latest engineering standards on sanitary demand (2025). A summary of the design flow calculations is presented in Table 2. The total estimated peak sanitary flow from the proposed development is approximately 3.11 L/s. Detailed calculations are included in Appendix B.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Table 2: Sanitary Flow Calculations

Parameter	Site A	Site B	Site C	Total
Population	144 people	6 people	23 people	173 people
Development Area	1.84 ha	0.14 ha	0.25 ha	2.23 ha
Average Per Capita Flow	0.285 m ³ /person/day		40 m ³ /ha/d	–
Infiltration Allowance	0.28 L/s/ha		–	–
Peak Sanitary Flow Factor	4.20	4.43	3.50	–
Average Sanitary Flow	0.48 L/s	0.02 L/s	0.11 L/s	0.61 L/s
Infiltration Flow	0.52 L/s	0.04 L/s	0.07 L/s	0.62 L/s
Peak Design Flow	2.51 L/s	0.13 L/s	0.47 L/s	3.11 L/s

Sanitary Network Review

Vallee requests that a sanitary hydraulic analysis be completed by Norfolk County's external consultant to confirm that the existing County infrastructure provides adequate capacity to accept the estimated sanitary design flows from the proposed development.

Water Servicing

Design Criteria

The Norfolk County Design Criteria (2019) stipulates that a water system must be designed to meet the greater of either the maximum daily demand (MDD) plus fire flow (FF) or peak hourly demand (PHD). The system pressure requirements are as follows:

- **Fire Flow Conditions:** the minimum system pressure shall not be less than 140 kPa (20 psi).
- **Normal Operating Conditions:** the minimum system pressure shall not be less than 280 kPa (40 psi).
- The maximum working pressure should not be more than 690 kPa (100 psi).

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
 Ontario

Authorized by the Association of Professional Engineers of Ontario
 to offer professional engineering services



Ontario Association
 of Architects

Site A

Norfolk County GIS mapping and record drawings indicate there is an existing 150 mm diameter watermain along Queen Street and Soverein Street, and a 200 mm diameter watermain along the Main Street of Delhi. Additionally, there is an existing 100 mm diameter watermain along East Street, which will be replaced with a 200 mm diameter watermain as part of Norfolk County's Ann Street and East Street Reconstruction project. As part of this work, a 200 mm diameter stub will be installed from the future watermain to provide a connection point for Site A. Note that the infrastructure upgrades under the reconstruction project are expected to be completed before construction begins on Site A.

It is proposed that Site A be serviced by a 150 mm diameter watermain located along the site's internal laneway connecting to the County's distribution system at three locations:

1. The existing 150 mm diameter watermain at the intersection of Queen Street and Soverein Street;
2. The existing 200 mm diameter watermain on the Main Street of Delhi; and
3. The future 200 mm diameter watermain stub off the upgraded watermain on East Street.

It is understood that Norfolk County policy allows only one connection to a development parcel, however given the unique size and shape of this parcel, it is requested that the County consider an alternative approach. Network modelling will be required to confirm this scenario; however, given the size of the parcel, a dead-end water service of approximately 550 m is unlikely to provide sufficient available fire flow. Looping the service connection to the municipal watermain, as proposed, is therefore likely the best solution to service the property. The proposed water servicing layout is presented on the Servicing Plans included in Appendix A. Each connection point will have backflow prevention to ensure isolation of the water main along private lands.

Site B

Site B will be serviced via the future 200 mm diameter watermain on East Street, which will be installed through the County's Ann Street and East Street Reconstruction project. As part of this work, water services will be installed to the property line of Site B to provide servicing for the site. Refer to the Servicing Plans included in Appendix A for the proposed water servicing layout.

Site C

Norfolk County GIS mapping and record drawings indicate there is an existing 300 mm diameter watermain along James Street. A 50 mm diameter water service was previously installed from this watermain to the property line of Site C. Consequently, Site C will be serviced by connecting to the existing water service stub. The proposed water servicing layout is presented on the Servicing Plans included in Appendix A.

Domestic Water Demand

Table 3 presents the domestic water demand calculations for the proposed development. The demands were calculated using the Norfolk County Design Criteria (2019) and the latest engineering standards on water demand (2025). The proposed development is anticipated to have a MDD of 1.28 L/s and a PHD of 2.13 L/s. Refer to Appendix C for detailed calculations.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Table 3: Water Demand Calculations

Parameter	Site A	Site B	Site C	Total
Population	144 people	6 people	23 people	173 people
Avg. Day Demand Per Capita		0.285 m ³ /per/day		–
Average Day Demand	41.04 m ³ /d (0.48 L/s)	1.71 m ³ /d (0.02 L/s)	6.56 m ³ /d (0.08 L/s)	49.31 m ³ /d (0.57 L/s)
MDD Peaking Factor	2.25	2.25	2.25	–
Maximum Day Demand	92.34 m ³ /d (1.07 L/s)	3.85 m ³ /d (0.04 L/s)	14.75 m ³ /d (0.17 L/s)	110.94 m ³ /d (1.28 L/s)
PHD Peaking Factor	4.00	4.00	2.00	–
Peak Hourly Demand	6.84 m ³ /hr (1.90 L/s)	0.29 m ³ /hr (0.08 L/s)	0.55 m ³ /hr (0.15 L/s)	7.67 m ³ /hr (2.13 L/s)

Fire Water Service

According to Norfolk County GIS mapping and record drawings, there are existing fire hydrants located near the development site boundaries. These fire hydrants are located along the existing municipal road network and provide partial coverage of the proposed development areas. Since these existing fire hydrants do not provide adequate coverage of the full development, new fire hydrants will be installed within the sites to ensure sufficient fire protection coverage is achieved.

Typically, the available fire flow during the maximum day demand is the critical criteria when evaluating a watermain distribution system's ability to service a residential development. The estimated fire flow requirement for the proposed development has been determined as the greater of that defined by the Ontario Building Code (OBC) method or the fire flow target as defined by Norfolk County's latest engineering standards (2025).

The calculated fire flow requirements are presented in Table 4, with supporting calculations provided in Appendix C. For each site, Table 4 lists the fire flow requirement for the building with the highest demand. Ultimately, the minimum required fire flow for all sites is based on Norfolk County's standards, as these provide the most conservative (i.e., critical) values when compared to those calculated using the Ontario Building Code.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Table 4: Fire Flow Requirements

Site	Building Type	Building No.	Fire Flow Requirement as per OBC	Fire Flow Target as per Norfolk County Standards
Site A	Group Townhouses	10-15	150 L/s	150 L/s
	Semi-Detached	40-41	45 L/s	125 L/s
Site B	Semi-Detached	1-2	45 L/s	125 L/s
Site C	Commercial Building	—	60 L/s	150 L/s

As shown in Table 4, the fire flow target for the development ranges from 125 L/s to 150 L/s, in accordance with Norfolk County's fire flow standards. According to these standards, a minimum fire flow of 150 L/s is required for commercial buildings and residential buildings with more than three units located in Delhi. This applies to the group townhouses in Site A and the commercial building in Site C. For residential buildings located in Delhi with three units or fewer, the required fire flow is 125 L/s. This requirement applies to the semi-detached homes in Site A and Site B.

Water Network Review

Vallee requests that a watermain hydraulic analysis be completed by Norfolk County's external consultant to determine the water servicing capacity and constraints of the existing system. The analysis is required to determine the impact of the proposed development on the existing distribution system and to evaluate the proposed watermains ability to deliver sufficient water flow as per the Norfolk County Design Criteria (2019). The analysis will identify if it is possible to construct the proposed development while meeting both pressure and fire flow requirements.

Stormwater Management

Existing Conditions

The development is situated along an abandoned, elevated railway corridor that is currently vacant. Runoff from the subject lands drains uncontrolled, overland, either to the north or south from the elevated railway toward the lower surrounding areas. There are several low-lying areas along the former railway that allows for some natural infiltration of runoff.

Norfolk County GIS mapping and record drawings indicate there is an existing 1050 mm diameter storm sewer located on the Main Street of Delhi (between William Street and Power Street). In addition, an existing storm sewer runs through Site A. This sewer will be maintained under post-development conditions as it conveys flows from the unopened road allowance of Quance Street and to the Main Street storm sewer.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Adjacent to Sites A and B, there are existing storm sewers along East Street that are scheduled to be replaced with a 525 mm diameter storm sewer as part of Norfolk County's Ann Street and East Street Reconstruction project. A new storm sewer will also be installed along Ann Street as part of these works.

Along James Street, there is an existing 300 mm diameter storm sewer adjacent to Site C. A 150 mm diameter storm lateral was previously installed from this sewer to the property line of Site C.

Ultimately, stormwater collected in the existing storm sewers near Sites A, B, and C is conveyed toward the Big Creek watercourse.

Overall Stormwater Management Strategy

The proposed stormwater servicing layout is presented on the Servicing Plans included in Appendix A. The stormwater management (SWM) approach varies between Sites A, B, and C, as described below.

Site A

Post-development runoff for Site A will be directed to an underground SWM chamber facility located at the west end of Site A. Runoff from both minor and major storm events (2-year to 100-year storms) will be conveyed to the chamber system via an internal storm sewer network and overland flow routes. Outflows from the SWM facility will discharge to the existing storm sewer that cuts through Site A, which conveys flows toward the existing storm sewer on the Main Street of Delhi.

Site B

Post-development flows from the two semi-detached dwellings will be uncontrolled and conveyed overland toward the future storm sewers on Ann Street and East Street.

Site C

Similar to Site A, post-development runoff from Site C will be directed to an underground SWM chamber facility located at the east end of Site C. Outflows from the facility will discharge to the existing storm sewer stub, which conveys flows toward the existing storm sewer on James Street.

Design Criteria

The design criteria for the proposed development are summarized as follows:

- **Quantity Control:** reduce or control post-development peak flow rates to levels that do not exceed the 5-year pre-development peak flow rate, for all storm events up to and including the 100-year storm.
 - In accordance with Norfolk County Design Criteria (2019), storm sewers are designed for the 5-year storm event. As such, discharge from the site's outlet will be controlled to the 5-year pre-development peak flow rate. This approach is intended to control post-development flows relative to the anticipated capacity allocation of the receiving storm sewers.
- **Quality Control:** stormwater to be treated to the Enhanced Protection Level, as per the Ministry of the Environment's *Stormwater Management Planning and Design Manual* (March 2003).

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Design Storm Parameters

A Visual OTTHYMO computer model was used to simulate the subject lands under pre-development and post-development conditions. Simulations were based on the 4-hour Chicago Distribution design storm, using the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year storm events. The SWM analysis was conducted using the Norfolk County IDF curves, in accordance with Norfolk County Design Criteria (2019), with input parameters summarized in Table 5.

Table 5: Norfolk County Rainfall IDF Parameters

Storm 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 Drainage Areas

Under existing conditions, the subject lands consist of an abandoned railway and grassed areas. Runoff drains uncontrolled, overland, either to the north or south from the elevated railway toward the lower surrounding areas. The pre-development catchment areas are shown on the Pre-Development Drainage Areas drawing in Appendix D, and are generally described below:

- **PRE-A:** the western portion of the subject lands (Site A), approximately 1.84 ha, drains away from the elevated railway toward the lower surrounding areas.
- **EXT-A1:** an external area of approximately 0.32 ha, where runoff from the rear yards of existing residential properties is anticipated to drain southerly to PRE-A.
- **EXT-A2:** an external area of approximately 0.42 ha, where runoff from the rear yards of existing residential properties is anticipated to drain northerly to PRE-A.
- **PRE-B:** the central portion of the subject lands (Site B), approximately 0.14 ha, drains away from the elevated railway toward the lower surrounding areas of Ann and East Street.
- **PRE-C:** the eastern portion of the subject lands (Site C), approximately 0.25 ha, drains away from the elevated railway toward the lower surrounding areas.
- **PRE-C1:** an external area of approximately 0.19 ha, where runoff from the rear yards of existing residential properties is anticipated to drain southerly to PRE-C.

Table 6 summarizes the catchment parameters for the pre-development drainage areas. Note that the soil parameters were assumed based on Ontario Soil Mapping. Refer to Appendix D for additional details on the catchment and soil parameters.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Table 6: Pre-Development Catchment Parameters

Parameter	PRE-A	EXT-A1	EXT-A2	PRE-B	PRE-C	EXT-C1
Area	1.84 ha	0.32 ha	0.42 ha	0.14 ha	0.25 ha	0.19 ha
Soil Type	Mainly lacustrine sand and loamy sand					
Soil Group	AB					
SCS Curve Number	70					
Initial Abstraction	9.0 mm (IA = $S_{0.05} * 0.05 * 25.4$ in mm, where $S_{0.05} = 1.33 * S_{0.20}^{1.15}$ in inches and $S_{0.20} = 1000/CN - 10$ in inches)					
Runoff Coefficient	0.27	0.28	0.38	0.32	0.31	0.51
Longest Flow Path	60 m	35 m	30 m	15 m	15 m	45 m
Average Slope	8.3%	4.3%	3.3%	23.3%	13.3%	2.2%
Time to Peak	0.10 hr	0.10 hr	0.09 hr	0.03 hr	0.04 hr	0.10 hr

Pre-Development Modelling

A Visual OTTHYMO computer model was used to simulate pre-development conditions for the subject lands. The model uses a modified SCS procedure to estimate losses that occur naturally during rainfall events, such as evaporation and infiltration. Table 7 presents the pre-development peak runoff rates for the catchment areas, based on the inputs in Table 6. Full modelling results are provided in Appendix D. Modelling was completed only for Sites A and C, as no stormwater infrastructure changes or controls are proposed for Site B. Post-development flows from Site B are assumed to remain uncontrolled and will discharge overland to the future storm sewers on Ann Street and East Street.

Table 7: Pre-Development Peak Runoff Rates for Sites A and C

Storm Event	Peak Flow Rate (m ³ /s)						
	PRE-A	EXT-A1	EXT-A2	PRE-A TOTAL	PRE-C	EXT-C1	PRE-C TOTAL
2-year	0.026	0.004	0.006	0.036	0.004	0.003	0.006
5-year	0.060	0.010	0.015	0.086	0.008	0.006	0.014
10-year	0.091	0.016	0.022	0.129	0.012	0.009	0.021
25-year	0.135	0.023	0.033	0.191	0.017	0.014	0.031
50-year	0.172	0.030	0.042	0.245	0.021	0.018	0.039
100-year	0.212	0.037	0.052	0.300	0.025	0.022	0.047

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Post-Development Drainage Areas

Under proposed conditions, the subject lands will include residential units (townhouses and semi-detached homes), a commercial building, internal roadways, parking areas, and landscaped spaces. The post-development catchment areas are shown on the Post-Development Drainage Areas drawing in Appendix D, and are generally described below. Also, the three (3) external drainage areas adjacent to Sites A and C will continue to drain into those sites under post-development conditions.

- **POST-A:** this catchment area consists of Site A, which includes two-storey group townhouses (35 units) and two-storey semi-detached homes (20 units), internal roadways, and landscaped spaces. This catchment will drain to the underground SWM chamber facility located on Site A.
- **POST-B:** this catchment area consists of Site B, which includes two-storey semi-detached homes (2 units), driveways, and some grassed areas. This catchment will remain uncontrolled and drain overland to the future storm sewers on Ann Street and East Street.
- **POST-C:** this catchment area consists of Site C, which includes a commercial building, parking lot, and grassed areas. This catchment will drain to the underground SWM chamber facility located on Site C.

Table 8 summarizes the post-development catchment parameters, with full details included in Appendix D. The directly connected impervious area includes all impervious surfaces that are directly connected to the storm system, such as driveways, roads, and parking areas. Also, note that the soil parameters were assumed based on Ontario Soil Mapping.

Table 8: Post-Development Catchment Parameters

Parameter	POST-A	POST-B	POST-C
Area	1.84 ha	0.14 ha	0.25 ha
Soil Type	Mainly lacustrine sand and loamy sand		
Soil Group	AB		
SCS Curve Number	70		
Initial Abstraction	9.0 mm (IA = $S_{0.05} * 0.05 * 25.4$ in mm, where $S_{0.05} = 1.33 * S_{0.20}^{1.15}$ in inches and $S_{0.20} = 1000/CN - 10$ in inches)		
Impervious %	58%	26%	74%
Directly Connected Impervious %	32%	11%	59%

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Stormwater Management Chamber Facilities

An underground chamber system is proposed to provide stormwater storage, control post-development peak flow rates, and to promote infiltration for Sites A and C. To determine the required storage volume the relationship between the storage volume and discharge must be defined; this relationship is referred to as the rating curve. The 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.

Discharge from SWM facilities is typically controlled using either orifices or weirs. These methods can be applied individually or in combination, depending on the desired discharge characteristics. For the proposed facilities, a single orifice is planned, 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

Site A

The proposed underground chamber system will utilize 132 StormTech MC-4500 chambers, with 10 end caps, a 305 mm stone reservoir above the chambers and a 230 mm stone reservoir below, resulting in a total storage volume of 662 m^3 . Drawings and specifications for the proposed StormTech chamber facility are provided in Appendix D.

To control the release rate from the SWM facility, a 180 mm diameter orifice will be installed in an outlet control structure at an invert elevation of 227.67 m. The complete discharge-to-storage rating curve is included in Appendix D.

Outflows from the facility will discharge to the existing storm sewer that cuts through Site A, which conveys flows toward the existing storm sewer on the Main Street of Delhi.

Site C

The proposed underground chamber system will utilize 48 StormTech DC-780 chambers, with 6 end caps, a 152 mm stone reservoir above the chambers and a 230 mm stone reservoir below, resulting in a total storage volume of 120.5 m^3 . Drawings and specifications for the proposed StormTech chamber facility are provided in Appendix D.

To control the release rate from the SWM facility, an 85 mm diameter orifice will be installed in an outlet control structure at an invert elevation of 235.60 m. The complete discharge-to-storage rating curve is included in Appendix D.

Outflows from the facility will discharge to the existing storm sewer stub at the property line of Site C, which conveys flows toward the existing storm sewer on James Street.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Post-Development Modelling

A Visual OTTHYMO computer model was used to simulate post-development conditions for Site A and Site C. Peak runoff rates were calculated for each site and compared to the allowable release rates for storm events up to and including the 100-year storm event. The allowable release rates are based on the total pre-development peak flows for Site A (i.e., PRE-A TOTAL) and Site C (i.e., PRE-C TOTAL), which include both on-site runoff and contributions from the external drainage areas adjacent to each site. In addition, a 25 mm, 4-hour Chicago Distribution design storm was modelled to assess the water quality control performance of the chamber facilities.

Based on Ontario Soil Mapping, the infiltration rate of the native soil was assumed to be approximately 62 mm/hr. This assumption is consistent with the results of a previous geotechnical investigation completed for a nearby project on James Street. Applying a safety factor of 2.5, a design infiltration rate of 25 mm/hr was used in the modelling.

Note that modelling was not completed for Site B, as no stormwater infrastructure changes or controls are proposed. Post-development flows from Site B are assumed to remain uncontrolled and will discharge overland to the future storm sewers on Ann Street and East Street.

Complete details of the modelling results for Sites A and C are provided in Appendix D.

Site A

Table 9 summarizes the total post-development peak runoff rates for Site A and compares them to the allowable release rates for each storm event up to and including the 100-year storm event.

Table 9: Post-Development Peak Runoff Rates for Site A

Storm Event	Pre-Dev Peak Flow from PRE-A TOTAL (m ³ /s)	Allowable Release Rate (m ³ /s)	Post-Dev Peak Flow (m ³ /s)	Net Change: Allowable minus Post-Dev (m ³ /s)
25 mm	N/A	N/A	0.000	N/A
2-year	0.036	0.036	0.014	-0.022
5-year	0.086	0.086	0.035	-0.051
10-year	0.129	0.086	0.046	-0.040
25-year	0.191	0.086	0.060	-0.026
50-year	0.245	0.086	0.071	-0.015
100-year	0.300	0.086	0.085	-0.001

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners

As shown in Table 9, the post-development peak flow rates are attenuated to less than or equal to the pre-development peak flows for all storm events up to and including the 100-year storm. Additionally, the post-development flows are reduced below the 5-year pre-development peak flow rate. Note that the collected stormwater runoff for the 25 mm storm event is fully infiltrated. Table 10 summarizes the performance of the proposed SWM facility for Site A, including the utilized storage volumes in the facility and corresponding storage elevations for each storm event.

Table 10: SWM Facility Performance – Site A

Storm Event	Inflow (m ³ /s)	Outflow (m ³ /s)	Volume Reduction Rate	Utilized Storage Volume (m ³)	Storage Depth (m)	Storage Elevation (m)	Drawdown Time (hr)
25 mm	0.084	0.000	100%	160.41	0.50	227.57	11.58
2-year	0.131	0.014	73%	220.68	0.64	227.71	15.42
5-year	0.205	0.035	46%	291.85	0.81	227.89	15.83
10-year	0.257	0.046	37%	362.72	0.99	228.07	16.33
25-year	0.362	0.060	29%	461.66	1.26	228.34	16.83
50-year	0.430	0.071	25%	547.00	1.53	228.60	17.25
100-year	0.499	0.085	22%	628.04	1.89	228.96	17.58

Note: The Volume Reduction Rate represents the proportion of runoff volume infiltrated by the SWM chamber facility. It is calculated as the difference between the runoff volume entering the system and the volume leaving through the outlet orifice, divided by the total incoming runoff volume.

As shown in Table 10, the SWM chamber facility provides significant volume reduction and peak flow control. The system fully infiltrates the 25 mm storm event (i.e., 100% volume reduction), while higher return periods show decreasing but still notable infiltration. Also, the drawdown time for each storm event is less than the maximum drawdown time of 96 hours specified in the Norfolk County Design Criteria. All corresponding calculations completed during the development of the Visual OTTHYMO model and the results from the Visual OTTHYMO analysis are detailed in Appendix D.

Site C

Table 11 summarizes the total post-development peak runoff rates for Site C and compares them to the allowable release rates for each storm event up to and including the 100-year storm event.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Table 11: Post-Development Peak Runoff Rates for Site C

Storm Event	Pre-Dev Peak Flow from PRE-A TOTAL (m ³ /s)	Allowable Release Rate (m ³ /s)	Post-Dev Peak Flow (m ³ /s)	Net Change: Allowable minus Post-Dev (m ³ /s)
25 mm	N/A	N/A	0.000	N/A
2-year	0.006	0.006	0.004	-0.002
5-year	0.014	0.014	0.006	-0.008
10-year	0.021	0.014	0.009	-0.005
25-year	0.031	0.014	0.011	-0.003
50-year	0.039	0.014	0.012	-0.002
100-year	0.047	0.014	0.014	0.000

As shown in Table 11, the post-development peak flow rates are attenuated to less than or equal to the pre-development peak flows for all storm events up to and including the 100-year storm. Additionally, the post-development flows are reduced below the 5-year pre-development peak flow rate. Note that the collected stormwater runoff for the 25 mm storm event is fully infiltrated.

Table 12 summarizes the performance of the proposed SWM facility for Site C, including the utilized storage volumes in the facility and corresponding storage elevations for each storm event.

Table 12: SWM Facility Performance – Site C

Storm Event	Inflow (m ³ /s)	Outflow (m ³ /s)	Volume Reduction Rate	Utilized Storage Volume (m ³)	Storage Depth (m)	Storage Elevation (m)	Drawdown Time (hr)
25 mm	0.022	0.000	100%	27.28	0.30	235.60	5.50
2-year	0.032	0.004	67%	34.64	0.36	235.65	5.92
5-year	0.048	0.006	45%	51.04	0.47	235.77	6.42
10-year	0.062	0.009	38%	64.77	0.58	235.87	6.92
25-year	0.078	0.011	31%	82.05	0.71	236.01	7.42
50-year	0.090	0.012	27%	97.60	0.86	236.15	7.67
100-year	0.103	0.014	24%	112.68	1.04	236.33	8.08

Note: The Volume Reduction Rate represents the proportion of runoff volume infiltrated by the SWM chamber facility. It is calculated as the difference between the runoff volume entering the system and the volume leaving through the outlet orifice, divided by the total incoming runoff volume.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



As shown in Table 12, the SWM chamber facility provides volume reduction and peak flow control. The system fully infiltrates the 25 mm storm event (i.e., 100% volume reduction), while higher return periods show decreasing but still notable infiltration. Also, the drawdown time for each storm event is less than the maximum drawdown time of 96 hours specified in the Norfolk County Design Criteria. All corresponding calculations completed during the development of the Visual OTTHYMO model and the results from the Visual OTTHYMO analysis are detailed in Appendix D.

Quality Control

The Ministry of Environment's *Stormwater Management Planning and Design Manual* (March 2003) was used in conjunction with the requirements of Norfolk County to determine the quality control design for the proposed SWM facility. For the proposed development stormwater shall be treated to the Enhanced Protection Level, corresponding to a removal of 80% of total suspended solids (TSS).

Chamber Facility Quality Control

Quality control for the proposed development will be provided by the StormTech Isolator PLUS Row in the underground SWM chamber facility, 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.

For Site A, each MC-4500 isolator row chamber has an ETV-verified treated flow rate of 7.93 L/s corresponding to greater than 80% TSS removal. The proposed chamber facility features 32 isolator row chambers, which allows for a total treated inlet flow rate of approximately 254 L/s. Using Visual OTTHYMO, the maximum flow rate entering the chambers during the 25 mm storm event (quality control event) was determined to be 84 L/s. Thus, it can be concluded that the proposed chamber facility provides more than 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 D.

For Site C, each DC-780 isolator row chamber has an ETV-verified treated flow rate of 7.36 L/s corresponding to greater than 80% TSS removal. The proposed chamber facility features 16 isolator row chambers, which allows for a total treated inlet flow rate of approximately 118 L/s. Using Visual OTTHYMO, the maximum flow rate entering the chambers during the 25 mm storm event (quality control event) was determined to be 22 L/s. Thus, it can be concluded that the proposed chamber facility provides more than 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 D.

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.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Minimum Orifice Size

A minimum orifice size of 75 mm is recommended as per the MOE guidelines. For this development, a 180 mm diameter orifice is proposed for Site A's facility and an 85 mm diameter orifice is proposed for Site C's facility.

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 catchbasins on-site.

Utility Coordination

The servicing plans will be forwarded to utility companies, including but not limited to Bell Canada, Rogers Communications, and Enbridge Gas Inc., as initial notification of the project. As the project progresses towards construction additional notification and coordination will occur. The servicing plans will also be forwarded to Canada Post for consideration of mail delivery to the proposed development.

Hydro One Networks Inc. will complete the electrical distribution servicing design for the project. Also, the proposed street lighting design will be completed by the developer's consulting team and will be submitted to Norfolk County and Hydro One Networks Inc. as part of the approvals system.

Ultimately, running paths (i.e., utility corridors) will be in accordance with Norfolk County standards.

Conclusions and Recommendations

The functional servicing design for the proposed Delhi Railway Development is summarized as follows:

Sanitary Servicing:

- **Site A:** servicing will be provided via a 200 mm diameter sanitary sewer along the site's internal roadway, which will connect to the existing sanitary infrastructure on the Main Street of Delhi.
- **Site B:** servicing will be provided via the future 200 mm diameter sanitary sewer on East Street, to be installed through Norfolk County's Ann Street and East Street Reconstruction project.
- **Site C:** will be serviced by connecting to the existing 125 mm diameter sanitary lateral that was previously installed from the 375 mm sewer on James Street to the property line of Site C.
- The development is estimated to generate a total peak sanitary flow of approximately 3.11 L/s (2.51 L/s for Site A, 0.13 L/s for Site B, and 0.47 L/s for Site C).
- Vallee requests that Norfolk County's external consultant complete a sanitary hydraulic analysis to confirm adequate downstream capacity.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Water Servicing:

- **Site A:** will be serviced by a 150 mm diameter watermain along the site's internal roadway, which will connect to the County's distribution system at three locations.
- **Site B:** servicing will be provided via the future 200 mm diameter watermain on East Street, which will be installed through the County's Ann Street and East Street Reconstruction project.
- **Site C:** will be serviced by connecting to the existing 50 mm diameter water service that was previously installed from the 300 mm watermain on James Street to the property line of Site C.
- The development is anticipated to have:
 - MDD of 1.28 L/s (1.07 L/s for Site A, 0.04 L/s for Site B, and 0.17 L/s for Site C).
 - PHD of 2.13 L/s (1.90 L/s for Site A, 0.08 L/s for Site B, and 0.15 L/s for Site C).
- The minimum required fire flow ranges from 125 L/s to 150 L/s, per Norfolk County's standards.
- Vallee requests that a watermain hydraulic analysis be completed by Norfolk County's external consultant to confirm system capacity, pressure, and fire flow adequacy.

Stormwater Management:

- **Sites A and C:** runoff will be detained in underground StormTech chamber facilities, receiving flow from both minor and major storm events (2-year to 100-year storms) via internal storm sewers and overland flow routes.
 - Site A: MC-4500 chambers (132 units with 10 end caps), providing a total storage volume of 662 m³. Outflows are controlled by a 180 mm orifice, at an elevation of 227.67 m, with flows discharging to the existing storm sewer that crosses through Site A
 - Site C: DC-780 chambers (48 units with 6 end caps), providing a total storage volume of 120.5 m³. Outflows are controlled by an 85 mm orifice, at an elevation of 235.60 m, with flows discharging to the existing storm sewer stub at the property line of Site C.
- **Site B:** runoff will remain uncontrolled, discharging overland to the future storm sewers on Ann Street and East Street.
- For Sites A and C, post-development peak flows are attenuated to less than or equal to the 5-year pre-development peak flows for all storms up to the 100-year event.
- Quality control will be achieved through the StormTech Isolator PLUS Row, providing an enhanced level of treatment corresponding to 80% TSS removal.

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

It is recommended that this report be provided to Norfolk County in support of 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,



Sarah Freeman, P.Eng.
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects and Planners

A handwritten signature of "John Iezzi" in black ink.

John Iezzi, P.Eng.
G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects and Planners

\vallee-nas1\data\Projects\2023\23-024 Railway Subdivision - Delhi\Design\FSR\East Sites\23-024 Functional Servicing Report - East Sites.docx

G. DOUGLAS VALLEE LIMITED
Consulting Engineers, Architects & Planners



Professional Engineers
Ontario

Authorized by the Association of Professional Engineers of Ontario
to offer professional engineering services



Ontario Association
of Architects

Appendix A

- Site Plan
- Servicing Plans

Appendix B

- Sanitary Flow Calculations

Appendix C

- Domestic Water Demand Calculations
- OBC Calculations
- Exposure Distances Figure
- Draft Form FFD1 – Fire Flow Determination

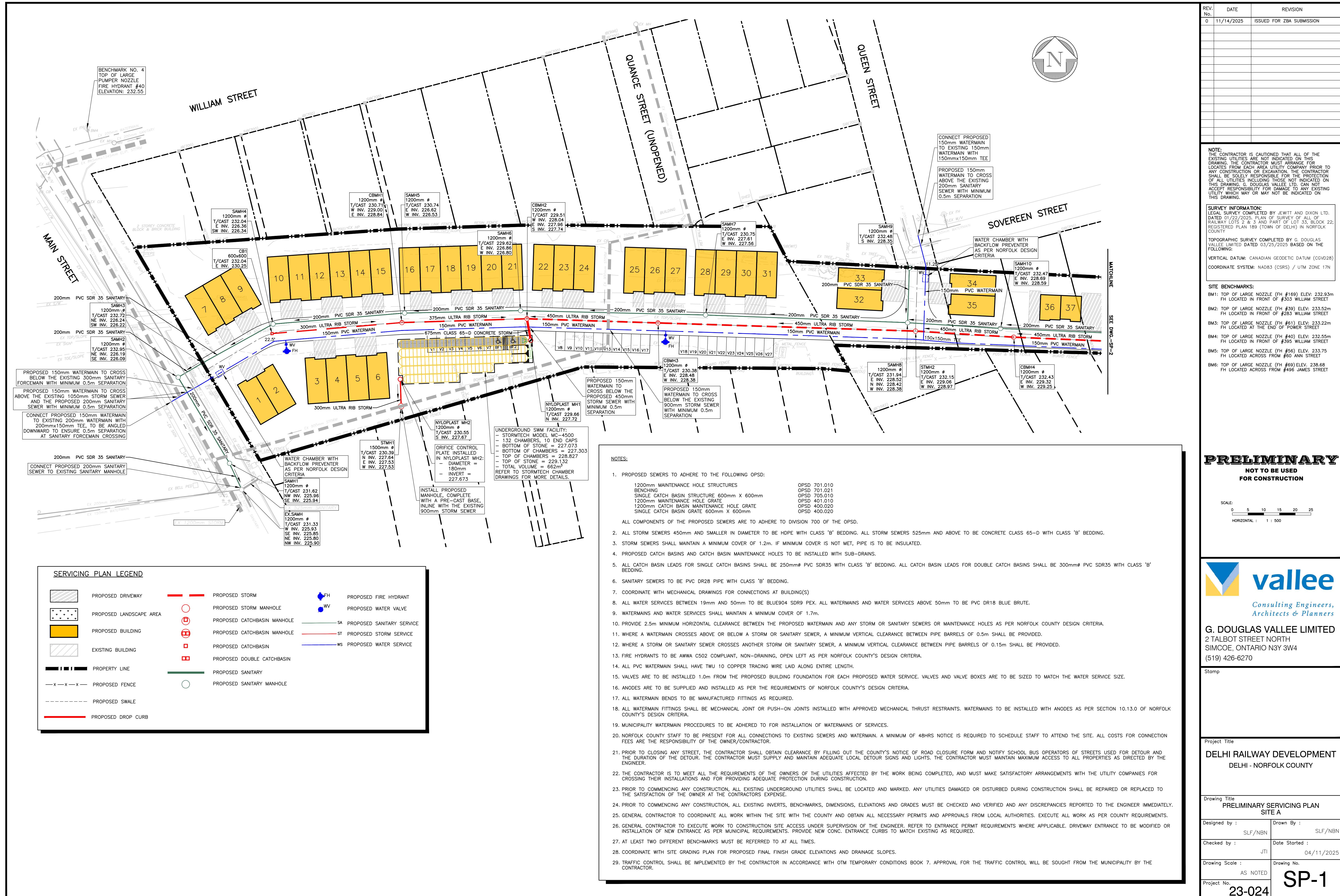
Appendix D

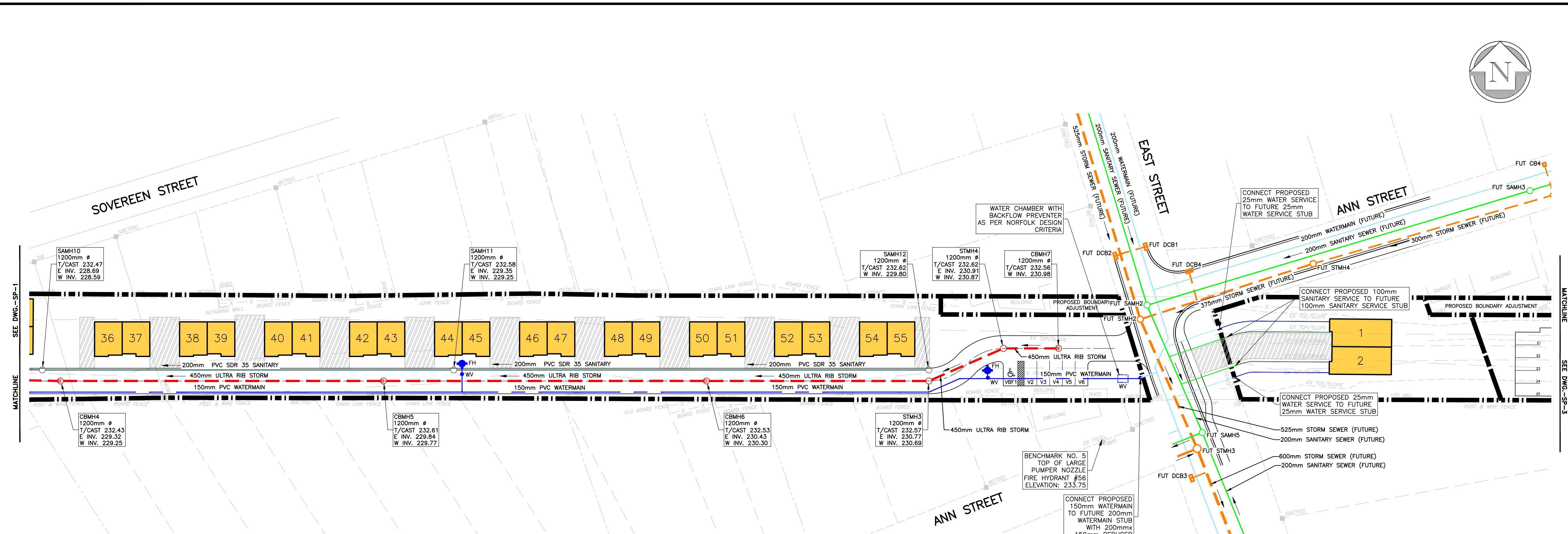
- Pre-Development Drainage Areas (Drawing No. 23-024-PRE)
- Post-Development Drainage Areas (Drawing No. 23-024-POST)
- Soil Parameters
- Catchment Parameters
- Design Storm Parameters
- Rating Curves (for Site A and Site C)
- Pre to Post Flows and Utilized Storage Volumes (for Site A and Site C)
- Quality Control (for Site A and Site C)
- 15% Infiltration Surplus Storage (for Site A and Site C)
- Pre-Development OTTHYMO Model Results
- Post-Development OTTHYMO Model Results
- ADS StormTech Chamber Drawings & Specifications

APPENDIX A

Site Plan

Servicing Plans





SERVICING PLAN LEGEND



NOTES

1. PROPOSED SEWERS TO ADHERE TO THE FOLLOWING OPSD:

1200mm MAINTENANCE HOLE STRUCTURES	OPSD 701.010
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.

2. 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.

3. STORM SEWERS SHALL MAINTAIN A MINIMUM COVER OF 1.2m. IF MINIMUM COVER IS NOT MET, PIPE IS TO BE INSULATED.

4. PROPOSED CATCH BASINS AND CATCH BASIN MAINTENANCE HOLES TO BE INSTALLED WITH SUB-DRAINS.

5. ALL CATCH BASIN LEADS FOR SINGLE CATCH BASINS SHALL BE 250mmØ PVC SDR35 WITH CLASS 'B' BEDDING. ALL CATCH BASIN LEADS FOR DOUBLE CATCH BASINS SHALL BE 300mmØ PVC SDR35 WITH CLASS 'B' BEDDING.

6. SANITARY SEWERS TO BE PVC DR28 PIPE WITH CLASS 'B' BEDDING.

7. COORDINATE WITH MECHANICAL DRAWINGS FOR CONNECTIONS AT BUILDING(S)

8. ALL WATER SERVICES BETWEEN 19mm AND 50mm TO BE BLUE904 SDR9 PEX. ALL WATERMAINS AND WATER SERVICES ABOVE 50mm TO BE PVC DR18 BLUE BRUTE.

9. WATERMAINS AND WATER SERVICES SHALL MAINTAIN A MINIMUM COVER OF 1.7m.

10. PROVIDE 2.5m MINIMUM HORIZONTAL CLEARANCE BETWEEN THE PROPOSED WATERMAIN AND ANY STORM OR SANITARY SEWERS OR MAINTENANCE HOLES AS PER NORFOLK COUNTY DESIGN CRITERIA.

11. WHERE A WATERMAIN CROSSES ABOVE OR BELOW A STORM OR SANITARY SEWER, A MINIMUM VERTICAL CLEARANCE BETWEEN PIPE BARRELS OF 0.5m SHALL BE PROVIDED.

12. WHERE A STORM OR SANITARY SEWER CROSSES ANOTHER STORM OR SANITARY SEWER, A MINIMUM VERTICAL CLEARANCE BETWEEN PIPE BARRELS OF 0.15m SHALL BE PROVIDED.

13. FIRE HYDRANTS TO BE AWWA C502 COMPLIANT, NON-DRAINING, OPEN LEFT AS PER NORFOLK COUNTY'S DESIGN CRITERIA.

14. ALL PVC WATERMAIN SHALL HAVE TWU 10 COPPER TRACING WIRE LAID ALONG ENTIRE LENGTH.

15. 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.

16. ANODES ARE TO BE SUPPLIED AND INSTALLED AS PER THE REQUIREMENTS OF NORFOLK COUNTY'S DESIGN CRITERIA.

17. ALL WATERMAIN BENDS TO BE MANUFACTURED FITTINGS AS REQUIRED.

18. ALL WATERMAIN FITTINGS SHALL BE MECHANICAL JOINT OR PUSH-ON JOINTS INSTALLED WITH APPROVED MECHANICAL THRUST RESTRAINTS. WATERMAINS TO BE INSTALLED WITH ANODES AS PER SECTION 10.13.0 OF NORFOLK COUNTY'S DESIGN CRITERIA.

19. MUNICIPALITY WATERMAIN PROCEDURES TO BE ADHERED TO FOR INSTALLATION OF WATERMAINS OF SERVICES.

20. 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.

21. PRIOR TO CLOSING ANY STREET, THE CONTRACTOR SHALL OBTAIN CLEARANCE BY FILLING 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. THE CONTRACTOR MUST MAINTAIN MAXIMUM ACCESS TO ALL PROPERTIES AS DIRECTED BY THE ENGINEER.

22. THE CONTRACTOR IS TO MEET ALL THE REQUIREMENTS OF THE OWNERS OF THE UTILITIES AFFECTED BY THE WORK BEING COMPLETED, AND MUST MAKE SATISFACTORY ARRANGEMENTS WITH THE UTILITY COMPANIES FOR CROSSING THEIR INSTALLATIONS AND FOR PROVIDING ADEQUATE PROTECTION DURING CONSTRUCTION.

23. 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 CONTRACTOR'S EXPENSE.

24. PRIOR TO COMMENCING ANY CONSTRUCTION, ALL EXISTING INVERTS, BENCHMARKS, DIMENSIONS, ELEVATIONS AND GRADES MUST BE CHECKED AND VERIFIED AND ANY DISCREPANCIES REPORTED TO THE ENGINEER IMMEDIATELY.

25. 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 COUNTY REQUIREMENTS.

26. 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 MUNICIPAL REQUIREMENTS. PROVIDE NEW CONC. ENTRANCE CURBS TO MATCH EXISTING AS REQUIRED.

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

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

29. 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.

SITE BENCHMARKS:

- BM1: TOP OF LARGE NOZZLE (FH #169) ELEV: 232.93m
FH LOCATED IN FRONT OF #303 WILLIAM STREET
- BM2: TOP OF LARGE NOZZLE (FH #39) ELEV: 233.52m
FH LOCATED IN FRONT OF #283 WILLIAM STREET
- BM3: TOP OF LARGE NOZZLE (FH #61) ELEV: 233.22m
FH LOCATED AT THE END OF POWER STREET
- BM4: TOP OF LARGE NOZZLE (FH #40) ELEV: 232.55m
FH LOCATED IN FRONT OF #395 WILLIAM STREET
- BM5: TOP OF LARGE NOZZLE (FH #56) ELEV. 233.75
FH LOCATED ACROSS FROM #60 ANN STREET
- BM6: TOP OF LARGE NOZZLE (FH #69) ELEV. 238.68
FH LOCATED ACROSS FROM #496 JAMES STREET

PRELIMINARY

**NOT TO BE USED
FOR CONSTRUCTION**

Project Title

DELHI RAILWAY DEVELOPMENT

DELHI - NORFOLK COUNTY

Drawing Title	
PRELIMINARY SERVICING PLAN SITE A & SITE B	
Designed by :	Drawn By :
SLF/NBN	SLF/NBN
Checked by :	Date Started :
JTI	04/11/2025
Drawing Scale :	Drawing No.
AS NOTED	
Project No.	
23-024	SP-2

APPENDIX B

Sanitary Flow Calculations

Norfolk County Design Criteria
Section 9 - Sanitary Sewers

9.2.01 Tributary Population

Type of Development: Residential

Land Use Breakdown:

Single and Semi-Detached Homes	20	units
Town/rowhomes	35	units

Equivalent Population Density:

Single and Semi-Detached Homes	3.0	persons/unit
Town/rowhomes	2.4	persons/unit

Estimated Population: 144 persons

Site Area: 1.845 ha

9.2.02 Sewage Flow

Unit Sewage Flow: 0.285 $\text{m}^3/\text{person/day}$

Average Sewage Flow: 0.475 L/s

9.2.03 Peak Sanitary Flow Factor

Residential Peaking Factor Formula:

$$\begin{aligned} P &= 0.144 \\ M &= 4.20 \end{aligned}$$

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

$2 \leq M \leq 5$

Where M = ratio of peak flow to average flow
 P = the tributary population in thousands

9.2.04 Infiltration Allowance

Infiltration Allowance: 0.28 L/s/ha

Infiltration Allowance: 0.52 L/s

9.2.05 Design Flow

Design Flow:

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

$$\boxed{\text{Design Flow} = 2.51 \text{ L/s}}$$

Notes:

(1) The sanitary demand / output parameters and associated persons per unit (PPU component) are based on Norfolk County's latest engineering standards (2025).

Norfolk County Design Criteria
Section 9 - Sanitary Sewers

9.2.01 Tributary Population

Type of Development: Residential

Land Use Breakdown:

Single and Semi-Detached Homes	2	units
Town/rowhomes	0	units

Equivalent Population Density:

Single and Semi-Detached Homes	3.0	persons/unit
Town/rowhomes	2.4	persons/unit

Estimated Population: 6 persons

Site Area: 0.140 ha

9.2.02 Sewage Flow

Unit Sewage Flow: 0.285 m³/person/day
 Average Sewage Flow: 0.020 L/s

9.2.03 Peak Sanitary Flow Factor

Residential Peaking Factor Formula:

$$P = 0.006$$

$$M = 4.43$$

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

Where M = ratio of peak flow to average flow
 P = the tributary population in thousands

9.2.04 Infiltration Allowance

Infiltration Allowance: 0.28 L/s/ha
 Infiltration Allowance: 0.04 L/s

9.2.05 Design Flow

Design Flow:

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

$$\boxed{\text{Design Flow} = 0.13 \text{ L/s}}$$

Notes:

(1) The sanitary demand / output parameters and associated persons per unit (PPU component) are based on Norfolk County's latest engineering standards (2025).

Norfolk County Design Criteria
Section 9 - Sanitary Sewers

9.2.01 Tributary Population

Type of Development: Commercial

Land Use Breakdown:

Commercial Area	0.25	ha
-----------------	------	----

Equivalent Population Density:

Commercial Developments	90.0	persons/ha
-------------------------	------	------------

Estimated Population:

23 persons

Site Area:

0.247 ha

9.2.02 Sewage Flow

Unit Sewage Flow: 40 m³/ha/day

Average Sewage Flow: 0.114 L/s

9.2.03 Peak Sanitary Flow Factor

Residential Peaking Factor Formula:

P = 0.023
 M = 3.50

For **commercial and industrial land uses**, the peaking factor will be determined from a modified Harmon formula as follows:

$$Me = 0.80 * (1 + (14 / (4 + Pe^{0.5})))$$

Where Me = ratio of peak flow to average flow
 Pe = equivalent tributary population in thousands

9.2.04 Infiltration Allowance

Infiltration Allowance: 0.28 L/s/ha

Infiltration Allowance: 0.07 L/s

9.2.05 Design Flow

Design Flow:

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

Design Flow = 0.47 L/s

Notes:

(1) The sanitary demand / output parameters and associated persons per unit (PPU component) are based on Norfolk County's latest engineering standards (2025).

APPENDIX C

Domestic Water Demand Calculations

OBC Calculations

Exposure Distances Figure

Draft Form FFD1 – Fire Flow Determination

Norfolk County Design Criteria
Section 10 - Watermains

10.1.2 Design Factors

Type of Development: Residential

Land Use Breakdown:

Single and Semi-Detached Homes	20	units
Town/rowhomes	35	units

Equivalent Population Density:

Single and Semi-Detached Homes	3.0	persons/unit
Town/rowhomes	2.4	persons/unit

Estimated Population: 144 persons

Average Daily Demand per Capita 0.285 m³/person/day

Maximum Daily Demand Factor 2.25

Maximum Hourly Demand Factor 4.00 (for residential)

Average Daily Demand

Average Daily Demand per Capita	0.285	m ³ /person/day
Average Daily Demand	41.04	m ³ /day
	0.48	L/s

Maximum Daily Demand

Maximum Daily Demand Factor	2.25	
Maximum Daily Demand	92.34	m ³ /day
	1.07	L/s

Maximum Hourly Demand

Maximum Hourly Demand Factor	4.00	
Maximum Hourly Demand	6.84	m ³ /hour
	1.90	L/s

Notes:

(1) The water demand / output parameters and associated persons per unit (PPU component) are based on Norfolk County's latest engineering standards (2025).

Norfolk County Design Criteria
Section 10 - Watermains

10.1.2 Design Factors

Type of Development: Residential

Land Use Breakdown:

Single and Semi-Detached Homes	2	units
Town/rowhomes	0	units

Equivalent Population Density:

Single and Semi-Detached Homes	3.0	persons/unit
Town/rowhomes	2.4	persons/unit

Estimated Population: 6 persons

Average Daily Demand per Capita 0.285 m³/person/day

Maximum Daily Demand Factor 2.25

Maximum Hourly Demand Factor 4.00 (for residential)

Average Daily Demand

Average Daily Demand per Capita	0.285	m ³ /person/day
Average Daily Demand	1.71	m ³ /day
	0.02	L/s

Maximum Daily Demand

Maximum Daily Demand Factor	2.25	
Maximum Daily Demand	3.85	m ³ /day
	0.04	L/s

Maximum Hourly Demand

Maximum Hourly Demand Factor	4.00	
Maximum Hourly Demand	0.29	m ³ /hour
	0.08	L/s

Notes:

(1) The water demand / output parameters and associated persons per unit (PPU component) are based on Norfolk County's latest engineering standards (2025).

Norfolk County Design Criteria
Section 10 - Watermains

10.1.2 Design Factors

Type of Development: Commercial

Land Use Breakdown:

Commercial Area	0.25	ha
-----------------	------	----

Equivalent Population Density:

Commercial Developments	90.0	persons/ha
-------------------------	------	------------

Estimated Population: 23 persons

Average Daily Demand per Capita 0.285 *m³/person/day*

Maximum Daily Demand Factor 2.25

Maximum Hourly Demand Factor 2.00 *(for commercial)*

Average Daily Demand

Average Daily Demand per Capita 0.285 *m³/person/day*

Average Daily Demand 6.56 *m³/day*

0.08 *L/s*

Maximum Daily Demand

Maximum Daily Demand Factor 2.25

Maximum Daily Demand 14.75 *m³/day*

0.17 *L/s*

Maximum Hourly Demand

Maximum Hourly Demand Factor 2.00

Maximum Hourly Demand 0.55 *m³/hour*

0.15 *L/s*

Notes:

(1) The water demand / output parameters and associated persons per unit (PPU component) are based on Norfolk County's latest engineering standards (2025).

ON-SITE FIRE PROTECTION SUPPLY CALCULATION

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

Project: 23-024 Delhi Railway Development
Project Location: Delhi, ON

Building/Block #: Site A, Units 10-15
Firewalls/Sprinkler: No

Conditions not requiring On-Site Fire Protection:

Building area is Less than 200 m² 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:

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

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. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire resistance rating.		K Factor	23

Determining Building Volume:

Average Length (m)	14.6		
Average Width (m)	39.0		
Height, including basements (m)	11.0		
Building Volume (m ³)			6263

Total Spatial Coefficient:

	Exposure Distance (m)	Factor		
North Side	>10	0		
East Side	2.4	0.76		
South Side	>10	0		
West Side	3.0	0.7		
			S _{Tot} Factor	2.46

Minimum Water Supply Flow:

Minimum Water Supply Flow Rate OBC:	9000	L/min			Q (L)	354,383
	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 600m ² (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)

ON-SITE FIRE PROTECTION SUPPLY CALCULATION

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

Project: 23-024 Delhi Railway Development
Project Location: Delhi, ON

Building/Block #: Site A, Units 40-41
Firewalls/Sprinkler: No

Conditions not requiring On-Site Fire Protection:

Building area is Less than 200 m² 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:

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

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. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire resistance rating.		K Factor	23

Determining Building Volume:

Average Length (m)	8.1		
Average Width (m)	13.0		
Height, including basements (m)	11.0		
Building Volume (m ³)			1158

Total Spatial Coefficient:

	Exposure Distance (m)	Factor		
North Side	8	0.2		
East Side	7	0.3		
South Side	>10	0		
West Side	7	0.3		
			S _{Tot} Factor	1.8

Minimum Water Supply Flow:

Minimum Water Supply Flow Rate OBC:	2700	L/min		Q (L)	47,954
	45.0	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 600m ² (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)

ON-SITE FIRE PROTECTION SUPPLY CALCULATION

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

Project: 23-024 Delhi Railway Development
Project Location: Delhi, ON

Building/Block #: Site B
Firewalls/Sprinkler: No

Conditions not requiring On-Site Fire Protection:

Building area is Less than 200 m² 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:

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

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. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire resistance rating.		K Factor	23

Determining Building Volume:

Average Length (m)	14.6		
Average Width (m)	13.0		
Height, including basements (m)	11.0		
Building Volume (m ³)			2088

Total Spatial Coefficient:

	Exposure Distance (m)	Factor		
North Side	9.7	0.03		
East Side	>10	0		
South Side	8.3	0.17		
West Side	>10	0		
			S _{Tot} Factor	1.2

Minimum Water Supply Flow:

Minimum Water Supply Flow Rate OBC:	2700	L/min	Q (L)	57,623
	45.0	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 600m ² (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)

ON-SITE FIRE PROTECTION SUPPLY CALCULATION

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

Project: 23-024 Delhi Railway Development
Project Location: Delhi, ON

Building/Block #: Site C
Firewalls/Sprinkler: No

Conditions not requiring On-Site Fire Protection:

Building area is Less than 200 m² 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:

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

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	Mercantile Occupancies	
Group	E	
Division	-	
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2. of the OBC.		K Factor 31

Determining Building Volume:

Average Length (m)	22.7	Building Volume (m ³)	2747
Average Width (m)	11.0		
Height, including basements (m)	11.0		

Total Spatial Coefficient:

	Exposure Distance (m)	Factor		
North Side	5.6	0.44		
East Side	>10	0		
South Side	>10	0		
West Side	>10	0		
			S _{Tot} Factor	1.44

Minimum Water Supply Flow:

Minimum Water Supply Flow Rate OBC:	3600 L/min	60.0 L/sec	Q (L)	122,613

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 600m ² (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)



Figure C.1: Exposure Distances utilized in Fire Flow Calculations – Site A

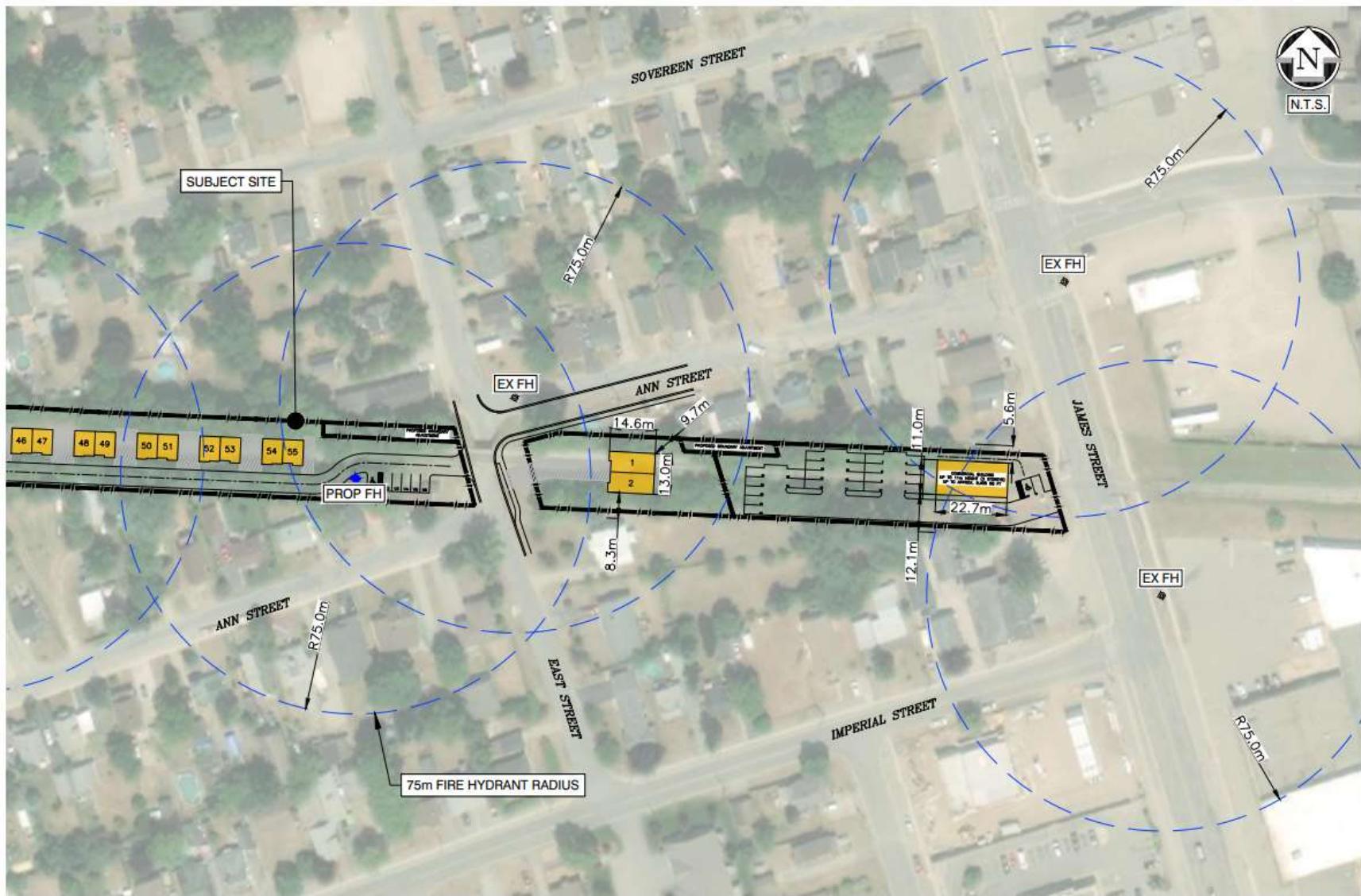


Figure C.2: Exposure Distances utilized in Fire Flow Calculations – Site B and Site C

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

Application Number:

Municipal Address:

Main Street of Delhi, Delhi

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

1. REQUIRED FIRE FLOW - RFF

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

Q=KVSTot		
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 BUILDING CODE - Q=KVSTot. 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 calculated value here (highest if multiple buildings)		
Required fire volume as calculated using Q=KVSTot	354,383	Litres
A. Required min. Water Supply Flow rate (Table 2 OBC A.3.2.5.7)	150.0	Litres/second
B. Sprinkler Requirements (per NFPA 13)	0.0	Litres/second
C. Standpipe Requirements (per NFPA 14)	0.0	Litres/second
Total OBC Requirements (A+B+C)	150.0	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)		
Land Use	Community Area	
	Simcoe, Delhi, Port Dover	Waterford, Port Rowan, Courtland
Commercial	150	150
Industrial	150	150
Intitutional	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 calculated value here (highest if multiple buildings)		
150.0 Litres/second		

1 c) Required Fire Flow - RFF c)

Enter the higher of a) or b) from above
150.0 Litres/second
Comments:

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

Application Number:

Municipal Address:

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

Comments:

DECLARATION OF ADEQUATE SERVICES

RFF c) is less than or equal to AFF, or



RFF c) is greater than AFF.

Prepared by:

Date:

APPENDIX D

Pre-Development Drainage Areas (Drawing No. 23-024-PRE)

Post-Development Drainage Areas (Drawing No. 23-024-POST)

Soil Parameters

Catchment Parameters

Design Storm Parameters

Rating Curves (for Site A and Site C)

Pre to Post Flows and Utilized Storage Volumes (for Site A and Site C)

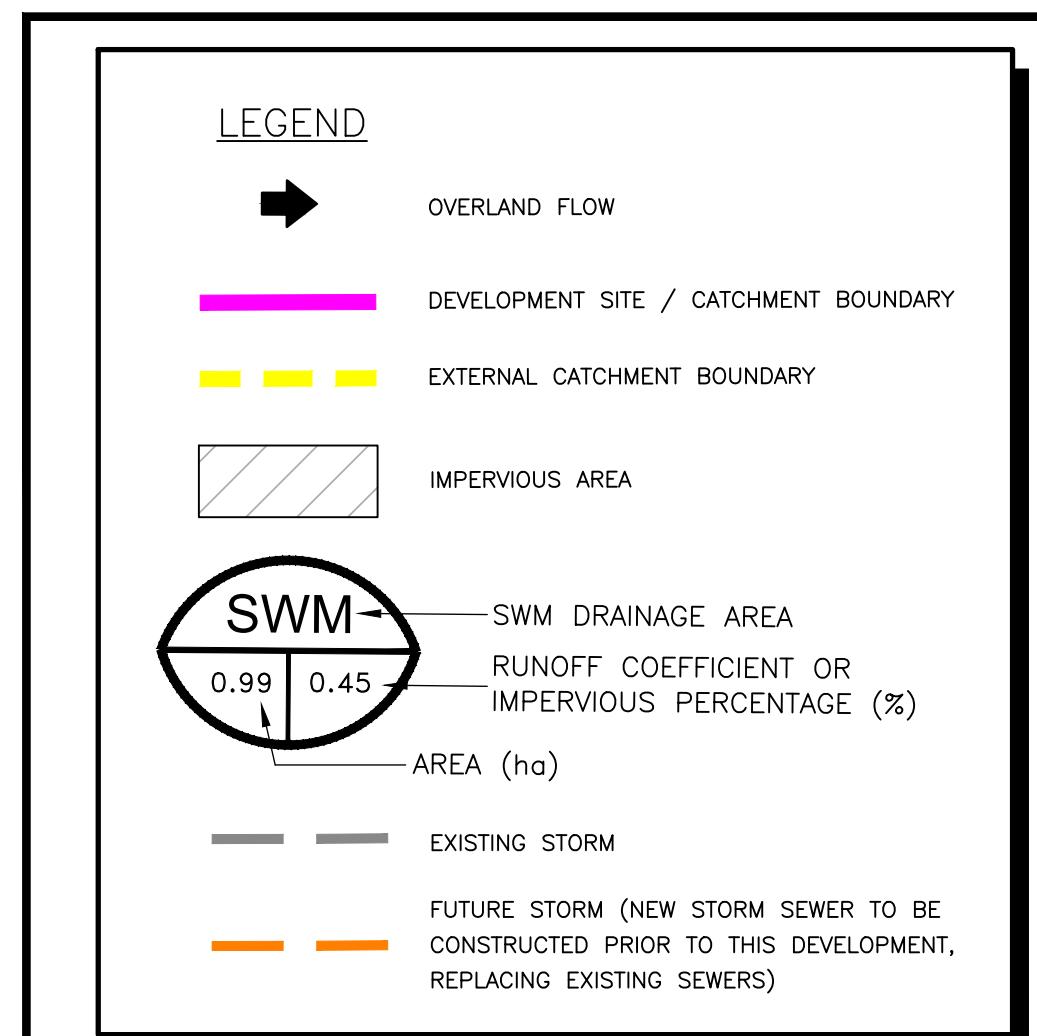
Quality Control (for Site A and Site C)

15% Infiltration Surplus Storage (for Site A and Site C)

Pre-Development OTTHYMO Model Results

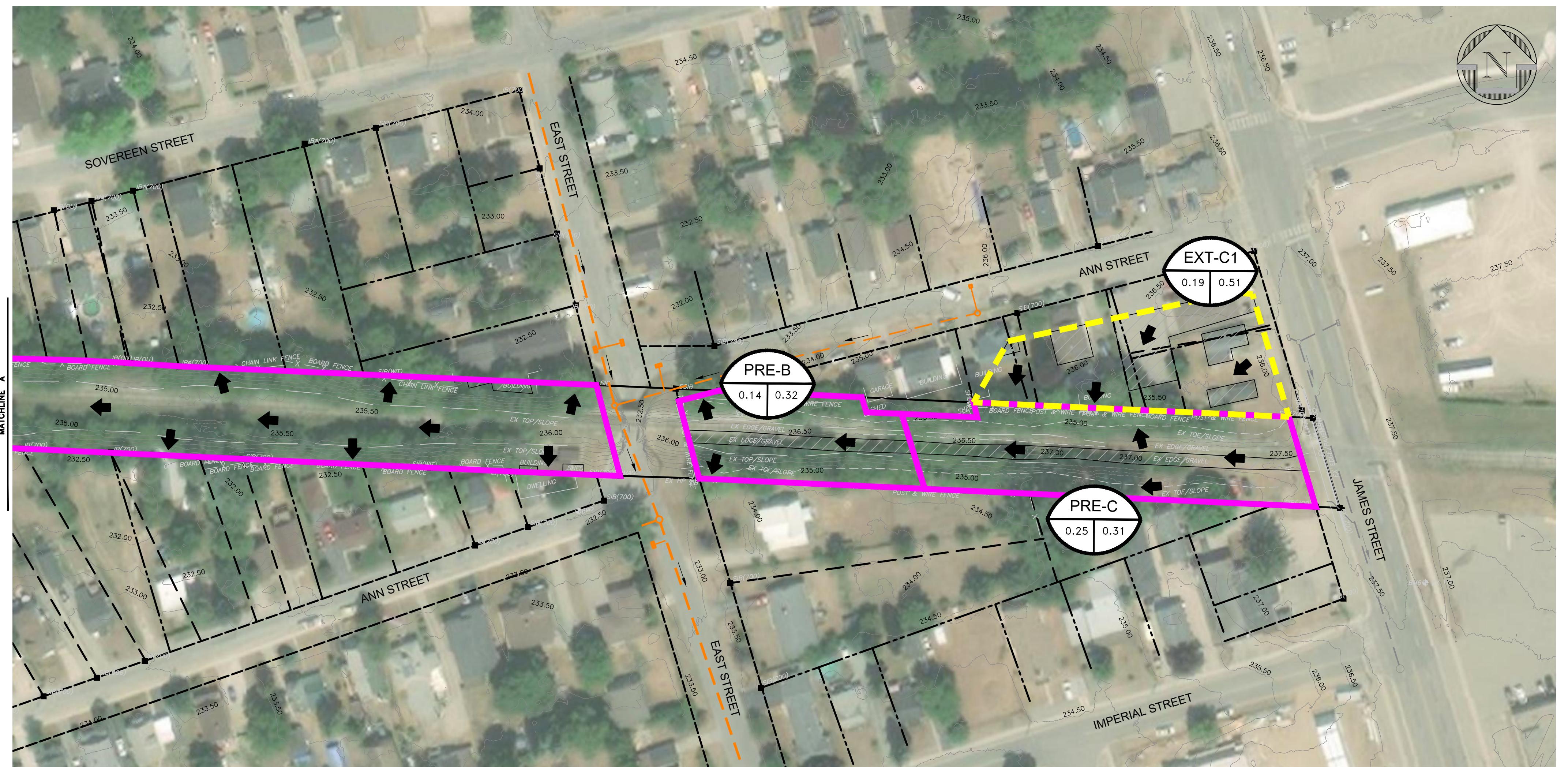
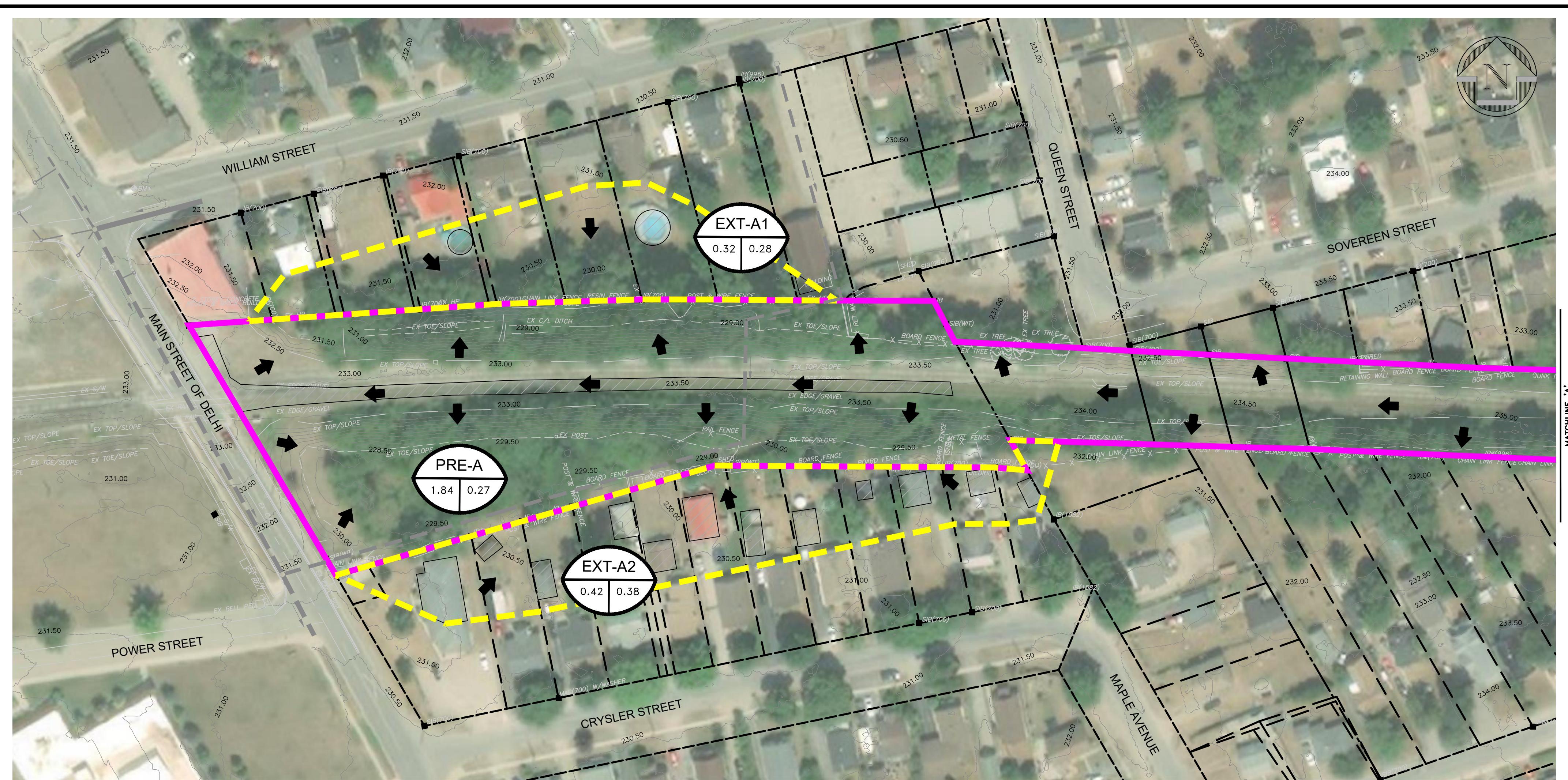
Post-Development OTTHYMO Model Results

ADS StormTech Chamber Drawings & Specifications



NOTE:

THE EXISTING CONTOURS SHOWN ON THIS DRAWING ARE APPROXIMATE AND BASED ON THE ONTARIO DIGITAL TERRAIN MODEL (LIDAR-DERIVED, 2025). THEY ARE PROVIDED FOR REFERENCE ONLY AND SHALL NOT BE RELIED UPON FOR CONSTRUCTION. EXISTING CONDITIONS TO BE CONFIRMED BY TOPOGRAPHIC SURVEY.



REV. No.	DATE	REVISION
0	11/14/2025	ISSUED FOR REVIEW

SCALE:	0	10	20	30	40
HORIZONTAL : 1 : 750					

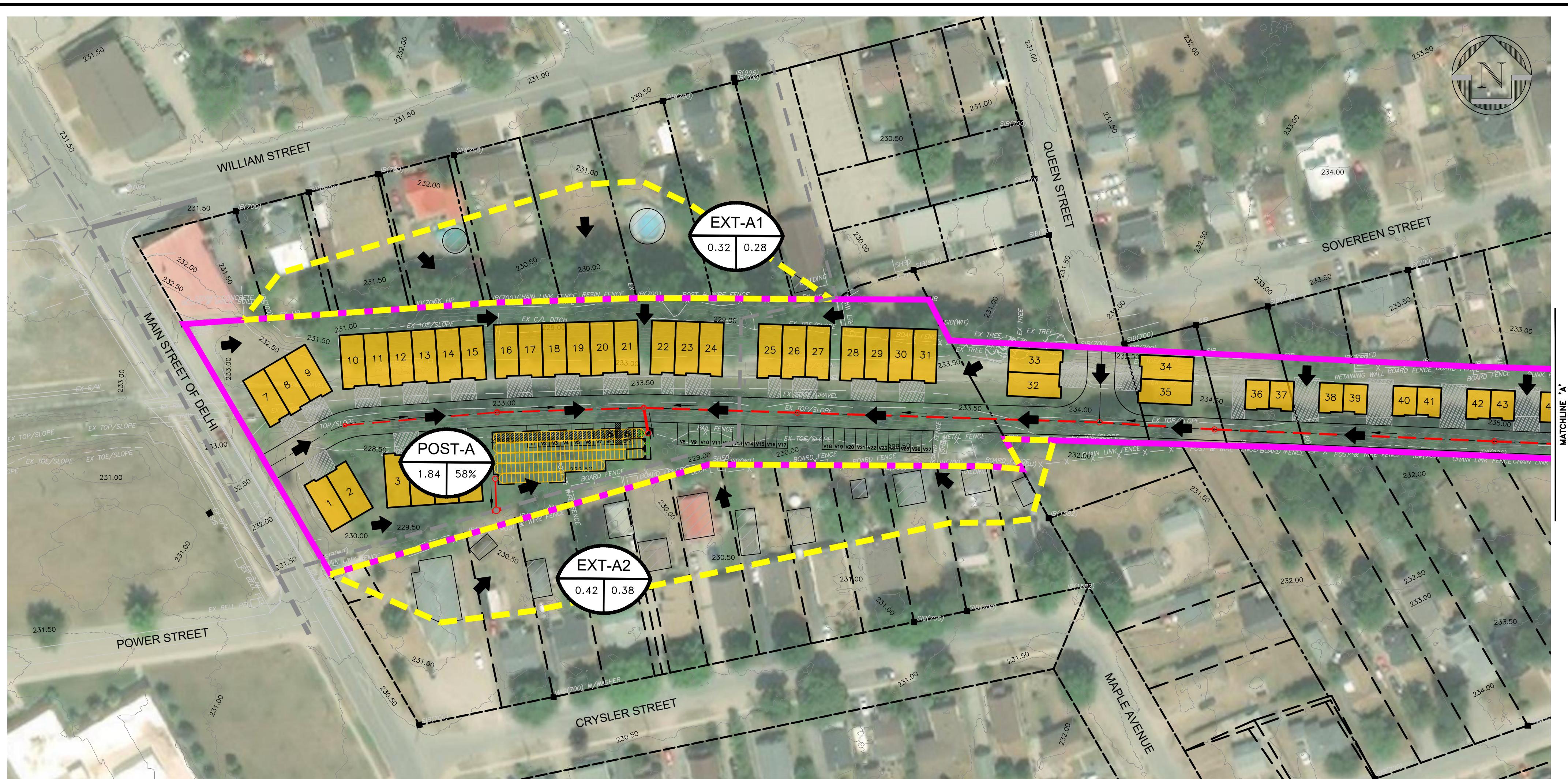
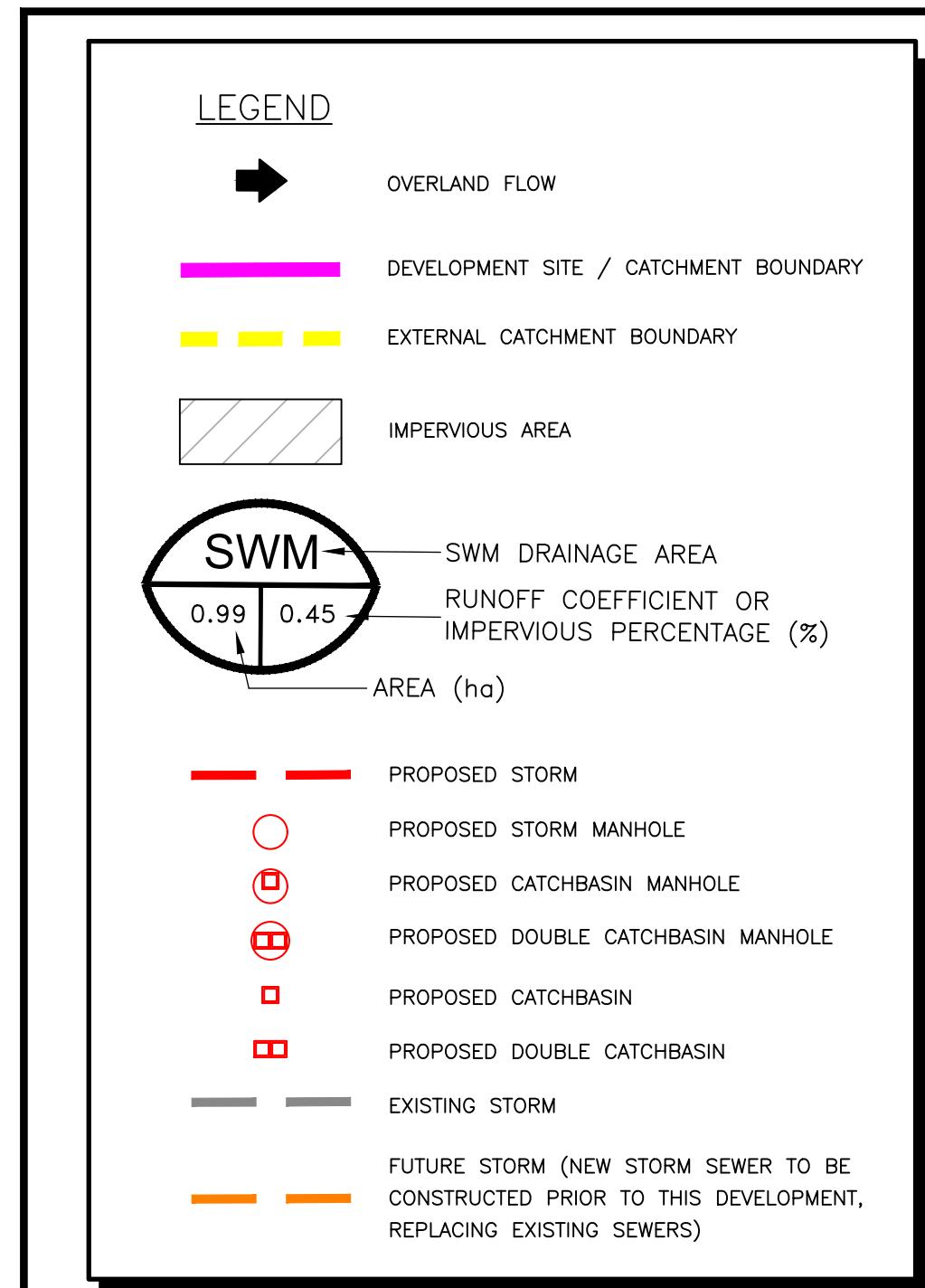
 **vallee**
Consulting Engineers,
Architects & Planners

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: **DELHI RAILWAY DEVELOPMENT**
DELHI - NORFOLK COUNTY
Drawing Title: **PRE-DEVELOPMENT DRAINAGE AREAS**
Designed by : SLF Drawn by : SLF
Checked by : JTI Date Started : 08/18/2025
Drawing Scale : 1:750 Drawing No.
Project No. **PRE**
23-024



REV. No.	DATE	REVISION
0	11/14/2025	ISSUED FOR REVIEW

SCALE: 0 10 20 30 40
HORIZONTAL: 1:750

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: DELHI RAILWAY DEVELOPMENT
DELHI - NORFOLK COUNTY

Drawing Title: POST-DEVELOPMENT DRAINAGE AREAS

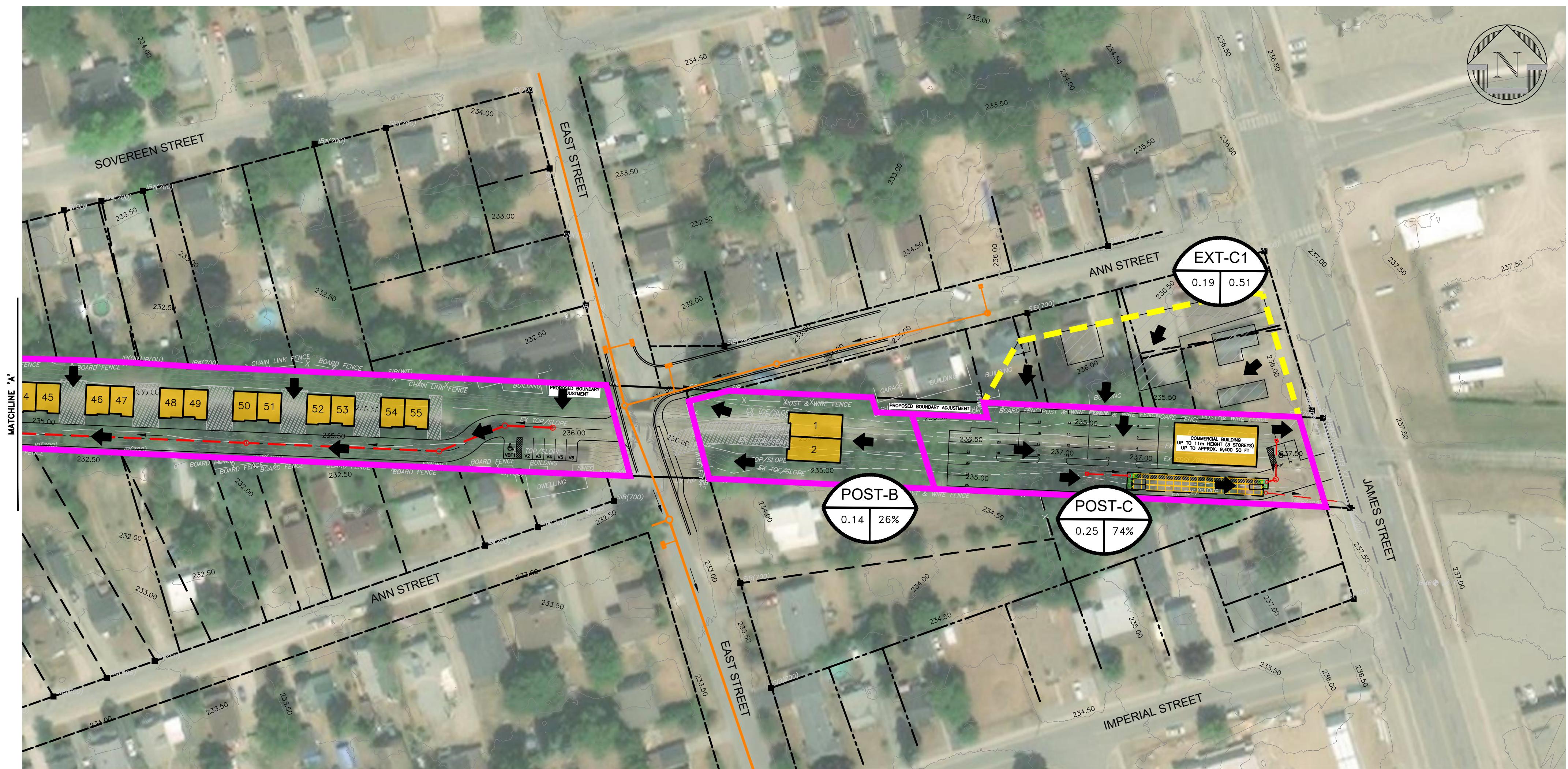
Designed by: SLF Drawn by: SLF

Checked by: JTI Date Started: 08/27/2025

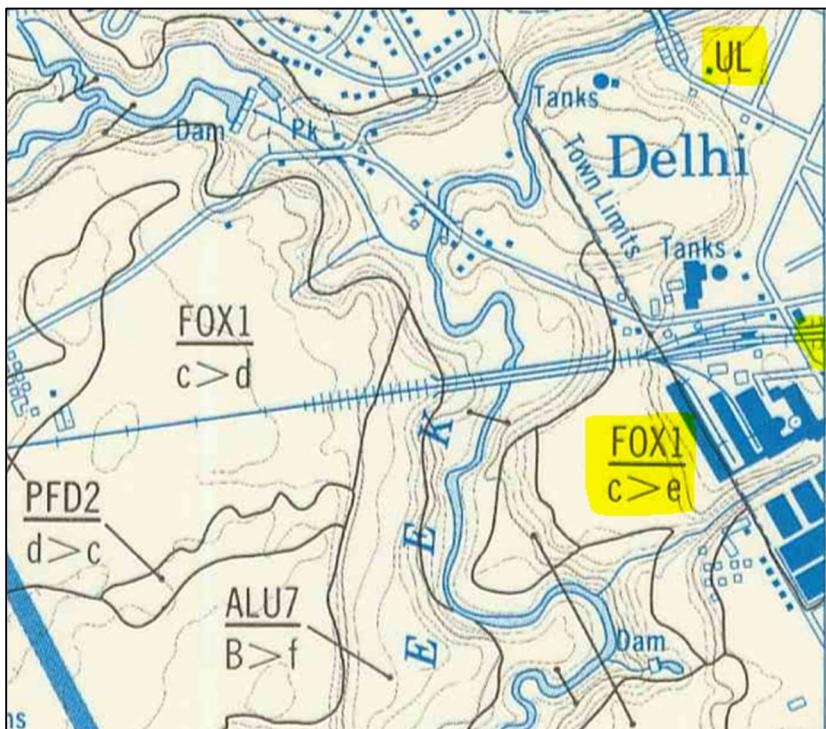
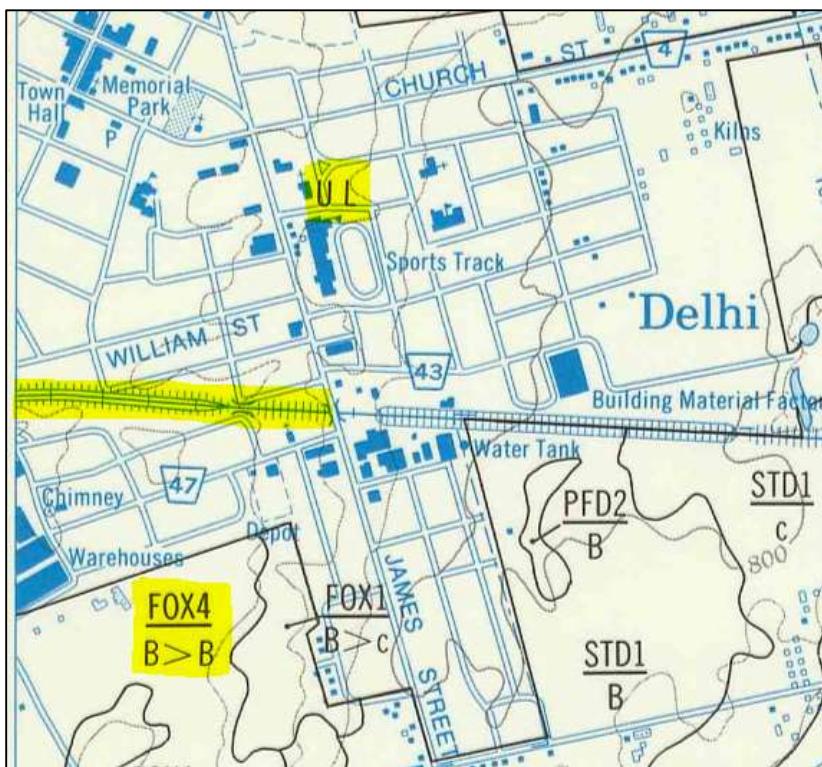
Drawing Scale: 1:750 Drawing No.

Project No. 23-024

POST



23-024 Soil Parameters



MISCELLANEOUS LAND UNITS						
CPX 1	Beach	Scarp		Beach-Scarp Complex	Variable	Rapid
CPX 2	Marsh	Beach		Marsh-Beach Complex	Very poor	Variable
CPX 3	Marsh	Dune		Marsh-Dune Complex	Very poor	Rapid
CPX 4	Marsh	Ridge		Marsh-Ridge Complex	Very poor	Rapid to well
CPX 5	Beach	Dune		Beach-Dune Complex	Variable	Rapid
CPX 6	Beach	Ridge		Beach-Ridge Complex	Variable	Rapid to well
MAR	Marsh	None	Marsh		Very poor	
RID	Ridge	None	Ridge		Rapid to well	
UL	Urban Land	None	Variable		Variable	

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

BAY – Brady						
BAY 1	BAY	None	Mainly lacustrine sand and loamy sand		Imperfect	
BAY 4	BAY	FOX	see BAY 1	see FOX 1	Imperfect	Rapid to well

1	C	"	c	1	so	Hendenburg	I.	S
	BC	Flamboro	s		C	Hendrie	s	/g
	BC	Floradale	l		B	Henwood	s	/g
	BC	Fonthill	g		B	Hespeler	s.	1
	B	Font	g	s	A	Hillier	c	
	BC	Forbes	c		D	Hillsburgh	s	1
	B	Fox	s		A	Himsworth	si	1
	A	"	s	1	AB	Hinchinbr.	s	1
	AB	Foxboro	s		A	"	l	
	C	Franktown	l		B	Honeywood	si	1
	BC	Freeport	s	1	B	"	si	1
	A	Galesburg	s	1	A	Howland	s	1
	AB	"	l		AB	"	l	
	A	Gameland	s	/g	AB	Huron	s	1
	B	Gananoque	c		C	"	l	

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 <u>directly</u> to stream		98					
Bare rock draining <u>indirectly</u> to stream		70					
Water surfaces	100						(use in special cases only)

SOIL PARAMETERS

Soil Type	Mainly lacustrine sand and loamy sand
Soil Group	AB
CN	70
Initial Abstraction	9.0 mm

$$S_{0.20} = 1000/CN - 10 \text{ (inches)}$$

$$S_{0.05} = 1.33 * S_{0.20}^{1.15} \text{ (inches)}$$

$$IA = S_{0.05} * 0.05 * 25.4 \text{ (mm)}$$

INFILTRATION PARAMETERS

Infiltration Rate	62 mm hr
Safety Correction Factor	2.5
Design Infiltration Rate (i)	25 mm/hr
Design Infiltration Rate (i)	0.025 m/hr

Maximum Infiltration Trench Depth

Void Ratio (Vr)	0.4
Drainage Time (ts)	96 hr
Max allowable stone depth (drmax)	5.95 m

**Infiltration rate assumed based on soil conditions obtained from Ontario Soil Mapping. Assumption is consistent with the results of a previous geotechnical investigation completed for a nearby project on James Street.*

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:

$$d_{r\ max} = \text{Maximum stone reservoir depth (mm)}$$

$$i = \text{Infiltration rate for native soils (mm/hr)}$$

$$V_r = \text{Void space ratio for aggregate used (typically 0.4 for 50 mm clear stone)}$$

$$t_s = \text{Time to drain (design for 48 hour time to drain is recommended)}$$

PRE-DEVELOPMENT CATCHMENT PARAMETERS

Area No.	Total Area (ha)	Runoff Coefficient Areas (ha)			Composite Runoff Coeff.	Drainage Length (m)	Upstream Elev. (m)	Downstream Elev. (m)	Slope (%)	Time of Conc. (min)	Time to Peak (0.6*tc) (hr)
		0.25	0.70	0.95							
PRE-A	1.84	1.76	0.08	0.01	0.27	60	234.00	229.00	8.3	10.40	0.10
EXT-A1	0.32	0.31	0.00	0.01	0.28	35	231.50	230.00	4.3	9.81	0.10
EXT-A2	0.42	0.34	0.00	0.08	0.38	30	230.50	229.50	3.3	8.61	0.09
PRE-B	0.14	0.12	0.02	0.00	0.32	15	236.50	233.00	23.3	3.49	0.03
PRE-C	0.25	0.21	0.04	0.00	0.31	15	237.00	235.00	13.3	4.22	0.04
EXT-C1	0.19	0.12	0.00	0.07	0.51	45	236.50	235.50	2.2	9.99	0.10

POST-DEVELOPMENT AREA PARAMETERS

Area Type	Area (m2)	Area (ha)	Total Number	Total Impervious Area (ha)
Site A				
2-unit Townhouse	186	0.019	3	0.056
3-unit Townhouse	279	0.028	3	0.084
4-unit Townhouse	372	0.037	2	0.074
6-unit Townhouse	558	0.056	2	0.112
Semi-Detached	102	0.010	10	0.102
Driveways	1567	0.157	1	0.157
Road / Parking	4260	0.426	1	0.426
Decks	12	0.001	55	0.066
Site B				
Building	186	0.019	1	0.019
Driveways	150	0.015	1	0.015
Decks	12	0.001	2	0.002
Site C				
Building	250	0.025	1	0.025
Road / Parking	1464	0.146	1	0.146
Retaining Wall	120	0.012	1	0.012

<--- assumed area of a potential retaining wall installed along site boundary

POST-DEVELOPMENT CATCHMENT PARAMETERS

Area No.	Total Area (ha)	Total Imp. Area (ha)	Impervious Area Ratio	Total Dir. Conn. Imp. Area (ha)	Directly Conn. Imp. Area Ratio
POST-A	1.84	1.08	58%	0.58	32%
POST-B	0.14	0.04	26%	0.02	11%
POST-C	0.25	0.18	74%	0.15	59%

DESIGN STORM PARAMETERS

Norfolk County Design Criteria
Section 7 - Storm Water Management and Drainage

Norfolk County Rainfall IDF Parameters			
Event	A	B	C
2	529.711	4.501	0.745
5	583.017	3.007	0.703
10	670.324	3.007	0.698
25	721.533	2.253	0.679
50	766.038	1.898	0.668
100	801.041	1.501	0.657

CHAMBERS PARAMETERS

Model	MC-4500
Number of Chambers	132
Number of End Caps	10
Depth of Stone Above Chambers	305 mm
Depth of Stone Below Chambers	230 mm
Base of Stone Elev.	227.073 m
Base of Chamber Elev.	227.303 m
Height of Chambers	1524 mm
Top of Chamber Elv.	228.827 m
Top of Stone Elev.	229.132 m
Min. Fill above Stone	305 mm
Base of Pavement	229.437 m
Pavement Depth (For Vehicles)*	540 mm
Min. Surface Elev. (For Vehicles)	229.977 m
System Footprint	506.61 m ²
Impermeable Liner?	No
Underdrain?	No
Max. Allowable Cover above Chambers	2.134 m
Max. Allowable Grade above Chambers	230.961 m

ORIFICE 1 PARAMETERS

Diameter	0.180 m
Area	0.0254 m ²
Inv. Elev.	227.673 m
CL Elev.	227.76 m
Depth	0.60 m

C = 0.63

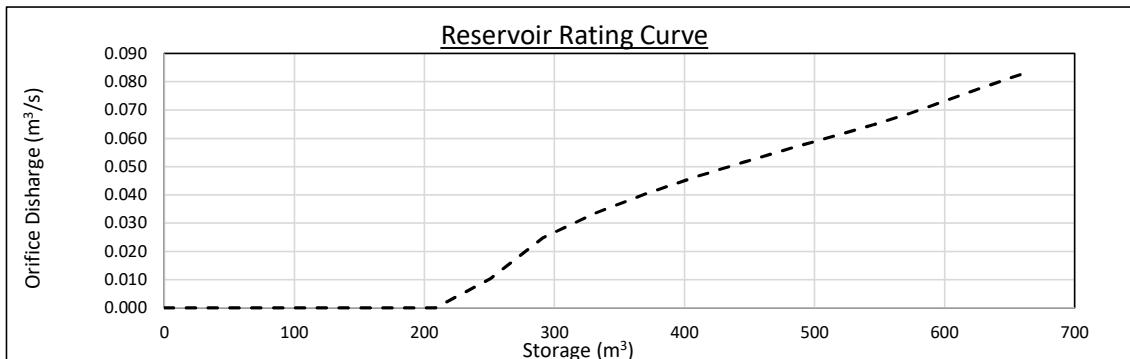
$$Q = CA\sqrt{2gh}$$

*300mm Gran B, 150mm Gran A, 50mm base, 40mm surface

STAGE-STORAGE-DISCHARGE

Description	Elevation (m)	Stage (mm)	Stage (m)	Volume (m ³)	Height Above Invert (m)	Q (m ³ /s) Orifice 1
Base of Stone Storage	227.07	0	0.00	0.0	0.00	0.0000
	227.18	102	0.10	20.6	0.00	0.0000
Base of Chambers	227.28	203	0.20	41.2	0.00	0.0000
	227.38	305	0.31	79.2	0.00	0.0000
Orifice 1	227.48	406	0.41	122.7	0.00	0.0000
	227.58	508	0.51	165.8	0.00	0.0000
	227.68	610	0.61	208.4	0.00	0.0000
	227.78	711	0.71	250.4	0.02	0.0103
	227.89	813	0.81	291.6	0.12	0.0249
	227.99	914	0.91	331.9	0.22	0.0336
	228.09	1016	1.02	371.2	0.33	0.0405
	228.19	1118	1.12	409.4	0.43	0.0465
	228.29	1219	1.22	446.2	0.53	0.0516
	228.39	1321	1.32	481.4	0.63	0.0564
	228.50	1422	1.42	514.7	0.73	0.0608
	228.60	1524	1.52	545.5	0.83	0.0648
	228.70	1626	1.63	572.5	0.94	0.0687
	228.80	1727	1.73	594.8	1.04	0.0723
	228.90	1829	1.83	615.5	1.14	0.0758
	229.00	1930	1.93	636.1	1.24	0.0791
	229.11	2032	2.03	656.6	1.34	0.0823
	229.13	2057	2.06	661.8	1.37	0.0830

*Storage volumes obtained from OTTHYMO



PRE TO POST FLOWS

Return Period	Q (m³/s)				Check
	PRE-A TOTAL	Target Flow	POST-A TOTAL	Net	
25-mm	N/A	N/A	0.000	N/A	N/A
2-yr	0.036	0.036	0.014	-0.022	✓
5-yr	0.086	0.086	0.035	-0.051	✓
10-yr	0.129	0.086	0.046	-0.040	✓
25-yr	0.191	0.086	0.060	-0.026	✓
50-yr	0.245	0.086	0.071	-0.015	✓
100-yr	0.300	0.086	0.085	-0.001	✓

SWM FACILITY FLOWS

Return Period	Q (m³/s)			Volume Reduction Rate
	Inflow	Ouflow	Overflow	
25-mm	0.084	0.000	0.000	100%
2-yr	0.131	0.014	0.000	73%
5-yr	0.205	0.035	0.000	46%
10-yr	0.257	0.046	0.000	37%
25-yr	0.362	0.060	0.000	29%
50-yr	0.430	0.071	0.000	25%
100-yr	0.499	0.085	0.000	22%

Volume Reduction Rate = $(RVin - RVout) / RVin$

STAGE-STORAGE-DISCHARGE

Description	Elevation (m)	Depth (m)	Volume (m³)	Q (m³/s)
Base of Stone Storage	227.07	0.00	0	0.000
	227.18	0.10	21	0.000
Base of Chambers	227.28	0.20	41	0.000
	227.38	0.31	79	0.000
	227.48	0.41	123	0.000
	227.58	0.51	166	0.000
Orifice 1	227.68	0.61	208	0.000
	227.78	0.71	250	0.010
	227.89	0.81	292	0.025
	227.99	0.91	332	0.034
	228.09	1.02	371	0.041
	228.19	1.12	409	0.046
	228.29	1.22	446	0.052
	228.39	1.32	481	0.056
	228.50	1.42	515	0.061
	228.60	1.52	545	0.065
	228.70	1.63	572	0.069
Top of Chambers	228.80	1.73	595	0.072
	228.90	1.83	615	0.076
	229.00	1.93	636	0.079
	229.11	2.03	657	0.082
Top of Stone Storage	229.13	2.06	662	0.083

*Storage volumes obtained from OTTHYMO

APPROXIMATE STORAGE & PONDING DEPTHS

Return Period	Storage (m³)	Storage Depth (m)	Storage Elevation (m)	Drawdown Time (hr)
25-mm	160.41	0.50	227.57	11.58
2-yr	220.68	0.64	227.71	15.42
5-yr	291.85	0.81	227.89	15.83
10-yr	362.72	0.99	228.07	16.33
25-yr	461.66	1.26	228.34	16.83
50-yr	547.00	1.53	228.60	17.25
100-yr	628.04	1.89	228.96	17.58

*Storage volumes obtained from OTTHYMO



Subject: Site A: Quality Control
Date: 8/20/2025 By: SLF
Project #: 23-024 Page: 5

Water Quality Control Provided by Stormtech Isolator Row

Inflow to Chambers During 25mm Quality Storm Event 0.084 m³/s
84 L/s

Chamber Type MC-4500
Treated Flowrate / Isolator Row Chamber 7.93 L/s

Required Number of Isolator Row Chambers 11
Provided Number of Isolator Row Chambers 32

Provided Treated Flowrate 254 L/s

StormTech Isolator Row Plus

Chamber Model	Chamber Storage	Chamber Footprint	Treatment Rate
SC-160LP	15.0 cf (0.42 m ³)	11.45 sf (1.06 m ²)	0.11 cfs (3.11 L/s)
SC-310	31.0 cf (0.88 m ³)	17.7 sf (1.64 m ²)	0.16 cfs (4.53 L/s)
SC-740	74.9 cf (2.12 m ³)	27.8 sf (2.58 m ²)	0.26 cfs (7.36 L/s)
DC-780	78.4 cf (2.22 m ³)	27.8 sf (2.58 m ²)	0.26 cfs (7.36 L/s)
SC-800	81.0 cf (2.29 m ³)	27.3 sf (2.54 m ²)	0.25 cfs (7.1 L/s)
MC-3500	175.0 cf (4.96 m ³)	42.9 sf (3.99 m ²)	0.40 cfs (11.32 L/s)
MC-4500	162.6 cf (4.60 m ³)	30.1 sf (2.80 m ²)	0.28 cfs (7.93 L/s)
MC-7200	267.3 cf (7.57 m ³)	50.0 sf (4.65 m ²)	0.45 cfs (12.74 L/s)

Summary of Verified Claims¹

Treatment Rate (gpm/ft ²)	4.1
Underlying Geotextile Layers	1
NJDEP Test Sediment	D50=75um
Mean Particle Concentration (mg/L)	200
TSS Removal Efficiency	>80%

¹ Verification testing of the StormTech SC-740 Isolator Row PLUS in accordance with NJDEP Laboratory protocol to access total suspended solids removal by filtration manufactured treatment device, 2013.

25mm Runoff Volume Infiltration

POST	
Catchment Area (ha)	2.58
25mm Runoff Volume In (mm)	8.15 *From Visual Otthymo
25mm Runoff Volume In (m ³)	210.08
25mm Runoff Volume Out (mm)	0.00 *From Visual Otthymo
25mm Runoff Volume Out (m ³)	0.00
Infiltrated 25mm Runoff Volume (m ³)	210.08
25mm Volume Reduction Rate	100%
Infiltrated 25mm Runoff Volume + 15% (m ³)	241.60
Extra 15% Volume Required (m ³)	31.51
Total Storage (m ³)	661.78
Surplus Storage (m3)	420.19 Surplus Storage > Extra 15% Volume Required

CHAMBERS PARAMETERS

Model	DC-780
Number of Chambers	48
Number of End Caps	6
Depth of Stone Above Chambers	152 mm
Depth of Stone Below Chambers	230 mm
Base of Stone Elev.	235.295 m
Base of Chamber Elev.	235.525 m
Height of Chambers	762 mm
Top of Chamber Elv.	236.287 m
Top of Stone Elev.	236.439 m
Min. Fill above Stone	305 mm
Base of Pavement	236.744 m
Pavement Depth (For Vehicles)*	540 mm
Min. Surface Elev. (For Vehicles)	237.284 m
System Footprint	180.97 m ²
Impermeable Liner?	No
Underdrain?	No
Max. Allowable Cover above Chambers	3.658 m
Max. Allowable Grade above Chambers	239.945 m

	DC-780
	48
	6
	152 mm
	230 mm
	235.295 m
	235.525 m
	762 mm
	236.287 m
	236.439 m
	305 mm
	236.744 m
	540 mm
	237.284 m
	180.97 m ²
	No
	No
	3.658 m
	239.945 m

ORIFICE 1 PARAMETERS

Diameter	0.085 m
Area	0.0057 m ²
Inv. Elev.	235.600 m
CL Elev.	235.64 m
Depth	0.305 m

C = 0.63

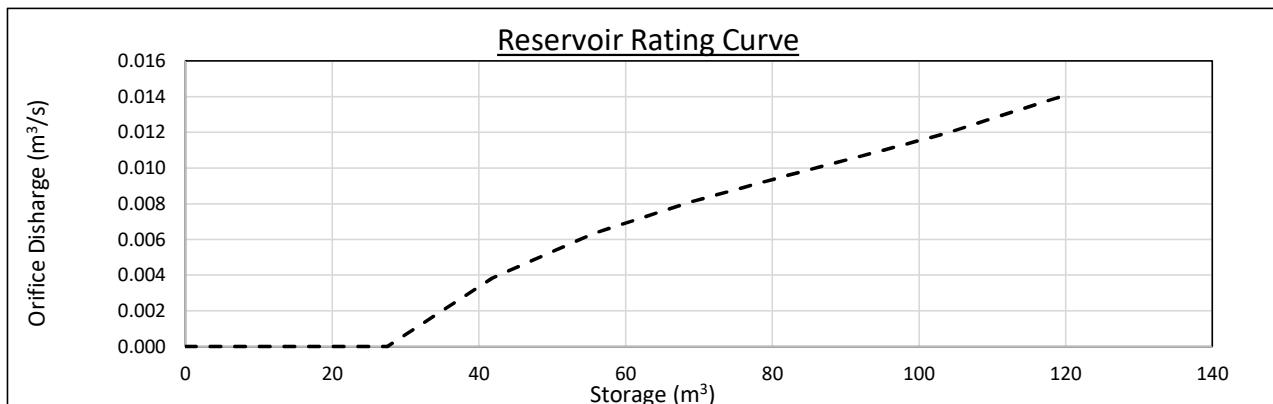
$$Q = CA\sqrt{2gh}$$

*300mm Gran B, 150mm Gran A, 50mm base, 40mm surface

STAGE-STORAGE-DISCHARGE

Description	Elevation (m)	Stage (mm)	Stage (m)	Volume (m ³)	Height Above Invert (m)	Q (m ³ /s) Orifice 1
Base of Stone Storage	235.30	0	0.00	0.0	0.00	0.0000
	235.40	102	0.10	7.4	0.00	0.0000
Base of Chambers	235.50	203	0.20	14.7	0.00	0.0000
Orifice 1	235.60	305	0.31	27.5	0.00	0.0000
	235.70	406	0.41	41.8	0.06	0.0038
	235.80	508	0.51	55.7	0.16	0.0063
	235.91	610	0.61	69.0	0.26	0.0081
	236.01	711	0.71	81.7	0.36	0.0095
	236.11	813	0.81	93.3	0.47	0.0108
	236.21	914	0.91	103.5	0.57	0.0119
Top of Chambers	236.31	1016	1.02	111.3	0.67	0.0129
	236.41	1118	1.12	118.6	0.77	0.0139
Top of Stone Storage	236.44	1143	1.14	120.5	0.80	0.0141

*Storage volumes obtained from OTTHYMO



PRE TO POST FLOWS

Return Period	Q (m3/s)				Check
	PRE-C TOTAL	Target Flow	POST-C TOTAL	Net	
25-mm	N/A	N/A	0.000	N/A	N/A
2-yr	0.006	0.006	0.004	-0.002	✓
5-yr	0.014	0.014	0.006	-0.008	✓
10-yr	0.021	0.014	0.009	-0.005	✓
25-yr	0.031	0.014	0.011	-0.003	✓
50-yr	0.039	0.014	0.012	-0.002	✓
100-yr	0.047	0.014	0.014	0.000	!

SWM FACILITY FLOWS

Return Period	Q (m3/s)			Volume Reduction Rate
	Inflow	Ouflow	Overflow	
25-mm	0.022	0.000	0.000	100%
2-yr	0.032	0.004	0.000	67%
5-yr	0.048	0.006	0.000	45%
10-yr	0.062	0.009	0.000	38%
25-yr	0.078	0.011	0.000	31%
50-yr	0.090	0.012	0.000	27%
100-yr	0.103	0.014	0.000	24%

Volume Reduction Rate = $(RVin - RVout) / RVin$

STAGE-STORAGE-DISCHARGE

Description	Elevation (m)	Depth (m)	Volume (m ³)	Q (m3/s)
Base of Stone Storage	235.30	0.00	0	0.000
	235.40	0.10	7	0.000
Base of Chambers	235.50	0.20	15	0.000
Orifice 1	235.60	0.31	27	0.000
	235.70	0.41	42	0.004
	235.80	0.51	56	0.006
	235.91	0.61	69	0.008
	236.01	0.71	82	0.010
	236.11	0.81	93	0.011
	236.21	0.91	103	0.012
Top of Chambers	236.31	1.02	111	0.013
	236.41	1.12	119	0.014
Top of Stone Storage	236.44	1.14	120	0.014

*Storage volumes obtained from OTTHYMO

APPROXIMATE STORAGE & PONDING DEPTHS

Return Period	Storage (m3)	Storage Depth (m)	Elevation (m)	Drawdown Time (hr)
25-mm	27.28	0.30	235.60	5.50
2-yr	34.64	0.36	235.65	5.92
5-yr	51.04	0.47	235.77	6.42
10-yr	64.77	0.58	235.87	6.92
25-yr	82.05	0.71	236.01	7.42
50-yr	97.60	0.86	236.15	7.67
100-yr	112.68	1.04	236.33	8.08

*Storage volumes obtained from OTTHYMO

Water Quality Control Provided by Stormtech Isolator Row

Inflow to Chambers During 25mm Quality Storm Event 0.022 m³/s
 22 L/s

Chamber Type DC-780
 Treated Flowrate / Isolator Row Chamber 7.36 L/s

Required Number of Isolator Row Chambers 3
 Provided Number of Isolator Row Chambers 16

Provided Treated Flowrate 118 L/s



StormTech Isolator Row Plus

Chamber Model	Chamber Storage	Chamber Footprint	Treatment Rate
SC-160LP	15.0 cf (0.42 m ³)	11.45 sf (1.06 m ²)	0.11 cfs (3.11 L/s)
SC-310	31.0 cf (0.88 m ³)	17.7 sf (1.64 m ²)	0.16 cfs (4.53 L/s)
SC-740	74.9 cf (2.12 m ³)	27.8 sf (2.58 m ²)	0.26 cfs (7.36 L/s)
DC-780	78.4 cf (2.22 m ³)	27.8 sf (2.58 m ²)	0.26 cfs (7.36 L/s)
SC-800	81.0 cf (2.29 m ³)	27.3 sf (2.54 m ²)	0.25 cfs (7.1 L/s)
MC-3500	175.0 cf (4.96 m ³)	42.9 sf (3.99 m ²)	0.40 cfs (11.32 L/s)
MC-4500	162.6 cf (4.60 m ³)	30.1 sf (2.80 m ²)	0.28 cfs (7.93 L/s)
MC-7200	267.3 cf (7.57 m ³)	50.0 sf (4.65 m ²)	0.45 cfs (12.74 L/s)

Summary of Verified Claims¹

Treatment Rate (gpm/ft ²)	4.1
Underlying Geotextile Layers	1
NJDEP Test Sediment	D50=75um
Mean Particle Concentration (mg/L)	200
TSS Removal Efficiency	>80%

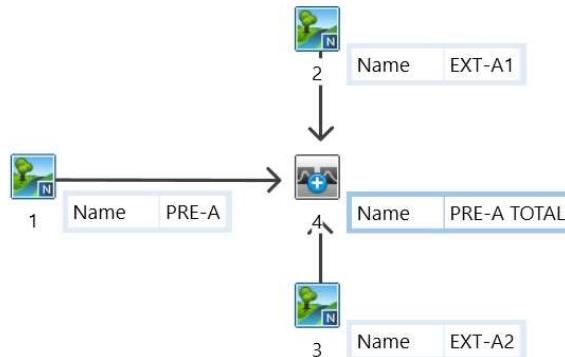
¹ Verification testing of the StormTech SC-740 Isolator Row PLUS in accordance with NJDEP Laboratory protocol to access total suspended solids removal by filtration manufactured treatment device, 2013.

25mm Runoff Volume Infiltration

	POST
Catchment Area (ha)	0.44
25mm Runoff Volume In (mm)	9.86
25mm Runoff Volume In (m ³)	43.53
25mm Runoff Volume Out (mm)	0.00
25mm Runoff Volume Out (m ³)	0.00
Infiltrated 25mm Runoff Volume (m ³)	43.53
25mm Volume Reduction Rate	100%
Infiltrated 25mm Runoff Volume + 15% (m ³)	50.06
Extra 15% Volume Required (m ³)	6.53
Total Storage (m ³)	120.46
Surplus Storage (m3)	70.40

Surplus Storage > Extra 15% Volume Required

23-024 DELHI RAILWAY DEVELOPMENT - SITE A
PRE-DEVELOPMENT OTTHYMO MODEL



2-YEAR STORM - PRE-DEVELOPMENT

```
=====
V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLL
OOO TTTTTT 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
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.
```

---- 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) = 0.703

PEAK FLOW (cms) = 0.026 (i)
 TIME TO PEAK (hrs) = 1.417
 RUNOFF VOLUME (mm) = 4.954
 TOTAL RAINFALL (mm) = 35.210
 RUNOFF COEFFICIENT = 0.141

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DATE: 08/27/2025 TIME: 03:38:57

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

Unit Hyd Qpeak (cms) = 0.122

PEAK FLOW (cms) = 0.004 (i)
 TIME TO PEAK (hrs) = 1.417
 RUNOFF VOLUME (mm) = 4.954
 TOTAL RAINFALL (mm) = 35.210
 RUNOFF COEFFICIENT = 0.141

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
=====
| CALIB | | NASHYD ( 0001) | Area (ha)= 1.84 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)= 0.10
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
=====
| CALIB | | NASHYD ( 0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)= 0.09
```

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)= 0.178

PEAK FLOW (cms)= 0.006 (i)

TIME TO PEAK (hrs)= 1.333

RUNOFF VOLUME (mm)= 4.893

TOTAL RAINFALL (mm)= 35.210

RUNOFF COEFFICIENT = 0.139

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0004)|
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.

| (ha) (cms) (hrs) (mm)
+ ID1= 1 (0001): 1.84 0.026 1.42 4.95
+ ID2= 2 (0002): 0.32 0.004 1.42 4.95
=====
ID = 3 (0004): 2.16 0.030 1.42 4.95

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ADD HYD (0004)|
| 3 + 2 = 1 | AREA QPEAK TPEAK R.V.

| (ha) (cms) (hrs) (mm)
+ ID1= 3 (0004): 2.16 0.030 1.42 4.95
+ ID2= 2 (0003): 0.42 0.006 1.33 4.89
=====
ID = 1 (0004): 2.58 0.036 1.42 4.94

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

5-YEAR STORM - PRE-DEVELOPMENT

```

V V I SSSSS U U A L          (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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 M OOO

```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** DETAILLED OUTPUT *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\23910bbc-4697-4a00-8864-e9b03186f141\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\23910bbc-4697-4a00-8864-e9b03186f141\scena

DATE: 08/27/2025 TIME: 03:38:57

USER:

COMMENTS: _____

** SIMULATION : 02_5-Year Norfolk **

| CHICAGO STORM | IDF curve parameters: A= 583.017
| Pttotal= 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 (0001) | Area (ha)= 1.84 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10

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	2.667	6.13	3.67	4.10
0.667	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)= 0.703

PEAK FLOW (cms)= 0.060 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 10.484
TOTAL RAINFALL (mm)= 49.033
RUNOFF COEFFICIENT = 0.214

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| NASHYD (0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10

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	2.667	6.13	3.67	4.10
0.667	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)= 0.122

PEAK FLOW (cms)= 0.010 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 10.483
TOTAL RAINFALL (mm)= 49.033
RUNOFF COEFFICIENT = 0.214

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| NASHYD (0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.09

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	2.667	6.13	3.67	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)= 0.178

PEAK FLOW (cms)= 0.015 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 10.357
TOTAL RAINFALL (mm)= 49.033
RUNOFF COEFFICIENT = 0.211

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0004) |
1 + 2 = 3
AREA (ha) QPEAK (cms) TPEAK (hrs) R.V. (mm)
ID1= 1 (0001): 1.84 0.060 1.33 10.48
+ ID2= 2 (0002): 0.32 0.010 1.33 10.48

| ID = 3 (0004): 2.16 0.071 1.33 10.48 |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ADD HYD (0004) |
3 + 2 = 1
AREA (ha) QPEAK (cms) TPEAK (hrs) R.V. (mm)
ID1= 3 (0004): 2.16 0.071 1.33 10.48
+ ID2= 2 (0003): 0.42 0.015 1.33 10.36

| ID = 1 (0004): 2.58 0.086 1.33 10.46 |

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

----- 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	2.667	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)= 0.703

PEAK FLOW (cms)= 0.060 (i)

TIME TO PEAK (hrs)= 1.333

RUNOFF VOLUME (mm)= 10.484

TOTAL RAINFALL (mm)= 49.033

RUNOFF COEFFICIENT = 0.214

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

----- 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	2.667	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)= 0.100

PEAK FLOW (cms)= 0.010 (i)

TIME TO PEAK (hrs)= 1.333

RUNOFF VOLUME (mm)= 10.483

TOTAL RAINFALL (mm)= 49.033

RUNOFF COEFFICIENT = 0.214

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

10-YEAR STORM - PRE-DEVELOPMENT

```
=====
V V I SSSSS U U A L          (v 6.2.2019)
V V I SS U U A A L
V V I SS U U AAAAAA L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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
```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\le6d3cee-31e6-40e8-930e-1645a770130f\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\le6d3cee-31e6-40e8-930e-1645a770130f\scena

DATE: 08/27/2025 TIME: 03:38:57

USER:

COMMENTS: _____

```
=====
***** SIMULATION : 03_10-Year Norfolk ****
=====
| CHICAGO STORM | IDF curve parameters: A= 670.324
| Pttotal= 57.94 mm | 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	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	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 | | NASHYD ( 0001) | Area (ha)= 1.84 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hrs)= 0.10
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
=====
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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
```

Unit Hyd Qpeak (cms)= 0.703

PEAK FLOW (cms)= 0.091 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 14.786
TOTAL RAINFALL (mm)= 57.945
RUNOFF COEFFICIENT = 0.255

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
=====
| CALIB | | NASHYD ( 0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hrs)= 0.10
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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
```

Unit Hyd Qpeak (cms)= 0.122

PEAK FLOW (cms)= 0.016 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 14.786
TOTAL RAINFALL (mm)= 57.945
RUNOFF COEFFICIENT = 0.255

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
=====
| CALIB | | NASHYD ( 0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hrs)= 0.09
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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
```

Unit Hyd Qpeak (cms)= 0.178

PEAK FLOW (cms)= 0.022 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 14.607
TOTAL RAINFALL (mm)= 57.945
RUNOFF COEFFICIENT = 0.252

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
=====
| ADD HYD ( 0004) | | AREA QPEAK TPEAK R.V.
| 1 + 2 = 3 | | (ha) (cms) (hrs) (mm)
-----| | | | | | | |
| ID1= 1 ( 0001): 1.84 0.091 1.33 14.79
+ ID2= 2 ( 0002): 0.32 0.016 1.33 14.79
=====| | | | | | | |
| ID = 3 ( 0004): 2.16 0.106 1.33 14.79
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
=====
| ADD HYD ( 0004) | | AREA QPEAK TPEAK R.V.
| 3 + 2 = 1 | | (ha) (cms) (hrs) (mm)
-----| | | | | | | |
| ID1= 3 ( 0004): 2.16 0.106 1.33 14.79
+ ID2= 2 ( 0003): 0.42 0.022 1.33 14.61
=====| | | | | | | |
| ID = 1 ( 0004): 2.58 0.129 1.33 14.76
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
=====
| CALIB | | NASHYD ( 0001) | Area (ha)= 1.84 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hrs)= 0.10
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

50-YEAR STORM - PRE-DEVELOPMENT

```

V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLL

```

```

000 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
000 T T H H Y M M OOO

```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\085bc38f-d002-45c1-b54f-8536d9127f32\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\085bc38f-d002-45c1-b54f-8536d9127f32\scena

```

DATE: 08/27/2025 TIME: 03:38:57

USER:

COMMENTS: _____

```

*****  

** SIMULATION: 05_50-Year Norfolk **  

*****  


```

```

| 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	RAIN	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	'	hrs	mm/hr	'	hrs	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 |  

| NASHYD ( 0001) | Area (ha)= 1.84 Curve Number (CN)= 70.0  

| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00  

----- U.H. Tp(hr)= 0.10

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	'	hrs	mm/hr	'	hrs	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			

Unit Hyd Qpeak (cms)= 0.703

PEAK FLOW (cms)= 0.172 (i)

TIME TO PEAK (hrs)= 1.333

RUNOFF VOLUME (mm)= 26.268

TOTAL RAINFALL (mm)= 78.320

RUNOFF COEFFICIENT = 0.335

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----  

| CALIB |  

| NASHYD ( 0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0  

| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00  

----- U.H. Tp(hr)= 0.10

```

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	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

Unit Hyd Qpeak (cms)= 0.122

PEAK FLOW (cms)= 0.030 (i)

TIME TO PEAK (hrs)= 1.333

RUNOFF VOLUME (mm)= 26.267

TOTAL RAINFALL (mm)= 78.320

RUNOFF COEFFICIENT = 0.335

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----  

| CALIB |  

| NASHYD ( 0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0  

| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00  

----- U.H. Tp(hr)= 0.09

```

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	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

Unit Hyd Qpeak (cms)= 0.178

PEAK FLOW (cms)= 0.042 (i)

TIME TO PEAK (hrs)= 1.333

RUNOFF VOLUME (mm)= 25.950

TOTAL RAINFALL (mm)= 78.320

RUNOFF COEFFICIENT = 0.331

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----  

| ADD HYD ( 0004) |  

| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.  

-----  

| (ha) (cms) (hrs) (mm)  

| ID1= 1 ( 0001): 1.84 0.172 1.33 26.27  

| + ID2= 2 ( 0002): 0.32 0.030 1.33 26.27  

-----  

| ID = 3 ( 0004): 2.16 0.202 1.33 26.27

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----  

| ADD HYD ( 0004) |  

| 3 + 2 = 1 | AREA QPEAK TPEAK R.V.  

-----  

| (ha) (cms) (hrs) (mm)  

| ID1= 3 ( 0004): 2.16 0.202 1.33 26.27  

| + ID2= 2 ( 0003): 0.42 0.042 1.33 25.95  

-----  

| ID = 1 ( 0004): 2.58 0.245 1.33 26.22

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

100-YEAR STORM - PRE-DEVELOPMENT

```
=====
V V I SSSSS U U A L          (v 6.2.2019)
V V I SS U U A A L
V V I SS U U AAAAAA L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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
```

Developed and Distributed by Smart City Water Inc
 Copyright 2007 - 2022 Smart City Water Inc
 All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
 Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\4b43e82d-cc92-4525-a5f4-199e0bdee1c9\scena
 Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\4b43e82d-cc92-4525-a5f4-199e0bdee1c9\scena

DATE: 08/27/2025 TIME: 03:38:57

USER:

COMMENTS: _____

 ** SIMULATION : 06_100-Year Norfolk **

| CHICAGO STORM | IDF curve parameters: A= 801.041
 | Pttotal= 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 (0001) | Area (ha)= 1.84 Curve Number (CN)= 70.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
 | U.H. Tp(hrs)= 0.10

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)= 0.703

PEAK FLOW (cms)= 0.212 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 31.771
 TOTAL RAINFALL (mm)= 87.089
 RUNOFF COEFFICIENT = 0.365

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
 | NASHYD (0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
 | U.H. Tp(hrs)= 0.10

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)= 0.122

PEAK FLOW (cms)= 0.037 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 31.770
 TOTAL RAINFALL (mm)= 87.089
 RUNOFF COEFFICIENT = 0.365

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
 | NASHYD (0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
 | U.H. Tp(hrs)= 0.09

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)= 0.178

PEAK FLOW (cms)= 0.052 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 31.387
 TOTAL RAINFALL (mm)= 87.080
 RUNOFF COEFFICIENT = 0.360

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| ADD HYD (0004) |
1 + 2 = 3
AREA (ha) QPEAK (cms) TPEAK (hrs) R.V. (mm)

ID1= 1 (0001): 1.84 0.212 1.33 31.77
ID2= 2 (0002): 0.32 0.037 1.33 31.77

ID = 3 (0004): 2.16 0.249 1.33 31.77

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ADD HYD (0004) |
3 + 2 = 1
AREA (ha) QPEAK (cms) TPEAK (hrs) R.V. (mm)

ID1= 3 (0004): 2.16 0.249 1.33 31.77
ID2= 2 (0003): 0.42 0.052 1.33 31.39

ID = 1 (0004): 2.58 0.300 1.33 31.71

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

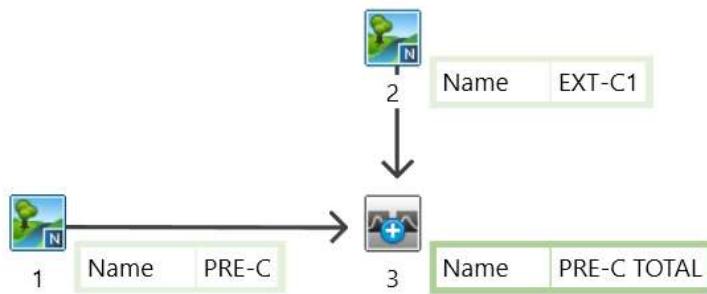
FINISH

=====

| CALIB |
 | NASHYD (0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
 | U.H. Tp(hrs)= 0.10

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

23-024 DELHI RAILWAY DEVELOPMENT - SITE C
PRE-DEVELOPMENT OTTHYMO MODEL



2-YEAR STORM - PRE-DEVELOPMENT

```
=====
V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLLLL

000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.
```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

----- 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)= 0.073

PEAK FLOW (cms)= 0.003 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 4.952
TOTAL RAINFALL (mm)= 35.210
RUNOFF COEFFICIENT = 0.141

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
DATE: 11/14/2025 TIME: 11:53:20
USER:
COMMENTS: _____
```

CALIB	NASHYD (0001)	Area (ha)= 0.25	Curve Number (CN)= 70.0
ID= 1 DT= 5.0 min	Ia (mm)= 9.00	# of Linear Res.(N)= 3.00	
	U.H. Tp (hrs)= 0.04		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
=====
***** SIMULATION : 01_2-Year Norfolk ****
***** CHICAGO STORM | IDF curve parameters: A= 529.711
| Pttotal= 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 | TIME RAIN
| hrs mm/hr | 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
```

----- 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)= 0.239

PEAK FLOW (cms)= 0.004 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 3.035
TOTAL RAINFALL (mm)= 35.210
RUNOFF COEFFICIENT = 0.086

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
=====
| CALIB | NASHYD (0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp (hrs)= 0.10
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

ADD HYD (0003)	1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):		0.25	0.004	1.33	3.04
+ ID2= 2 (0002):		0.19	0.003	1.42	4.95
ID = 3 (0003):		0.44	0.006	1.33	3.86

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

5-YEAR STORM - PRE-DEVELOPMENT

```

V   V   I   SSSSS  U   U   A   L   (v 6.2.2019)
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
V   V   I   SSSSS UUUUU A   A   LLLL

```

```

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

```

Developed and Distributed by Smart City Water Inc

Copyright 2007 - 2022 Smart City Water Inc

All rights reserved.

***** D E T A I L E D O U T P U T *****

```

Input  filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output  filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\d51ee143-59f7-4c64-92d7-a65ccbbe400a8\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\d51ee143-59f7-4c64-92d7-a65ccbbe400a8\scena

```

DATE: 11/14/2025 TIME: 11:53:20

USER:

COMMENTS: _____

```

*****
** SIMULATION : 02_5-Year Norfolk
*****

```

```

| CHICAGO STORM | IDF curve parameters: A= 583.017
| Pttotal= 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 ( 0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| | | U.H. Tp(hr)= 0.10

```

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   29.33 | 2.333   7.56 | 3.33   4.32
0.417   5.42 | 1.417   29.33 | 2.417   6.76 | 3.42   4.10
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   8.09 | 1.667   12.62 | 2.683   5.63 | 3.67   3.90
0.750   8.09 | 1.750   12.62 | 2.750   5.63 | 3.75   3.72
0.833   8.09 | 1.833   12.62 | 2.833   5.63 | 3.83   3.72
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)= 0.073

```

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 10.483
TOTAL RAINFALL (mm)= 49.033
RUNOFF COEFFICIENT = 0.214

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----+
| CALIB | NASHYD ( 0001) | Area (ha)= 0.25 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| | | U.H. Tp(hr)= 0.04

```

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   29.33 | 2.333   7.56 | 3.33   4.32
0.417   5.42 | 1.417   29.33 | 2.417   6.76 | 3.42   4.10
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   8.09 | 1.667   12.62 | 2.683   5.63 | 3.67   3.90
0.750   8.09 | 1.750   12.62 | 2.750   5.63 | 3.75   3.72
0.833   8.09 | 1.833   12.62 | 2.833   5.63 | 3.83   3.72
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)= 0.239

```

PEAK FLOW (cms)= 0.008 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 6.423
TOTAL RAINFALL (mm)= 49.033
RUNOFF COEFFICIENT = 0.131

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----+
| ADD HYD ( 0003) |
| 1 + 2 = 3 | AREA   QPEAK   TPEAK   R.V.
| | | (ha)   (cms)   (hrs)   (mm)
-----+
ID1= 1 ( 0001): 0.25 0.008 1.33 6.42
+ ID2= 2 ( 0002): 0.19 0.006 1.33 10.48
-----+
ID = 3 ( 0003): 0.44 0.014 1.33 8.18

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

10-YEAR STORM - PRE-DEVELOPMENT

```

V   V   I   SSSSS U   U   A   L   (v 6.2.2019)
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
V   V   I   SSSSS UUUUU A   A   LLLL

```

```

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

```

Developed and Distributed by Smart City Water Inc

Copyright 2007 - 2022 Smart City Water Inc

All rights reserved.

***** D E T A I L E D O U T P U T *****

```

Input  filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output  filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\769edc3f-8ac6-4fc4-9f52-68441c9161a7\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\769edc3f-8ac6-4fc4-9f52-68441c9161a7\scena

```

DATE: 11/14/2025 TIME: 11:53:20

USER:

COMMENTS: _____

```

*****
** SIMULATION : 03_10-Year Norfolk
*****

```

```

| CHICAGO STORM | IDF curve parameters: A= 670.324
| Pttotal= 57.94 mm | 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   RAIN | TIME   RAIN |' TIME   RAIN | TIME   RAIN
hrs   mm/hr | hrs   mm/hr |' hrs   mm/hr | hrs   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 | NASHYD ( 0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hr)= 0.10

```

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  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 17.50 | 2.667 15.00 | 3.67  4.68
0.750  9.66 | 1.750 15.00 | 2.750 12.13 | 3.74  4.47
0.833  9.66 | 1.833 15.00 | 2.833 12.13 | 3.83  4.47
1.000 13.55 | 2.000 12.13 | 3.000 12.13 | 4.00  4.47

```

Unit Hyd Qpeak (cms)= 0.073

```

PEAK FLOW (cms)= 0.009 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 14.785
TOTAL RAINFALL (mm)= 57.945
RUNOFF COEFFICIENT = 0.255

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

----- CALIB -----
| NASHYD ( 0001) | Area (ha)= 0.25 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hr)= 0.04

```

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  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 17.50 | 2.667 15.00 | 3.67  4.68
0.750  9.66 | 1.750 15.00 | 2.750 12.13 | 3.74  4.47
0.833  9.66 | 1.833 15.00 | 2.833 12.13 | 3.83  4.47
1.000 13.55 | 2.000 12.13 | 3.000 12.13 | 4.00  4.47

```

Unit Hyd Qpeak (cms)= 0.239

```

PEAK FLOW (cms)= 0.012 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 9.059
TOTAL RAINFALL (mm)= 57.945
RUNOFF COEFFICIENT = 0.156

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

----- ADD HYD ( 0003) -----
| 1 + 2 = 3 | AREA   QPEAK   TPEAK   R.V.
|           (ha)   (cms)   (hrs)   (mm)
-----| ID1= 1 ( 0001): 0.25  0.012  1.33  9.06
+ ID2= 2 ( 0002): 0.19  0.009  1.33  14.79
-----| ID = 3 ( 0003): 0.44  0.021  1.33  11.53

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

25-YEAR STORM - PRE-DEVELOPMENT

```

V   V   I   SSSSS  U   U   A   L   (v 6.2.2019)
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
V   V   I   SSSSS UUUUU A   A   LLLL

```

```

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

```

Developed and Distributed by Smart City Water Inc

Copyright 2007 - 2022 Smart City Water Inc

All rights reserved.

***** D E T A I L E D O U T P U T *****

```

Input  filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output  filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\65b4b201-0253-4773-b4e4-12ce6d0c35af\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\65b4b201-0253-4773-b4e4-12ce6d0c35af\scena

```

DATE: 11/14/2025 TIME: 11:53:20

USER:

COMMENTS: _____

```

*****
** SIMULATION : 04_25-Year Norfolk
*****

```

```

| CHICAGO STORM | IDF curve parameters: A= 721.533
| Pttotal= 69.38 mm | 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   RAIN | TIME   RAIN |' TIME   RAIN | TIME   RAIN
hrs   mm/hr | hrs   mm/hr |' hrs   mm/hr | hrs   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 | NASHYD ( 0002) | Area (ha)= 0.19   Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00   # of Linear Res.(N)= 3.00
| | | U.H. Tp(hr)= 0.10

```

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  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

```

Unit Hyd Qpeak (cms)= 0.073

```

PEAK FLOW (cms)= 0.014 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 20.980
TOTAL RAINFALL (mm)= 69.379
RUNOFF COEFFICIENT = 0.302

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----+
| CALIB | NASHYD ( 0001) | Area (ha)= 0.25   Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00   # of Linear Res.(N)= 3.00
| | | U.H. Tp(hr)= 0.04

```

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  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

```

Unit Hyd Qpeak (cms)= 0.239

```

PEAK FLOW (cms)= 0.017 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 12.855
TOTAL RAINFALL (mm)= 69.379
RUNOFF COEFFICIENT = 0.185

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----+
| ADD HYD ( 0003) |
| 1 + 2 = 3 | AREA   QPEAK   TPEAK   R.V.
| | | (ha)   (cms)   (hrs)   (mm)
-----+
ID1= 1 ( 0001): 0.25   0.017   1.33   12.86
+ ID2= 2 ( 0002): 0.19   0.014   1.33   20.98
-----+
ID = 3 ( 0003): 0.44   0.031   1.33   16.36

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

50-YEAR STORM - PRE-DEVELOPMENT

```

=====
V   V   I   SSSSS  U   U   A   L   (v 6.2.2019)
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   LLLL
=====
  000   TTTTT  TTTTT  H   H   Y   Y   M   M   000   TM
O   O   T   T   H   H   Y   Y   MM   MM   O   O
O   O   T   T   H   H   Y   M   M   O   O
  000   T   T   H   H   Y   M   M   000
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```

=====
***** D E T A I L E D   O U T P U T *****
=====
Input  filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output  filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\5b4abbef-6941-473e-a8cd-420015e6fle5\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\5b4abbef-6941-473e-a8cd-420015e6fle5\scena
=====
DATE: 11/14/2025      TIME: 11:53:20
USER:
COMMENTS: _____
=====
```

```

=====
***** SIMULATION : 05_50-Year Norfolk ****
=====
| 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	RAIN	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	'	hrs	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          |
| NASHYD ( 0002) | Area   (ha)= 0.19   Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia     (mm)= 9.00   # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10
=====

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

TIME	RAIN	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	'	hrs	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	10.95	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

Unit Hyd Qpeak (cms)= 0.073

PEAK FLOW (cms)= 0.018 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 26.267
 TOTAL RAINFALL (mm)= 78.320
 RUNOFF COEFFICIENT = 0.335

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

=====
| CALIB          |
| NASHYD ( 0001) | Area   (ha)= 0.25   Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia     (mm)= 9.00   # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.04
=====

```

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	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	10.95	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

Unit Hyd Qpeak (cms)= 0.239

PEAK FLOW (cms)= 0.021 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 16.094
 TOTAL RAINFALL (mm)= 78.320
 RUNOFF COEFFICIENT = 0.205

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---- ADD HYD (0003) ----				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):	0.25	0.021	1.33	16.09
+ ID2= 2 (0002):	0.19	0.018	1.33	26.27
ID = 3 (0003):	0.44	0.039	1.33	20.49

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

100-YEAR STORM - PRE-DEVELOPMENT

```

V   V   I   SSSSS  U   U   A   L   (v 6.2.2019)
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
V   V   I   SSSSS UUUUU A   A   LLLL

```

```

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

```

Developed and Distributed by Smart City Water Inc

Copyright 2007 - 2022 Smart City Water Inc

All rights reserved.

***** D E T A I L E D O U T P U T *****

```

Input  filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output  filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\957a45057-957a-4752-bc31-5213893cf1f3\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\957a45057-957a-4752-bc31-5213893cf1f3\scena

```

DATE: 11/14/2025 TIME: 11:53:20

USER:

COMMENTS: _____

```

***** SIMULATION : 06_100-Year Norfolk ****
***** ****

```

```

| CHICAGO STORM | IDF curve parameters: A= 801.041
| Pttotal= 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 ( 0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| | | U.H. Tp(hr)= 0.10

```

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)= 0.073

```

PEAK FLOW (cms)= 0.022 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 31.770
TOTAL RAINFALL (mm)= 87.089
RUNOFF COEFFICIENT = 0.365

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

----- CALIB -----
| NASHYD ( 0001) | Area (ha)= 0.25 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| | | U.H. Tp(hr)= 0.04

```

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)= 0.239

```

PEAK FLOW (cms)= 0.025 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 19.466
TOTAL RAINFALL (mm)= 87.089
RUNOFF COEFFICIENT = 0.224

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

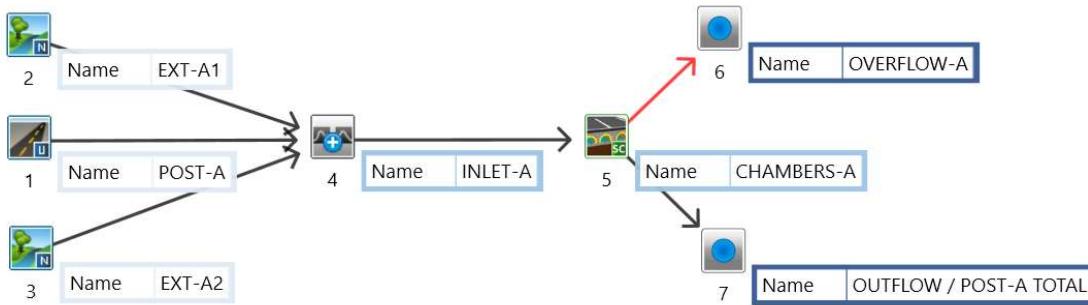
```

----- ADD HYD ( 0003) -----
| 1 + 2 = 3 | AREA   QPEAK   TPEAK   R.V.
| (ha)   (cms)   (hrs)   (mm) |
-----+
| ID1= 1 ( 0001): 0.25   0.025   1.33   19.47
+ ID2= 2 ( 0002): 0.19   0.022   1.33   31.77
-----+
| ID = 3 ( 0003): 0.44   0.047   1.33   24.78

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

23-024 DELHI RAILWAY DEVELOPMENT - SITE A
POST-DEVELOPMENT OTTHYMO MODEL



2-YEAR STORM - POST-DEVELOPMENT

```
=====
V V I SSSSS U U A L          (v 6.2.2019)
V V I SS U U A A L
V V I SS U U AAAA L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLL
```

```
000 TTTTT TTTTT H H Y Y M M 000 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 000
```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

---- 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) = 0.122

PEAK FLOW (cms) = 0.004 (i)
TIME TO PEAK (hrs) = 1.417
RUNOFF VOLUME (mm) = 4.954
TOTAL RAINFALL (mm) = 35.210
RUNOFF COEFFICIENT = 0.141

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

DATE: 08/27/2025

TIME: 04:06:05

USER:

COMMENTS: _____

```
=====
*****
** SIMULATION : 01_2-Year Norfolk **
*****
```

| CHICAGO STORM | IDF curve parameters: A= 529.711
| Pttotal= 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 (0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hr)= 0.10

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

| CALIB |
| NASHYD (0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hr)= 0.09

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) = 0.178

PEAK FLOW (cms) = 0.006 (i)
TIME TO PEAK (hrs) = 1.333
RUNOFF VOLUME (mm) = 4.893
TOTAL RAINFALL (mm) = 35.210
RUNOFF COEFFICIENT = 0.139

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| STANDHYD (0001) | Area (ha)= 1.84
| ID= 1 DT= 5.0 min | Total Imp(%)= 58.00 Dir. Conn.(%)= 32.00

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 1.07 0.77
Dep. Storage (mm)= 1.00 9.00
Average Slope (%)= 1.00 2.00
Length (m)= 110.75 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 19.20
 over (min) 5.00 20.00
 Storage Coeff. (min)= 3.09 (ii) 16.75 (iii)
 Unit Hyd. Tpeak (min)= 5.00 20.00
 Unit Hyd. peak (cms)= 0.27 0.06

TOTALS

PEAK FLOW (cms)= 0.11 0.02 0.121 (iii)
 TIME TO PEAK (hrs)= 1.33 1.58 1.33
 RUNOFF VOLUME (mm)= 34.21 9.07 17.11
 TOTAL RAINFALL (mm)= 35.21 35.21 35.21
 RUNOFF COEFFICIENT = 0.97 0.26 0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

- (i) CN PROCEDURE SELECTED FOR PERVERIOUS LOSSES:
 $CN^* = 70.0$ 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 (0004)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):		1.84	0.121	1.33	17.11
+ ID2= 2 (0002):		0.32	0.004	1.42	4.95
=====					
ID = 3 (0004):		2.16	0.125	1.33	15.31

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)		AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1		(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0004):		2.16	0.125	1.33	15.31
+ ID2= 2 (0003):		0.42	0.006	1.33	4.89
=====					
ID = 1 (0004):		2.58	0.131	1.33	13.62

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CHAMBER(0005)		OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON		
IN= 2--> OUT= 3	CHAMBER:	MAX STO VOL (cu.m.)= 661.78 Bottom Area(m2) = 506.61		
DT= 5.0 min				

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1041.00	380.89
25.00	5.15	1067.00	390.48
51.00	10.29	1092.00	399.98
76.00	15.44	1118.00	409.40
102.00	20.58	1143.00	418.74
127.00	25.73	1168.00	427.99
152.00	30.88	1194.00	437.14
178.00	36.02	1219.00	446.20
203.00	41.17	1245.00	455.17
229.00	46.31	1270.00	464.02
254.00	57.30	1295.00	472.77
279.00	68.26	1321.00	481.41
305.00	79.20	1346.00	489.92
330.00	90.12	1372.00	498.31
356.00	101.02	1397.00	506.56
381.00	111.89	1422.00	514.67
406.00	122.74	1448.00	522.63
432.00	133.56	1473.00	530.43
457.00	144.35	1499.00	538.05
483.00	155.12	1524.00	545.48
508.00	165.85	1549.00	552.69
533.00	176.54	1575.00	559.65
559.00	187.21	1600.00	566.31
584.00	197.84	1626.00	572.49
610.00	208.43	1651.00	578.24
635.00	218.98	1676.00	583.87
660.00	229.48	1702.00	589.39
686.00	239.95	1727.00	594.79
711.00	250.37	1753.00	600.03
737.00	260.75	1778.00	605.18
762.00	271.08	1803.00	610.32
787.00	281.35	1829.00	615.47
813.00	291.58	1854.00	620.62
838.00	301.75	1880.00	625.76
864.00	311.86	1905.00	630.91
889.00	321.91	1930.00	636.05
914.00	331.91	1956.00	641.20
940.00	341.84	1981.00	646.35
965.00	351.71	2007.00	651.49
991.00	361.51	2032.00	656.64
1016.00	371.24	2057.00	661.78

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.730	0.061
0.020	0.010	0.830	0.065

0.120	0.025	0.940	0.069
0.220	0.034	1.040	0.072
0.330	0.041	1.140	0.076
0.430	0.046	1.240	0.079
0.530	0.052	1.340	0.082
0.630	0.056	1.370	0.083

NATIVE SOIL LAYER:
 Infiltration (mm/hr) = 0.0250

Max.Eff.Inten.(mm/hr)= 72.24 19.20
 over (min) 5.00 20.00
 Storage Coeff. (min)= 3.09 (ii) 16.75 (iii)
 Unit Hyd. Tpeak (min)= 5.00 20.00
 Unit Hyd. peak (cms)= 0.27 0.06

TOTALS

PEAK FLOW (cms)= 0.11 0.02 0.121 (iii)
 TIME TO PEAK (hrs)= 1.33 1.58 1.33
 RUNOFF VOLUME (mm)= 34.21 9.07 17.11
 TOTAL RAINFALL (mm)= 35.21 35.21 35.21
 RUNOFF COEFFICIENT = 0.97 0.26 0.49

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVERIOUS LOSSES:
 $CN^* = 70.0$ 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 (0004) |
 1 + 2 = 3 | AREA (ha) QPEAK (cms) TPEAK (hrs) R.V. (mm)
 ID1= 1 (0001): 1.84 0.121 1.33 17.11
 + ID2= 2 (0002): 0.32 0.004 1.42 4.95
 =====

ID = 3 (0004): 2.16 0.125 1.33 15.31

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.)= 661.78 Bottom Area(m2) = 506.61

DEPTH (mm)

STORAGE (cu.m.)

5-YEAR STORM - POST-DEVELOPMENT

```

V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A A A L
VV I SSSSS UUUUU A A LLLL

```

000 TTTTT TTTTT H H Y Y M M 000 TM

O O T T H H Y Y MM MM O O

O O T T H H Y M M O O

000 T T H H Y M M 000

Developed and Distributed by Smart City Water Inc

Copyright 2007 - 2022 Smart City Water Inc

All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\8e9ead0f-8fef-48e8-9eb2-3f105bad3b7c\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\8e9ead0f-8fef-48e8-9eb2-3f105bad3b7c\scena

DATE: 08/27/2025 TIME: 04:06:05

USER:

COMMENTS: _____

** SIMULATION : 02_5-Year Norfolk **

| CHICAGO STORM | IDF curve parameters: A= 583.017
| Pttotal= 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 (0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10

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)= 0.122

PEAK FLOW (cms)= 0.010 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 10.483
TOTAL RAINFALL (mm)= 49.033
RUNOFF COEFFICIENT = 0.214

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| NASHYD (0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.09

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)= 0.178

PEAK FLOW (cms)= 0.015 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 10.357
TOTAL RAINFALL (mm)= 49.033
RUNOFF COEFFICIENT = 0.211

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0001)	Area (ha)= 1.84	Total Imp(%)= 58.00	Dir. Conn.(%)= 32.00
ID= 1 DT= 5.0 min				

IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)= 1.07	0.77
Dep. Storage (mm)= 1.00	9.00
Average Slope (%)= 1.00	2.00
Length (m)= 110.75	3.25
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	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 45.27
over (min)= 5.00 15.00

Storage Coeff. (min)= 2.76 (ii) 12.45 (ii)

Unit Hyd. Tpeak (min)= 5.00 15.00

Unit Hyd. peak (cms)= 0.28 0.08

TOTALS

PEAK FLOW (cms)= 0.15 0.05 0.179 (iii)
TIME TO PEAK (hrs)= 1.33 1.50 1.33
RUNOFF VOLUME (mm)= 48.03 17.07 26.98
TOTAL RAINFALL (mm)= 49.03 49.03 49.03
RUNOFF COEFFICIENT = 0.98 0.35 0.55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 70.0 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 (0004)	1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):	1.84	0.179	1.33	26.98	
+ ID2= 2 (0002):	0.32	0.010	1.33	10.48	
=====					
ID = 3 (0004):	2.16	0.190	1.33	24.53	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)	3 + 2 = 1	AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0004):	2.16	0.190	1.33	24.53	
+ ID2= 2 (0003):	0.42	0.015	1.33	10.36	
=====					
ID = 1 (0004):	2.58	0.205	1.33	22.22	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CALIB	NASHYD (0003)	Area (ha)= 0.42	Curve Number (CN)= 70.0
ID= 1 DT= 5.0 min	Ia (mm)= 9.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.09		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```

| CHAMBER( 0005) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
| IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 661.78 Bottom Area(m2) = 506.61
-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1041.00	380.89
25.00	5.15	1067.00	390.48
51.00	10.29	1092.00	399.98
76.00	15.44	1118.00	409.40
102.00	20.58	1143.00	418.74
127.00	25.73	1168.00	427.99
152.00	30.88	1194.00	437.14
178.00	36.02	1219.00	446.20
203.00	41.17	1245.00	455.17
229.00	46.31	1270.00	464.02
254.00	57.30	1295.00	472.77
279.00	68.26	1321.00	481.41
305.00	79.20	1346.00	489.92
330.00	90.12	1372.00	498.31
356.00	101.02	1397.00	506.56
381.00	111.89	1422.00	514.67
406.00	122.74	1448.00	522.63
432.00	133.56	1473.00	530.43
457.00	144.35	1499.00	538.05
483.00	155.12	1524.00	545.48
508.00	165.85	1549.00	552.69
533.00	176.54	1575.00	559.65
559.00	187.21	1600.00	566.31
584.00	197.84	1626.00	572.49
610.00	208.43	1651.00	578.24
635.00	218.98	1676.00	583.87
660.00	229.48	1702.00	589.39
686.00	239.95	1727.00	594.79
711.00	250.37	1753.00	600.03
737.00	260.75	1778.00	605.18
762.00	271.08	1803.00	610.32
787.00	281.35	1829.00	615.47
813.00	291.58	1854.00	620.62
838.00	301.75	1880.00	625.76
864.00	311.86	1905.00	630.91
889.00	321.91	1930.00	636.05
914.00	331.91	1956.00	641.20
940.00	341.84	1981.00	646.35
965.00	351.71	2007.00	651.49
991.00	361.51	2032.00	656.64
1016.00	371.24	2057.00	661.78

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.730	0.061
0.020	0.010	0.830	0.065
0.120	0.025	0.940	0.069
0.220	0.034	1.040	0.072
0.330	0.041	1.140	0.076
0.430	0.046	1.240	0.079
0.530	0.052	1.340	0.082
0.630	0.056	1.370	0.083

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW: ID= 2	2.58	0.205	22.22
OUTFLOW: ID= 1	2.58	0.035	12.03
OVERFLOW: ID= 3	0.00	0.000	0.00

Volume Reduction Rate[(RVin-RVout)/RVin] (%)= 45.87
Time to reach Max storage (Hr)= 2.25
Volume of water for drawdown in LID (cu.m.)= 201.34
Volume of maximum water storage (cu.m.)= 291.85
Calculated Drawdown Time (Hr)= 15.83

```

-----| Junction Command(0006) |-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3 (0005)	0.00	0.00	0.00
OUTFLOW: ID= 2 (0006)	0.00	0.00	0.00

```

-----| Junction Command(0007) |-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1 (0005)	2.58	0.04	12.03
OUTFLOW: ID= 2 (0007)	2.58	0.04	12.03

10-YEAR STORM - POST-DEVELOPMENT

```
=====
V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U AAAAAA L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL L
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
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.
```

***** D E T A I L E D O U T P U T *****

```
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\511603c-fc79-4f4c-b6ef-7275a0122d24\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\511603c-fc79-4f4c-b6ef-7275a0122d24\scena
```

DATE: 08/27/2025 TIME: 04:06:05

USER:

COMMENTS: _____

```
*****
** SIMULATION : 03_10-Year Norfolk **
*****
```

```
| CHICAGO STORM | IDF curve parameters: A= 670.324
| Pttotal= 57.94 mm | 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 RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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 | NASHYD ( 0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hrs)= 0.10
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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
```

Unit Hyd Qpeak (cms)= 0.122

```
PEAK FLOW (cms)= 0.016 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 14.786
TOTAL RAINFALL (mm)= 57.945
RUNOFF COEFFICIENT = 0.255
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
| CALIB | NASHYD ( 0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hrs)= 0.09
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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
```

Unit Hyd Qpeak (cms)= 0.178

```
PEAK FLOW (cms)= 0.022 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 14.607
TOTAL RAINFALL (mm)= 57.945
RUNOFF COEFFICIENT = 0.252
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
----- | CALIB | STANDHYD ( 0001) | Area (ha)= 1.84
| ID= 1 DT= 5.0 min | Total Imp(%)= 58.00 Dir. Conn.(%)= 32.00
----- | IMPERVIOUS | PVIOUS (i)
Surface Area (ha)= 1.07 0.77
Dep. Storage (mm)= 1.00 9.00
Average Slope (%)= 1.00 2.00
Length (m)= 110.75 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 | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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 62.43
over (min) 5.00 15.00
Storage Coeff. (min)= 2.60 (ii) 11.12 (ii)
Unit Hyd. Tpeak (min)= 5.00 15.00
Unit Hyd. peak (cms)= 0.29 0.09
----- *TOTALS*
PEAK FLOW (cms)= 0.18 0.08 0.219 (iii)
TIME TO PEAK (hrs)= 1.33 1.50 1.33
RUNOFF VOLUME (mm)= 56.94 22.94 33.82
TOTAL RAINFALL (mm)= 57.94 57.94 57.94
RUNOFF COEFFICIENT = 0.98 0.40 0.58
```

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

```
(i) CN PROCEDURE SELECTED FOR PVIOUS LOSSES:
CN* = 70.0 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 ( 0004) | 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
----- | (ha) (cms) (hrs) (mm)
----- ID1= 1 ( 0001): 1.84 0.219 1.33 33.82
+ ID2= 2 ( 0002): 0.32 0.016 1.33 14.79
----- ID = 3 ( 0004): 2.16 0.235 1.33 31.00
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
----- | ADD HYD ( 0004) | 3 + 2 = 1 | AREA QPEAK TPEAK R.V.
----- | (ha) (cms) (hrs) (mm)
----- ID1= 3 ( 0004): 2.16 0.235 1.33 31.00
+ ID2= 2 ( 0003): 0.42 0.022 1.33 14.61
----- ID = 1 ( 0004): 2.58 0.257 1.33 28.33
```

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.)= 661.78 Bottom Area(m2) = 506.61
-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1041.00	380.89
25.00	5.15	1067.00	390.48
51.00	10.29	1092.00	399.98
76.00	15.44	1118.00	409.40
102.00	20.58	1143.00	418.74
127.00	25.73	1168.00	427.99
152.00	30.88	1194.00	437.14
178.00	36.02	1219.00	446.20
203.00	41.17	1245.00	455.17
229.00	46.31	1270.00	464.02
254.00	57.30	1295.00	472.77
279.00	68.26	1321.00	481.41
305.00	79.20	1346.00	489.92
330.00	90.12	1372.00	498.31
356.00	101.02	1397.00	506.56
381.00	111.89	1422.00	514.67
406.00	122.74	1448.00	522.63
432.00	133.56	1473.00	530.43
457.00	144.35	1499.00	538.05
483.00	155.12	1524.00	545.48
508.00	165.85	1549.00	552.69
533.00	176.54	1575.00	559.65
559.00	187.21	1600.00	566.31
584.00	197.84	1626.00	572.49
610.00	208.43	1651.00	578.24
635.00	218.98	1676.00	583.87
660.00	229.48	1702.00	589.39
686.00	239.95	1727.00	594.79
711.00	250.37	1753.00	600.03
737.00	260.75	1778.00	605.18
762.00	271.08	1803.00	610.32
787.00	281.35	1829.00	615.47
813.00	291.58	1854.00	620.62
838.00	301.75	1880.00	625.76
864.00	311.86	1905.00	630.91
889.00	321.91	1930.00	636.05
914.00	331.91	1956.00	641.20
940.00	341.84	1981.00	646.35
965.00	351.71	2007.00	651.49
991.00	361.51	2032.00	656.64
1016.00	371.24	2057.00	661.78

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.730	0.061
0.020	0.010	0.830	0.065
0.120	0.025	0.940	0.069
0.220	0.034	1.040	0.072
0.330	0.041	1.140	0.076
0.430	0.046	1.240	0.079
0.530	0.052	1.340	0.082
0.630	0.056	1.370	0.083

```

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250

```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	2.58	0.257	28.33
OUTFLOW:ID= 1	2.58	0.046	2.25
OVERFLOW:ID= 3	0.00	0.000	17.94

```

Volume Reduction Rate[(RVin-RVout)/RVin] (%)= 36.68
Time to reach Max storage (Hr)= 2.25
Volume of water for drawdown in LID (cu.m.)= 208.23
Volume of maximum water storage (cu.m.)= 362.72
Calculated Drawdown Time (Hr)= 16.33

```

```

-----| Junction Command(0006) | -----

```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00

```

-----
```

```

| Junction Command(0007) | -----

```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	2.58	0.05	2.25
OUTFLOW: ID= 2(0007)	2.58	0.05	17.94

```

-----
```

```

FINISH
=====
```

25-YEAR STORM - POST-DEVELOPMENT

```
=====
V V I SSSSS U U A L          (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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 M OOO
```

Developed and Distributed by Smart City Water Inc
 Copyright 2007 - 2022 Smart City Water Inc
 All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
 Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\b54ca0eb-630a-4349-81d3-355a79d09812\scena
 Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\b54ca0eb-630a-4349-81d3-355a79d09812\scena

DATE: 08/27/2025 TIME: 04:06:05

USER:

COMMENTS: _____

```
*****
** SIMULATION : 04_25-Year Norfolk **
*****
```

| CHICAGO STORM | IDF curve parameters: A= 721.533
| Pttotal= 69.38 mm | 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	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	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 |
| NASHYD (0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
=====
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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 23.97 | 2.333 131.63 | 3.233 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
```

Unit Hyd Qpeak (cms)= 0.122

PEAK FLOW (cms)= 0.023 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 20.981
 TOTAL RAINFALL (mm)= 69.379
 RUNOFF COEFFICIENT = 0.302

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| NASHYD (0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.09

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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 23.97 | 2.333 131.63 | 3.233 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
```

Unit Hyd Qpeak (cms)= 0.178

PEAK FLOW (cms)= 0.033 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 20.727
 TOTAL RAINFALL (mm)= 69.379
 RUNOFF COEFFICIENT = 0.299

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0001)	Area (ha)= 1.84	ID= 1 DT= 5.0 min	Total Imp(%)= 58.00	Dir. Conn.(%)= 32.00
Surface Area (ha)=	1.07	IMPERVIOUS	PERVIOUS (i)		
Dep. Storage (mm)=	1.00		0.77		
Average Slope (%)=	1.00		9.00		
Length (m)=	110.75		2.00		
Mannings n =	0.013		40.00		
			0.250		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs 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 23.97 | 2.333 131.63 | 3.233 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 86.19
 over (min) 5.00 10.00
 Storage Coeff. (min)= 2.43 (ii) 9.92 (ii)
 Unit Hyd. Tpeak (min)= 5.00 10.00
 Unit Hyd. peak (cms)= 0.30 0.11

TOTALS

PEAK FLOW (cms)= 0.21 0.12 0.306 (iii)
 TIME TO PEAK (hrs)= 1.33 1.42 1.33
 RUNOFF VOLUME (mm)= 68.38 31.08 43.01
 TOTAL RAINFALL (mm)= 69.38 69.38 69.38
 RUNOFF COEFFICIENT = 0.99 0.45 0.62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 70.0 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 (0004)	1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):	1.84	0.306	1.33	43.01	
+ ID2= 2 (0002):	0.32	0.023	1.33	20.98	
ID = 3 (0004):	2.16	0.329	1.33	39.75	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)	3 + 2 = 1	AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0004):	2.16	0.329	1.33	39.75	
+ ID2= 2 (0003):	0.42	0.033	1.33	20.73	
ID = 1 (0004):	2.58	0.362	1.33	36.65	

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.)= 661.78 Bottom Area(m2) = 506.61
-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1041.00	380.89
25.00	5.15	1067.00	390.48
51.00	10.29	1092.00	399.98
76.00	15.44	1118.00	409.40
102.00	20.58	1143.00	418.74
127.00	25.73	1168.00	427.99
152.00	30.88	1194.00	437.14
178.00	36.02	1219.00	446.20
203.00	41.17	1245.00	455.17
229.00	46.31	1270.00	464.02
254.00	57.30	1295.00	472.77
279.00	68.26	1321.00	481.41
305.00	79.20	1346.00	489.92
330.00	90.12	1372.00	498.31
356.00	101.02	1397.00	506.56
381.00	111.89	1422.00	514.67
406.00	122.74	1448.00	522.63
432.00	133.56	1473.00	530.43
457.00	144.35	1499.00	538.05
483.00	155.12	1524.00	545.48
508.00	165.85	1549.00	552.69
533.00	176.54	1575.00	559.65
559.00	187.21	1600.00	566.31
584.00	197.84	1626.00	572.49
610.00	208.43	1651.00	578.24
635.00	218.98	1676.00	583.87
660.00	229.48	1702.00	589.39
686.00	239.95	1727.00	594.79
711.00	250.37	1753.00	600.03
737.00	260.75	1778.00	605.18
762.00	271.08	1803.00	610.32
787.00	281.35	1829.00	615.47
813.00	291.58	1854.00	620.62
838.00	301.75	1880.00	625.76
864.00	311.86	1905.00	630.91
889.00	321.91	1930.00	636.05
914.00	331.91	1956.00	641.20
940.00	341.84	1981.00	646.35
965.00	351.71	2007.00	651.49
991.00	361.51	2032.00	656.64
1016.00	371.24	2057.00	661.78

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.730	0.061
0.020	0.010	0.830	0.065
0.120	0.025	0.940	0.069
0.220	0.034	1.040	0.072
0.330	0.041	1.140	0.076
0.430	0.046	1.240	0.079
0.530	0.052	1.340	0.082
0.630	0.056	1.370	0.083

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	2.58	0.362	36.65
OUTFLOW:ID= 1	2.58	0.060	26.01
OVERFLOW:ID= 3	0.00	0.000	0.00

Volume Reduction Rate[(RVin-RVout)/RVin] (%)= 29.02
Time to reach Max storage (Hr)= 2.17
Volume of water for drawdown in LID (cu.m.)= 244.00
Volume of maximum water storage (cu.m.)= 461.66
Calculated Drawdown Time (Hr)= 16.83

```

-----| Junction Command(0006) |-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00

```

-----| Junction Command(0007) |-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	2.58	0.06	26.01
OUTFLOW: ID= 2(0007)	2.58	0.06	26.01

50-YEAR STORM - POST-DEVELOPMENT

```

V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLL

```

```

000 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
000 T T H H Y M M OOO

```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\78bdbac3-0715-42d4-94ff-3de685208e88\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\78bdbac3-0715-42d4-94ff-3de685208e88\scena

```

DATE: 08/27/2025 TIME: 04:06:05

USER:

COMMENTS: _____

```

***** SIMULATION : 05_50-Year Norfolk ****
-----| 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	RAIN	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	'	hrs	mm/hr	'	hrs	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 | Area (ha)= 0.32 Curve Number (CN)= 70.0
-----| NASHYD ( 0002) | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hr)= 0.10

```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

----- TRANSFORMED HYETOGRAPH -----

TIME	RAIN	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN	'	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	'	hrs	mm/hr	'	hrs	mm/hr	'	hrs	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	'		

Unit Hyd Qpeak (cms)= 0.122

PEAK FLOW (cms)= 0.030 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 26.267
TOTAL RAINFALL (mm)= 78.320
RUNOFF COEFFICIENT = 0.335

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----| CALIB | Area (ha)= 0.42 Curve Number (CN)= 70.0
-----| NASHYD ( 0003) | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hr)= 0.09

```

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	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

Unit Hyd Qpeak (cms)= 0.178

PEAK FLOW (cms)= 0.042 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 25.950
TOTAL RAINFALL (mm)= 78.320
RUNOFF COEFFICIENT = 0.331

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

-----| CALIB | Area (ha)= 1.84
-----| STANDHYD ( 0001) | Total Imp(%)= 58.00 Dir. Conn.(%)= 32.00
-----| ID= 1 DT= 5.0 min |

```

Surface Area (ha)=	IMPERVIOUS	PERVIOUS (i)
Dep. Storage (mm)=	1.07	0.77
Average Slope (%)=	1.00	9.00
Length (m)=	110.75	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	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	105.62
over (min)=	5.00	10.00
Storage Coeff. (min)=	2.33 (ii)	9.24 (ii)
Unit Hyd. Tpeak (min)=	5.00	10.00
Unit Hyd. peak (cms)=	0.30	0.12

TOTALS

PEAK FLOW (cms)= 0.24 0.15 0.358 (iii)
TIME TO PEAK (hrs)= 1.33 1.42 1.33
RUNOFF VOLUME (mm)= 77.32 37.82 50.45
TOTAL RAINFALL (mm)= 78.32 78.32 78.32
RUNOFF COEFFICIENT = 0.99 0.48 0.64

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 70.0 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 ( 0004) |
-----| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
-----| (ha) (cms) (hrs) (mm) |
-----| ID1= 1 ( 0001): 1.84 0.358 1.33 50.45
+ ID2= 2 ( 0002): 0.32 0.030 1.33 26.27
-----| ID = 3 ( 0004): 2.16 0.388 1.33 46.87

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)				
3 + 2 = 1	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0004):	2.16	0.388	1.33	46.87
+ ID2= 2 (0003):	0.42	0.042	1.33	25.95
=====				
ID = 1 (0004):	2.58	0.430	1.33	43.47

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Junction Command(0007)

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	2.58	0.07	2.17 32.62
OUTFLOW: ID= 2(0007)	2.58	0.07	2.17 32.62

CHAMBER(0005) OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON				
IN= 2--> OUT= 3 CHAMBER:	DT= 5.0 min MAX STO VOL (cu.m.)= 661.78 Bottom Area(m2) = 506.61			

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1041.00	380.89
25.00	5.15	1067.00	390.48
51.00	10.29	1092.00	399.98
76.00	15.44	1118.00	409.40
102.00	20.58	1143.00	418.74
127.00	25.73	1168.00	427.99
152.00	30.88	1194.00	437.14
178.00	36.02	1219.00	446.20
203.00	41.17	1245.00	455.17
229.00	46.31	1270.00	464.02
254.00	51.30	1295.00	472.77
279.00	68.26	1321.00	481.41
305.00	79.20	1346.00	489.92
330.00	90.12	1372.00	498.31
356.00	101.02	1397.00	506.56
381.00	111.89	1422.00	514.67
406.00	122.74	1448.00	522.63
432.00	133.56	1473.00	530.43
457.00	144.35	1499.00	538.05
483.00	155.12	1524.00	545.48
508.00	165.85	1549.00	552.69
533.00	176.54	1575.00	559.65
559.00	187.21	1600.00	566.31
584.00	197.84	1626.00	572.49
610.00	208.43	1651.00	578.24
635.00	218.98	1676.00	583.87
660.00	229.48	1702.00	589.39
686.00	239.95	1727.00	594.79
711.00	250.37	1753.00	600.03
737.00	260.75	1778.00	605.18
762.00	271.08	1803.00	610.32
787.00	281.35	1829.00	615.47
813.00	291.58	1854.00	620.62
838.00	301.75	1880.00	625.76
864.00	311.86	1905.00	630.91
889.00	321.91	1930.00	636.05
914.00	331.91	1956.00	641.20
940.00	341.84	1981.00	646.35
965.00	351.71	2007.00	651.49
991.00	361.51	2032.00	656.64
1016.00	371.24	2057.00	661.78

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.730	0.061
0.020	0.010	0.830	0.065
0.120	0.025	0.940	0.069
0.220	0.034	1.040	0.072
0.330	0.041	1.140	0.076
0.430	0.046	1.240	0.079
0.530	0.052	1.340	0.082
0.630	0.056	1.370	0.083

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	2.58	0.430	1.33 43.47
OUTFLOW:ID= 1	2.58	0.071	2.17 32.62
OVERFLOW:ID= 3	0.00	0.000	0.00 0.00

Volume Reduction Rate[(RVin-RVout)/RVin] (%)= 24.94
Time to reach Max storage (Hr)= 2.17
Volume of water for drawdown in LID (cu.m.)= 284.37
Volume of maximum water storage (cu.m.)= 547.00
Calculated Drawdown Time (Hr)= 17.25

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

100-YEAR STORM - POST-DEVELOPMENT

```
=====
V V I SSSSS U U A L          (v 6.2.2019)
V V I SS U U A A L
V V I SS U U AAAAAA L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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
```

Developed and Distributed by Smart City Water Inc
 Copyright 2007 - 2022 Smart City Water Inc
 All rights reserved.

***** DETAILLED OUTPUT *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
 Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\1d54f3f0-20le-4875-906d-3df7335418b0\scena
 Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\1d54f3f0-20le-4875-906d-3df7335418b0\scena

DATE: 08/27/2025 TIME: 04:06:05

USER:

COMMENTS: _____

```
*****
** SIMULATION : 06_100-Year Norfolk **
*****
```

| CHICAGO STORM | IDF curve parameters: A= 801.041
| Pttotal= 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 (0002) | Area (ha)= 0.32 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
=====
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | 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)= 0.122

PEAK FLOW (cms)= 0.037 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 31.770
 TOTAL RAINFALL (mm)= 87.089
 RUNOFF COEFFICIENT = 0.365

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB |
| NASHYD (0003) | Area (ha)= 0.42 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.09

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | 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)= 0.178

PEAK FLOW (cms)= 0.052 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 31.387
 TOTAL RAINFALL (mm)= 87.089
 RUNOFF COEFFICIENT = 0.360

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0001)	Area (ha)= 1.84	ID= 1 DT= 5.0 min	Total Imp(%)= 58.00	Dir. Conn.(%)= 32.00
Surface Area (ha)=	1.07	IMPERVIOUS	PERVIOUS (i)		
Dep. Storage (mm)=	1.00	1.00	9.00		
Average Slope (%)=	1.00	1.00	2.00		
Length (m)=	110.75	110.75	3.25		
Mannings n =	0.013	0.013	0.250		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | 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
```

Max.Eff.Inten.(mm/hr)= 160.97 125.44
 over (min) 5.00 10.00
 Storage Coeff. (min)= 2.25 (ii) 8.69 (ii)
 Unit Hyd. Tpeak (min)= 5.00 10.00
 Unit Hyd. peak (cms)= 0.30 0.12

TOTALS

PEAK FLOW (cms)= 0.26 0.18 0.411 (iii)
 TIME TO PEAK (hrs)= 1.33 1.42 1.33
 RUNOFF VOLUME (mm)= 86.09 44.68 57.93
 TOTAL RAINFALL (mm)= 87.09 87.09 87.09
 RUNOFF COEFFICIENT = 0.99 0.51 0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 70.0 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 (0004)	1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
(ha)	(cms)	(hrs)	(mm)		
ID1= 1 (0001):	1.84	0.411	1.33	57.93	
+ ID2= 2 (0002):	0.32	0.037	1.33	31.77	
ID = 3 (0004):	2.16	0.448	1.33	54.05	

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0004)	3 + 2 = 1	AREA	QPEAK	TPEAK	R.V.
(ha)	(cms)	(hrs)	(mm)		
ID1= 3 (0004):	2.16	0.448	1.33	54.05	
+ ID2= 2 (0003):	0.42	0.052	1.33	31.39	
ID = 1 (0004):	2.58	0.499	1.33	50.36	

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.)= 661.78 Bottom Area(m2) = 506.61
-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1041.00	380.89
25.00	5.15	1067.00	390.48
51.00	10.29	1092.00	399.98
76.00	15.44	1118.00	409.40
102.00	20.58	1143.00	418.74
127.00	25.73	1168.00	427.99
152.00	30.88	1194.00	437.14
178.00	36.02	1219.00	446.20
203.00	41.17	1245.00	455.17
229.00	46.31	1270.00	464.02
254.00	57.30	1295.00	472.77
279.00	68.26	1321.00	481.41
305.00	79.20	1346.00	489.92
330.00	90.12	1372.00	498.31
356.00	101.02	1397.00	506.56
381.00	111.89	1422.00	514.67
406.00	122.74	1448.00	522.63
432.00	133.56	1473.00	530.43
457.00	144.35	1499.00	538.05
483.00	155.12	1524.00	545.48
508.00	165.85	1549.00	552.69
533.00	176.54	1575.00	559.65
559.00	187.21	1600.00	566.31
584.00	197.84	1626.00	572.49
610.00	208.43	1651.00	578.24
635.00	218.98	1676.00	583.87
660.00	229.48	1702.00	589.39
686.00	239.95	1727.00	594.79
711.00	250.37	1753.00	600.03
737.00	260.75	1778.00	605.18
762.00	271.08	1803.00	610.32
787.00	281.35	1829.00	615.47
813.00	291.58	1854.00	620.62
838.00	301.75	1880.00	625.76
864.00	311.86	1905.00	630.91
889.00	321.91	1930.00	636.05
914.00	331.91	1956.00	641.20
940.00	341.84	1981.00	646.35
965.00	351.71	2007.00	651.49
991.00	361.51	2032.00	656.64
1016.00	371.24	2057.00	661.78

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.730	0.061
0.020	0.010	0.830	0.065
0.120	0.025	0.940	0.069
0.220	0.034	1.040	0.072
0.330	0.041	1.140	0.076
0.430	0.046	1.240	0.079
0.530	0.052	1.340	0.082
0.630	0.056	1.370	0.083

```

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250
-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	2.58	0.499	50.36
OUTFLOW:ID= 1	2.58	0.085	39.38
OVERFLOW:ID= 3	0.00	0.000	0.00

```

Volume Reduction Rate[(RVin-RVout)/RVin] (%)= 21.82
Time to reach Max storage (Hr)= 2.17
Volume of water for drawdown in LID (cu.m.)= 340.23
Volume of maximum water storage (cu.m.)= 628.04
Calculated Drawdown Time (Hr)= 17.58
-----
```

```

| Junction Command(0006) |
-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005)	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00

```

| Junction Command(0007) |
-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005)	2.58	0.08	39.38
OUTFLOW: ID= 2(0007)	2.58	0.08	39.38

25mm, 4 HOUR STORM - POST-DEVELOPMENT

```
=====
V V I SSSSS U U A L          (v 6.2.2019)
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 A L
VV I SSSSS UUUUU A A LLLL

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
```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** DETAILLED OUTPUT *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\aa6a4cb61-4fce-4657-9b62-659f47acfba0\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\aa6a4cb61-4fce-4657-9b62-659f47acfba0\scena

DATE: 08/27/2025 TIME: 04:06:05

USER:

COMMENTS: _____

** SIMULATION : 25 mm, 4 hr Norfolk **

```
| READ STORM |   Filename: C:\Users\Sarahf\AppData\Local\Temp\86a396af-6f39-4395-869e-cb03blaeca9ca\7baaeef9f
|           |   Ptotal= 25.00 mm |   Comments: 25 mm, 4 hr Norfolk
-----
```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	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 |   Area (ha)= 0.32   Curve Number (CN)= 70.0
| NASHYD ( 0002) |   Ia (mm)= 9.00   # of Linear Res.(N)= 3.00
| ID= 1 DT= 5.0 min |   U.H. Tp(hr)= 0.10
-----
```

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	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	16.17	2.750	2.83
0.583	2.51	1.667	16.17	2.750	2.87	2.83	1.85
0.667	2.51	1.750	8.96	2.833	2.87	3.92	1.75
0.750	3.03	1.833	2.917	2.61	4.00	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		

Unit Hyd Qpeak (cms)= 0.122

PEAK FLOW (cms)= 0.001 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 1.996
TOTAL RAINFALL (mm)= 24.999
RUNOFF COEFFICIENT = 0.080

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
| CALIB |   Area (ha)= 0.42   Curve Number (CN)= 70.0
| NASHYD ( 0003) |   Ia (mm)= 9.00   # of Linear Res.(N)= 3.00
| ID= 1 DT= 5.0 min |   U.H. Tp(hr)= 0.09
-----
```

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	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	2.917	2.61	4.00	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		

Unit Hyd Qpeak (cms)= 0.178

PEAK FLOW (cms)= 0.002 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 1.972
TOTAL RAINFALL (mm)= 24.999
RUNOFF COEFFICIENT = 0.079

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
| CALIB |   Area (ha)= 1.84
| STANDHYD ( 0001) |   Total Imp(%)= 58.00   Dir. Conn.(%)= 32.00
| ID= 1 DT= 5.0 min |
```

IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.07
Dep. Storage (mm)=	1.00
Average Slope (%)=	1.00
Length (m)=	110.75
Mannings n =	0.013
PERVIOUS (i)	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	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	2.917	2.61	4.00	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		

Max.Eff.Inten.(mm/hr)= 51.29
over (min)= 5.00
Storage Coeff. (min)= 3.55 (ii)
Unit Hyd. Tpeak (min)= 5.00
Unit Hyd. peak (cms)= 0.26

TOTALS
PEAK FLOW (cms)= 0.08
TIME TO PEAK (hrs)= 1.50
RUNOFF VOLUME (mm)= 24.00
TOTAL RAINFALL (mm)= 25.00
RUNOFF COEFFICIENT = 0.96

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 70.0 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 ( 0004) |   AREA QPEAK TPEAK R.V.
| 1 + 2 = 3 |   (ha) (cms) (hrs) (mm)
|           |   1.84 0.081 1.50 10.64
| ID1= 1 ( 0001): 1.84 0.081 1.50 10.64
+ ID2= 2 ( 0002): 0.32 0.001 1.67 2.00
=====
ID = 3 ( 0004): 2.16 0.082 1.50 9.36
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
| ADD HYD ( 0004) |   AREA QPEAK TPEAK R.V.
| 3 + 2 = 1 |   (ha) (cms) (hrs) (mm)
|           |   2.16 0.082 1.50 9.36
| ID1= 3 ( 0004): 2.16 0.082 1.50 9.36
+ ID2= 2 ( 0003): 0.42 0.002 1.67 1.97
=====
ID = 1 ( 0004): 2.58 0.084 1.50 8.15
```

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.)= 661.78 Bottom Area(m2) = 506.61
-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	1041.00	380.89
25.00	5.15	1067.00	390.48
51.00	10.29	1092.00	399.98
76.00	15.44	1118.00	409.40
102.00	20.58	1143.00	418.74
127.00	25.73	1168.00	427.99
152.00	30.88	1194.00	437.14
178.00	36.02	1219.00	446.20
203.00	41.17	1245.00	455.17
229.00	46.31	1270.00	464.02
254.00	57.30	1295.00	472.77
279.00	68.26	1321.00	481.41
305.00	79.20	1346.00	489.92
330.00	90.12	1372.00	498.31
356.00	101.02	1397.00	506.56
381.00	111.89	1422.00	514.67
406.00	122.74	1448.00	522.63
432.00	133.56	1473.00	530.43
457.00	144.35	1499.00	538.05
483.00	155.12	1524.00	545.48
508.00	165.85	1549.00	552.69
533.00	176.54	1575.00	559.65
559.00	187.21	1600.00	566.31
584.00	197.84	1626.00	572.49
610.00	208.43	1651.00	578.24
635.00	218.98	1676.00	583.87
660.00	229.48	1702.00	589.39
686.00	239.95	1727.00	594.79
711.00	250.37	1753.00	600.03
737.00	260.75	1778.00	605.18
762.00	271.08	1803.00	610.32
787.00	281.35	1829.00	615.47
813.00	291.58	1854.00	620.62
838.00	301.75	1880.00	625.76
864.00	311.86	1905.00	630.91
889.00	321.91	1930.00	636.05
914.00	331.91	1956.00	641.20
940.00	341.84	1981.00	646.35
965.00	351.71	2007.00	651.49
991.00	361.51	2032.00	656.64
1016.00	371.24	2057.00	661.78

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.730	0.061
0.020	0.010	0.830	0.065
0.120	0.025	0.940	0.069
0.220	0.034	1.040	0.072
0.330	0.041	1.140	0.076
0.430	0.046	1.240	0.079
0.530	0.052	1.340	0.082
0.630	0.056	1.370	0.083

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2 2.58	0.084	1.50	8.15
OUTFLOW:ID= 1 0.00	0.000	0.00	0.00
OVERFLOW:ID= 3 0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 100.00
Time to reach Max storage (Hr)= 4.25
Volume of water for drawdown in LID (cu.m.)= 146.67
Volume of maximum water storage (cu.m.)= 160.41
Calculated Drawdown Time (Hr)= 11.58

```

-----| Junction Command(0006) |-----
```

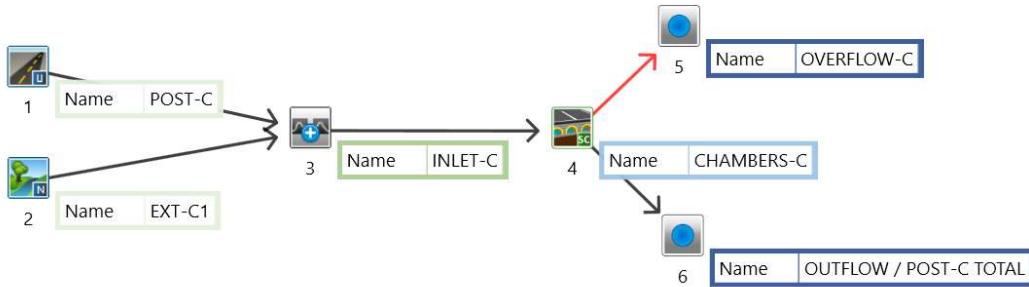
AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0005) 0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006) 0.00	0.00	0.00	0.00

```

-----| Junction Command(0007) |-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0005) 0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0007) 0.00	0.00	0.00	0.00

23-024 DELHI RAILWAY DEVELOPMENT - SITE C
POST-DEVELOPMENT OTTHYMO MODEL



2-YEAR STORM - POST-DEVELOPMENT

```
=====
V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.
```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

```
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VH5\76c0f17f-7ece-4502-940a-950dd0cf81b5\fifdb197-a874-4b15-9597-4c8928a79668\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VH5\76c0f17f-7ece-4502-940a-950dd0cf81b5\fifdb197-a874-4b15-9597-4c8928a79668\scena
```

DATE: 11/14/2025

TIME: 11:56:45

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 | TIME RAIN
hrs mm/hr | 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 | Area (ha)= 0.19 Curve Number (CN)= 70.0
| NASHYD ( 0002) | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| ID= 1 DT= 5.0 min | U.H. Tp(hrs)= 0.10
```

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)= 0.073

PEAK FLOW (cms)= 0.003 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 4.952
TOTAL RAINFALL (mm)= 35.210
RUNOFF COEFFICIENT = 0.141

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
-----| CALIB | Area (ha)= 0.25
| STANDHYD ( 0001) | Total Imp(%)= 74.00 Dir. Conn.(%)= 59.00
| ID= 1 DT= 5.0 min |
```

IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)= 0.19	0.06
Dep. Storage (mm)= 1.00	9.00
Average Slope (%)= 1.00	2.00
Length (m)= 40.82	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 18.04

over (min) 5.00 20.00

Storage Coeff. (min)= 1.70 (ii) 15.70 (ii)

Unit Hyd. Tpeak (min)= 5.00 20.00

Unit Hyd. peak (cms)= 0.32 0.07

TOTALS

PEAK FLOW	TIME TO PEAK	RUNOFF VOLUME	TOTAL RAINFALL	RUNOFF COEFFICIENT
(cms)= 0.03	(hrs)= 1.33	(mm)= 34.21	(mm)= 35.21	= 0.97
0.00	1.58	8.83	23.76	0.25
0.030 (iii)	1.33	8.83	35.21	0.67

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 70.0 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 ( 0003) |
| 1 + 2 = 3 |      AREA    QPEAK    TPEAK    R.V.
-----| (ha)      (cms)    (hrs)    (mm)
ID1= 1 ( 0001): 0.25  0.030  1.33  23.76
+ ID2= 2 ( 0002): 0.19  0.003  1.42  4.95
=====
ID = 3 ( 0003): 0.44  0.032  1.33  15.64

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| CHAMBER( 0004) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
| IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 120.46 Bottom Area(m2) = 180.97

```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	584.00	65.75
25.00	1.84	610.00	69.02
51.00	3.68	635.00	72.25
76.00	5.51	660.00	75.44
102.00	7.35	686.00	78.58
127.00	9.19	711.00	81.66
152.00	11.03	737.00	84.68
178.00	12.87	762.00	87.64
203.00	14.71	787.00	90.51
229.00	16.54	813.00	93.32
254.00	20.21	838.00	96.04
279.00	23.86	864.00	98.66
305.00	27.49	889.00	101.16
330.00	31.10	914.00	103.50
356.00	34.69	940.00	105.57
381.00	38.26	965.00	107.54
406.00	41.80	991.00	109.43
432.00	45.31	1016.00	111.27
457.00	48.80	1041.00	113.11
483.00	52.26	1067.00	114.94
508.00	55.68	1092.00	116.78
533.00	59.07	1118.00	118.62
559.00	62.43	1143.00	120.46

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.470	0.011
0.060	0.004	0.570	0.012
0.160	0.006	0.670	0.013
0.260	0.008	0.770	0.014
0.360	0.010	0.800	0.014

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2 0.44	0.032	1.33	15.64
OUTFLOW:ID= 1 0.44	0.004	2.00	5.24
OVERFLOW:ID= 3 0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 66.51
 Time to reach Max storage (Hr)= 2.00
 Volume of water for drawdown in LID (cu.m.)= 26.96
 Volume of maximum water storage (cu.m.)= 34.64
 Calculated Drawdown Time (Hr)= 5.92

```

| Junction Command(0006) |
-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0004) 0.44	0.00	2.00	5.24
OUTFLOW: ID= 2(0006) 0.44	0.00	2.00	5.24

```

| Junction Command(0005) |
-----
```

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0004) 0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0005) 0.00	0.00	0.00	0.00

FINISH

5-YEAR STORM - POST-DEVELOPMENT

```

V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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 O O

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

```

***** DETAILLED OUTPUT *****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\dd7acb19-1808-46bc-9e85-a8e5114f5e4f\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\dd7acb19-1808-46bc-9e85-a8e5114f5e4f\scena

```

DATE: 11/14/2025 TIME: 11:56:45

USER:

COMMENTS: _____

** SIMULATION : 02_5-Year Norfolk **

```

| CHICAGO STORM | IDF curve parameters: A= 583.017
| Pttotal= 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 ( 0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10
-----
```

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	29.33	'	2.333	7.56	3.33	4.32
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)= 0.073

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 10.483
TOTAL RAINFALL (mm)= 49.033
RUNOFF COEFFICIENT = 0.214

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

| CALIB | STANDHYD ( 0001) | Area (ha)= 0.25
| ID= 1 DT= 5.0 min | Total Imp(%)= 74.00 Dir. Conn.(%)= 59.00
-----
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.19	0.06
Dep. Storage	(mm)=	1.00	9.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	40.82	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	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	29.33	'	2.333	7.56	3.33	4.32
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	42.83
over (min)	5.00	15.00
Storage Coeff. (min)=	1.52 (ii)	11.42 (ii)
Unit Hyd. Tpeak (min)=	5.00	15.00
Unit Hyd. peak (cms)=	0.33	0.09

TOTALS

PEAK FLOW (cms)=	0.04	0.00	0.041 (iii)
TIME TO PEAK (hrs)=	1.33	1.50	1.33
RUNOFF VOLUME (mm)=	48.03	16.71	35.16
TOTAL RAINFALL (mm)=	49.03	49.03	49.03
RUNOFF COEFFICIENT =	0.98	0.34	0.72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 70.0 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 ( 0003) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
|-----| (ha) (cms) (hrs) (mm)
| ID1= 1 ( 0001): 0.25 0.041 1.33 35.16
| + ID2= 2 ( 0002): 0.19 0.006 1.33 10.48
|-----|
| ID = 3 ( 0003): 0.44 0.048 1.33 24.50
-----
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| CHAMBER( 0004) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
| IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 120.46 Bottom Area(m2) = 180.97
-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	584.00	65.75
25.00	1.84	610.00	69.02
51.00	3.68	635.00	72.25
76.00	5.51	660.00	75.44
102.00	7.35	686.00	78.58
127.00	9.19	711.00	81.66
152.00	11.03	737.00	84.68
178.00	12.87	762.00	87.64
203.00	14.71	787.00	90.51
229.00	16.54	813.00	93.32
254.00	20.21	838.00	96.04
279.00	23.86	864.00	98.66
305.00	27.49	889.00	101.16
330.00	31.10	914.00	103.50
356.00	34.69	940.00	105.57
381.00	38.26	965.00	107.54
406.00	41.80	991.00	109.43
432.00	45.31	1016.00	111.27
457.00	48.80	1041.00	113.11
483.00	52.26	1067.00	114.94
508.00	55.68	1092.00	116.78
533.00	59.07	1118.00	118.62
559.00	62.43	1143.00	120.46

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.470	0.011
0.060	0.004	0.570	0.012
0.160	0.006	0.670	0.013
0.260	0.008	0.770	0.014
0.360	0.010	0.800	0.014

NATIVE SOIL LAYER:
Infiltration (mm/hr) = 0.0250

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.44	0.048	1.33	24.50
OUTFLOW:ID= 1	0.44	0.006	2.00	13.46
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00
Volume Reduction Rate[(RVin-RVout)/RVin] (%)=			45.07	
Time to reach Max storage (Hr)=			2.00	
Volume of water for drawdown in LID (cu.m.)=			29.84	
Volume of maximum water storage (cu.m.)=			51.04	
Calculated Drawdown Time (Hr)=			6.42	

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0004)	0.44	0.01	2.00	13.46
OUTFLOW: ID= 2(0006)	0.44	0.01	2.00	13.46

Junction Command(0005)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0004)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0005)	0.00	0.00	0.00	0.00

10-YEAR STORM - POST-DEVELOPMENT

```

V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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 B OOO

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

```

***** D E T A I L E D O U T P U T *****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\c3d8958b-c16b-402a-8ffe-6d6b1b72e734\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\c3d8958b-c16b-402a-8ffe-6d6b1b72e734\scena

```

DATE: 11/14/2025 TIME: 11:56:45

USER:

COMMENTS: _____

** SIMULATION : 03_10-Year Norfolk **

```

| CHICAGO STORM | IDF curve parameters: A= 670.324
| Pttotal= 57.94 mm | 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 RAIN | TIME RAIN |' TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr |' hrs mm/hr | hrs 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 | NASHYD ( 0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10
-----
```

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	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

Unit Hyd Qpeak (cms)= 0.073

PEAK FLOW (cms)= 0.009 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 14.785
TOTAL RAINFALL (mm)= 57.945
RUNOFF COEFFICIENT = 0.255

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

| CALIB | STANDHYD ( 0001) | Area (ha)= 0.25
| ID= 1 DT= 5.0 min | Total Imp(%)= 74.00 Dir. Conn.(%)= 59.00
-----
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.19	0.06
Dep. Storage	(mm)=	1.00	9.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	40.82	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	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	59.27
over (min)	5.00	10.00
Storage Coeff. (min)=	1.43 (ii)	6.29 (ii)
Unit Hyd. Tpeak (min)=	5.00	10.00
Unit Hyd. peak (cms)=	0.33	0.15

TOTALS

PEAK FLOW (cms)=	0.05	0.01	0.052 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.33
RUNOFF VOLUME (mm)=	56.94	22.50	42.81
TOTAL RAINFALL (mm)=	57.94	57.94	57.94
RUNOFF COEFFICIENT =	0.98	0.39	0.74

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 70.0 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 ( 0003) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm)
-----
```

ID1= 1 (0001):	0.25	0.052	1.33	42.81
+ ID2= 2 (0002):	0.19	0.009	1.33	14.79
ID = 3 (0003):	0.44	0.062	1.33	30.71

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| CHAMBER( 0004) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
| IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 120.46 Bottom Area(m2) = 180.97
-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	584.00	65.75
25.00	1.84	610.00	69.02
51.00	3.68	635.00	72.25
76.00	5.51	660.00	75.44
102.00	7.35	686.00	78.58
127.00	9.19	711.00	81.66
152.00	11.03	737.00	84.68
178.00	12.87	762.00	87.64
203.00	14.71	787.00	90.51
229.00	16.54	813.00	93.32
254.00	20.21	838.00	96.04
279.00	23.86	864.00	98.66
305.00	27.49	889.00	101.16
330.00	31.10	914.00	103.50
356.00	34.69	940.00	105.57
381.00	38.26	965.00	107.54
406.00	41.80	991.00	109.43
432.00	45.31	1016.00	111.27
457.00	48.80	1041.00	113.11
483.00	52.26	1067.00	114.94
508.00	55.68	1092.00	116.78
533.00	59.07	1118.00	118.62
559.00	62.43	1143.00	120.46

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.470	0.011
0.060	0.004	0.570	0.012
0.160	0.006	0.670	0.013
0.260	0.008	0.770	0.014
0.360	0.010	0.800	0.014

NATIVE SOIL LAYER:
Infiltration (mm/hr) = 0.0250

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.44	0.062	1.33	30.71
OUTFLOW:ID= 1	0.44	0.009	2.00	19.19
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00
Volume Reduction Rate[(RVin-RVout)/RVin] (%)=				37.50
Time to reach Max storage (Hr)=				2.00
Volume of water for drawdown in LID (cu.m.)=				36.47
Volume of maximum water storage (cu.m.)=				64.77
Calculated Drawdown Time (Hr)=				6.92

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0004)	0.44	0.01	2.00	19.19
OUTFLOW: ID= 2(0006)	0.44	0.01	2.00	19.19

Junction Command(0005)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0004)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0005)	0.00	0.00	0.00	0.00

25-YEAR STORM - POST-DEVELOPMENT

```

V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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 O O

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

```

***** D E T A I L E D O U T P U T *****

```

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\3aeadf489-c2e5-4c75-9d78-2fd1133ca470\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-
940a-950dd0cf81b5\3aeadf489-c2e5-4c75-9d78-2fd1133ca470\scena

```

DATE: 11/14/2025 TIME: 11:56:45

USER:

COMMENTS: _____

** SIMULATION : 04_25-Year Norfolk **

```

| CHICAGO STORM | IDF curve parameters: A= 721.533
| Pttotal= 69.38 mm | 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 RAIN | TIME RAIN |' TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr |' hrs mm/hr | hrs 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 | NASHYD ( 0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| U.H. Tp(hrs)= 0.10
-----
```

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 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

```

Unit Hyd Qpeak (cms)= 0.073

```

PEAK FLOW (cms)= 0.014 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 20.980
TOTAL RAINFALL (mm)= 69.379
RUNOFF COEFFICIENT = 0.302

```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```

| CALIB | STANDHYD ( 0001) | Area (ha)= 0.25
| ID= 1 DT= 5.0 min | Total Imp(%)= 74.00 Dir. Conn.(%)= 59.00
-----
```

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.19	0.06
Dep. Storage (mm)=	1.00	9.00
Average Slope (%)=	1.00	2.00
Length (m)=	40.82	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 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	82.08
over (min)	5.00	10.00
Storage Coeff. (min)=	1.34 (ii)	5.89 (ii)
Unit Hyd. Tpeak (min)=	5.00	10.00
Unit Hyd. peak (cms)=	0.33	0.15

TOTALS

PEAK FLOW (cms)=	0.05	0.01	0.064 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.33
RUNOFF VOLUME (mm)=	68.38	30.55	52.85
TOTAL RAINFALL (mm)=	69.38	69.38	69.38
RUNOFF COEFFICIENT =	0.99	0.44	0.76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 70.0 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 ( 0003) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
-----
```

(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0001):	0.25	0.064	1.33 52.85
+ ID2= 2 (0002):	0.19	0.014	1.33 20.98
ID = 3 (0003):	0.44	0.078	1.33 39.09

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| CHAMBER( 0004) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
| IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 120.46 Bottom Area(m2) = 180.97
-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	584.00	65.75
25.00	1.84	610.00	69.02
51.00	3.68	635.00	72.25
76.00	5.51	660.00	75.44
102.00	7.35	686.00	78.58
127.00	9.19	711.00	81.66
152.00	11.03	737.00	84.68
178.00	12.87	762.00	87.64
203.00	14.71	787.00	90.51
229.00	16.54	813.00	93.32
254.00	20.21	838.00	96.04
279.00	23.86	864.00	98.66
305.00	27.49	889.00	101.16
330.00	31.10	914.00	103.50
356.00	34.69	940.00	105.57
381.00	38.26	965.00	107.54
406.00	41.80	991.00	109.43
432.00	45.31	1016.00	111.27
457.00	48.80	1041.00	113.11
483.00	52.26	1067.00	114.94
508.00	55.68	1092.00	116.78
533.00	59.07	1118.00	118.62
559.00	62.43	1143.00	120.46

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.470	0.011
0.060	0.004	0.570	0.012
0.160	0.006	0.670	0.013
0.260	0.008	0.770	0.014
0.360	0.010	0.800	0.014

NATIVE SOIL LAYER:
Infiltration (mm/hr) = 0.0250

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.44	0.078	1.33	39.09
OUTFLOW:ID= 1	0.44	0.011	2.00	27.06
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00
Volume Reduction Rate[(RVin-RVout)/RVin] (%)=			30.77	
Time to reach Max storage (Hr)=			2.00	
Volume of water for drawdown in LID (cu.m.)=			47.10	
Volume of maximum water storage (cu.m.)=			82.05	
Calculated Drawdown Time (Hr)=			7.42	

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0004)	0.44	0.01	2.00	27.06
OUTFLOW: ID= 2(0006)	0.44	0.01	2.00	27.06

Junction Command(0005)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0004)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0005)	0.00	0.00	0.00	0.00

50-YEAR STORM - POST-DEVELOPMENT

```

V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLL
OOO 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

```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\f17e7c99-9849-48f9-a33d-2ce99b508cb6\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\f17e7c99-9849-48f9-a33d-2ce99b508cb6\scena

DATE: 11/14/2025 TIME: 11:56:45

USER:

COMMENTS: _____

** SIMULATION : 05_50-Year Norfolk **

| 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	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	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 |
| NASHYD (0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
----- U.H. Tp(hrs)= 0.10

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	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	7.55
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	6.55
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

Unit Hyd Qpeak (cms)= 0.073

PEAK FLOW (cms)= 0.018 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 26.267
TOTAL RAINFALL (mm)= 78.320
RUNOFF COEFFICIENT = 0.335

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB		STANDHYD (0001)	Area (ha)= 0.25	Total Imp(%)= 74.00	Dir. Conn.(%)= 59.00
ID= 1	DT= 5.0 min				
IMPERVIOUS PERVIOUS (i)					
Surface Area (ha)=	0.19	0.06			
Dep. Storage (mm)=	1.00	9.00			
Average Slope (%)=	1.00	2.00			
Length (m)=	40.82	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	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	7.55
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	6.55
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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	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	7.55
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	6.55
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	100.78
over (min)	5.00	10.00
Storage Coeff. (min)	1.28 (ii)	5.65 (ii)
Unit Hyd. Tpeak (min)	5.00	10.00
Unit Hyd. peak (cms)	0.33	0.15
TOTALS		
PEAK FLOW (cms)	0.06	0.01
TIME TO PEAK (hrs)	1.33	1.42
RUNOFF VOLUME (mm)	77.32	37.22
TOTAL RAINFALL (mm)	78.32	78.32
RUNOFF COEFFICIENT	0.99	0.48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PEROVIOUS LOSSES:
CN* = 70.0 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 (0003) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.

| (ha) (cms) (hrs) (mm) |
| ID1= 1 (0001): 0.25 0.072 1.33 60.86 |
+ ID2= 2 (0002): 0.19 0.018 1.33 26.27
ID = 3 (0003): 0.44 0.090 1.33 45.92

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| CHAMBER(0004) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
| IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 120.46 Bottom Area(m2) = 180.97

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	584.00	65.75
25.00	1.84	610.00	69.02
51.00	3.68	635.00	72.25
76.00	5.51	660.00	75.44
102.00	7.35	686.00	78.58
127.00	9.19	711.00	81.66
152.00	11.03	737.00	84.68
178.00	12.87	762.00	87.64
203.00	14.71	787.00	90.51
229.00	16.54	813.00	93.32
254.00	20.21	838.00	96.04
279.00	23.86	864.00	98.66
305.00	27.49	889.00	101.16
330.00	31.10	914.00	103.50
356.00	34.69	940.00	105.57
381.00	38.26	965.00	107.54
406.00	41.80	991.00	109.43
432.00	45.31	1016.00	111.27
457.00	48.80	1041.00	113.11
483.00	52.26	1067.00	114.94
508.00	55.68	1092.00	116.78
533.00	59.07	1118.00	118.62
559.00	62.43	1143.00	120.46

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.470	0.011
0.060	0.004	0.570	0.012
0.160	0.006	0.670	0.013
0.260	0.008	0.770	0.014
0.360	0.010	0.800	0.014

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.44	0.090	1.33	45.92
OUTFLOW:ID= 1	0.44	0.012	2.08	33.43
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)=	27.20
Time to reach Max storage (Hr)=	2.08
Volume of water for drawdown in LID (cu.m.)=	55.54
Volume of maximum water storage (cu.m.)=	97.60
Calculated Drawdown Time (Hr)=	7.67

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0004)	0.44	0.01	2.08	33.43
OUTFLOW: ID= 2(0006)	0.44	0.01	2.08	33.43

Junction Command(0005)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0004)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0005)	0.00	0.00	0.00	0.00

100-YEAR STORM - POST-DEVELOPMENT

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
=====
V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL
```

```
000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000
```

Developed and Distributed by Smart City Water Inc

Copyright 2007 - 2022 Smart City Water Inc

All rights reserved.

***** DETAILLED OUTPUT *****

```
Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\887a87de-cb93-4677-9e4f-379ac70a9cc3\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\887a87de-cb93-4677-9e4f-379ac70a9cc3\scena
```

DATE: 11/14/2025 TIME: 11:56:45

USER:

COMMENTS: _____

```
*****
** SIMULATION : 06_100-Year Norfolk **
*****
```

```
-----| CHICAGO STORM | IDF curve parameters: A= 801.041
| Pttotal= 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 ( 0002) | Area (ha)= 0.19 Curve Number (CN)= 70.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
-----| U.H. Tp(hr)= 0.10-----
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

```
-----| CALIB | NASHYD ( 0001) | Area (ha)= 0.25
| ID= 1 DT= 5.0 min | Total Imp(%)= 74.00 Dir. Conn.()%= 59.00
-----| IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 0.19 0.06
Dep. Storage (mm)= 1.00 9.00
Average Slope (%)= 1.00 2.00
Length (m)= 40.82 40.00
Mannings n = 0.013 0.250-----
```

Unit Hyd Qpeak (cms)= 0.073

PEAK FLOW (cms)= 0.022 (i)
TIME TO PEAK (hrs)= 1.333
RUNOFF VOLUME (mm)= 31.770
TOTAL RAINFALL (mm)= 87.089
RUNOFF COEFFICIENT = 0.365

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
-----| CALIB | STANDHYD ( 0001) | Area (ha)= 0.25
| ID= 1 DT= 5.0 min | Total Imp(%)= 74.00 Dir. Conn.()%= 59.00-----
```

IMPERVIOUS PERVIOUS (i)
Surface Area (ha)= 0.19 0.06
Dep. Storage (mm)= 1.00 9.00
Average Slope (%)= 1.00 2.00
Length (m)= 40.82 40.00
Mannings n = 0.013 0.250-----

```
----- 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-----
```

```
Max.Eff.Inten.(mm/hr)= 160.97 119.87
over (min) 5.00 10.00
Storage Coeff. (min)= 1.23 (ii) 5.44 (ii)
Unit Hyd. Tpeak (min)= 5.00 10.00
Unit Hyd. peak (cms)= 0.33 0.16
*TOTALS*
PEAK FLOW (cms)= 0.07 0.02 0.081 (iii)
TIME TO PEAK (hrs)= 1.33 1.42 1.33
RUNOFF VOLUME (mm)= 86.09 44.03 68.83
TOTAL RAINFALL (mm)= 87.09 87.09 87.09
RUNOFF COEFFICIENT = 0.99 0.51 0.79-----
```

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PREVIOUS LOSSES:
CN* = 70.0 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 ( 0003) | AREA QPEAK TPEAK R.V.
| 1 + 2 = 3 | (ha) (cms) (hrs) (mm)
-----| ID1= 1 ( 0001): 0.25 0.081 1.33 68.83
+ ID2= 2 ( 0002): 0.19 0.022 1.33 31.77
-----| ID = 3 ( 0003): 0.44 0.103 1.33 52.83-----
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-----| CHAMBER( 0004) | OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
| IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 120.46 Bottom Area(m2) = 180.97-----
```

DEPTH (mm)	STORAGE (cu.m.)	DEPTH (mm)	STORAGE (cu.m.)
0.00	0.00	584.00	65.75
25.00	1.84	610.00	69.02
51.00	3.68	635.00	72.25
76.00	5.51	660.00	75.44
102.00	7.35	686.00	78.58
127.00	9.19	711.00	81.66
152.00	11.03	737.00	84.68
178.00	12.87	762.00	87.64
203.00	14.71	787.00	90.51
229.00	16.54	813.00	93.32
254.00	20.21	838.00	96.04
279.00	23.86	864.00	98.66
305.00	27.49	889.00	101.16
330.00	31.10	914.00	103.50
356.00	34.69	940.00	105.57
381.00	38.26	965.00	107.54
406.00	41.80	991.00	109.43
432.00	45.31	1016.00	111.27
457.00	48.80	1041.00	113.11
483.00	52.26	1067.00	114.94
508.00	55.68	1092.00	116.78
533.00	59.07	1118.00	118.62
559.00	62.43	1143.00	120.46

DEPTH (m)

DISCHARGE (cms)

DEPTH (m)

DISCHARGE (cms)

AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.44	0.103	1.33 52.83
OUTFLOW:ID= 1	0.44	0.014	1.92 39.97
OVERFLOW:ID= 3	0.00	0.000	0.00 0.00

NATIVE SOIL LAYER:

Infiltration (m/hr) = 0.0250

DEPTH (m)	DISCHARGE (cms)	DEPTH (m)	DISCHARGE (cms)
0.000	0.000	0.470	0.011
0.060	0.004	0.570	0.012
0.160	0.006	0.670	0.013
0.260	0.008	0.770	0.014
0.360	0.010	0.800	0.014

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 24.34

Time to reach Max storage (Hr)= 2.08

Volume of water for drawdown in LID (cu.m.)= 66.82

Volume of maximum water storage (cu.m.)= 112.68

Calculated Drawdown Time (Hr)= 8.08

| Junction Command(0006) |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0004)	0.44	0.01	1.92	39.97
OUTFLOW: ID= 2(0006)	0.44	0.01	1.92	39.97

| Junction Command(0005) |

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0004)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0005)	0.00	0.00	0.00	0.00

25mm, 4 HOUR STORM - POST-DEVELOPMENT

```

V V I SSSSS U U A L (v 6.2.2019)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A A L
VV I SSSSS UUUUU A A LLLL

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

```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2022 Smart City Water Inc
All rights reserved.

***** DETAILLED OUTPUT *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2.2019\VO2\voin.dat
Output filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\47c65dd0-2835-4dd3-8358-c0e117aae44\scena
Summary filename: C:\Users\Sarahf\AppData\Local\Civica\VHS\76c0f17f-7ece-4502-940a-950dd0cf81b5\47c65dd0-2835-4dd3-8358-c0e117aae44\scena

DATE: 11/14/2025 TIME: 11:56:45

USER:

COMMENTS: _____

** SIMULATION : 25 mm, 4 hr Norfolk **

| READ STORM | Filename: C:\Users\Sarahf\AppData\Local\Temp\2a913778-3119-4a77-b141-287faa99eff9\7baaeef9f
| Ptotal= 25.00 mm | Comments: 25 mm, 4 hr Norfolk

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	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 | Area (ha)= 0.19 Curve Number (CN)= 70.0
| NASHYD (0002) | Ia (mm)= 9.00 # of Linear Res.(N)= 3.00
| ID= 1 DT= 5.0 min | U.H. Tp(hr)= 0.10

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	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	1.85
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	1.917	8.96	2.917	2.61	4.00	1.67
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		

Unit Hyd Qpeak (cms)= 0.073

PEAK FLOW (cms)= 0.001 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 1.996
TOTAL RAINFALL (mm)= 24.999
RUNOFF COEFFICIENT = 0.080

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	STANDHYD (0001)	Area (ha)= 0.25	Total Imp(%)= 74.00	Dir. Conn.(%)= 59.00
ID= 1 DT= 5.0 min				
		IMPERVIOUS	PERVIOUS (i)	
		Surface Area (ha)= 0.19	0.06	
		Dep. Storage (mm)= 1.00	9.00	
		Average Slope (%)= 1.00	2.00	
		Length (m)= 40.82	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	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	1.85
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	1.917	8.96	2.917	2.61	4.00	1.67
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		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	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	1.85
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	1.917	8.96	2.917	2.61	4.00	1.67
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		

Max.Eff.Inten.(mm/hr)= 51.29
over (min)= 5.00
Storage Coeff. (min)= 1.95 (ii)
Unit Hyd. Tpeak (min)= 5.00
Unit Hyd. peak (cms)= 0.31

TOTALS
PEAK FLOW (cms)= 0.02
TIME TO PEAK (hrs)= 1.50
RUNOFF VOLUME (mm)= 24.00
TOTAL RAINFALL (mm)= 25.00
RUNOFF COEFFICIENT = 0.96

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 70.0 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 (0003)| AREA QPEAK TPEAK R.V.
| 1 + 2 = 3 | (ha) (cms) (hrs) (mm)
| ID1= 1 (0001): 0.25 0.021 1.50 15.83
+ ID2= 2 (0002): 0.19 0.001 1.67 2.00
| ID = 3 (0003): 0.44 0.022 1.50 9.86

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| CHAMBER(0004)| OUTFLOW: ON, UNDERDRAIN: OFF, INFIL: ON
| IN= 2--> OUT= 3 | CHAMBER:
| DT= 5.0 min | MAX STO VOL (cu.m.)= 120.46 Bottom Area(m2) = 180.97

DEPTH	STORAGE	DEPTH	STORAGE
(mm)	(cu.m.)	(mm)	(cu.m.)
0.00	0.00	584.00	65.75
25.00	1.84	610.00	69.02
51.00	3.68	635.00	72.25
76.00	5.51	660.00	75.44
102.00	7.35	686.00	78.58
127.00	9.19	711.00	81.66
152.00	11.03	737.00	84.68
178.00	12.87	762.00	87.64
203.00	14.71	787.00	90.51
229.00	16.54	813.00	93.32
254.00	20.21	838.00	96.04
279.00	23.86	864.00	98.66
305.00	27.49	889.00	101.16
330.00	31.10	914.00	103.50
356.00	34.69	940.00	105.57
381.00	38.26	965.00	107.54
406.00	41.80	991.00	109.43
432.00	45.31	1016.00	111.27
457.00	48.80	1041.00	113.11
483.00	52.26	1067.00	114.94
508.00	55.68	1092.00	116.78
533.00	59.07	1118.00	118.62
559.00	62.43	1143.00	120.46

DEPTH	DISCHARGE	DEPTH	DISCHARGE
(m)	(cms)	(m)	(cms)
0.000	0.000	0.470	0.011
0.060	0.004	0.570	0.012
0.160	0.006	0.670	0.013
0.260	0.008	0.770	0.014
0.360	0.010	0.800	0.014

NATIVE SOIL LAYER:
Infiltration (m/hr) = 0.0250

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW:ID= 2	0.44	0.022	1.50	9.86
OUTFLOW:ID= 1	0.00	0.000	0.00	0.00
OVERFLOW:ID= 3	0.00	0.000	0.00	0.00

Volume Reduction Rate[(RVin-RVout)/RVin](%)= 100.00
Time to reach Max storage (Hr)= 3.67
Volume of water for drawdown in LID (cu.m.)= 25.18
Volume of maximum water storage (cu.m.)= 27.28
Calculated Drawdown Time (Hr)= 5.50

Junction Command(0006)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 1(0004)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0006)	0.00	0.00	0.00	0.00

Junction Command(0005)

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 3(0004)	0.00	0.00	0.00	0.00
OUTFLOW: ID= 2(0005)	0.00	0.00	0.00	0.00

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	



RAILWAY DEVELOPMENT - EAST SITE - SITE A

DELHI, ON, CANADA

MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
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-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 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.

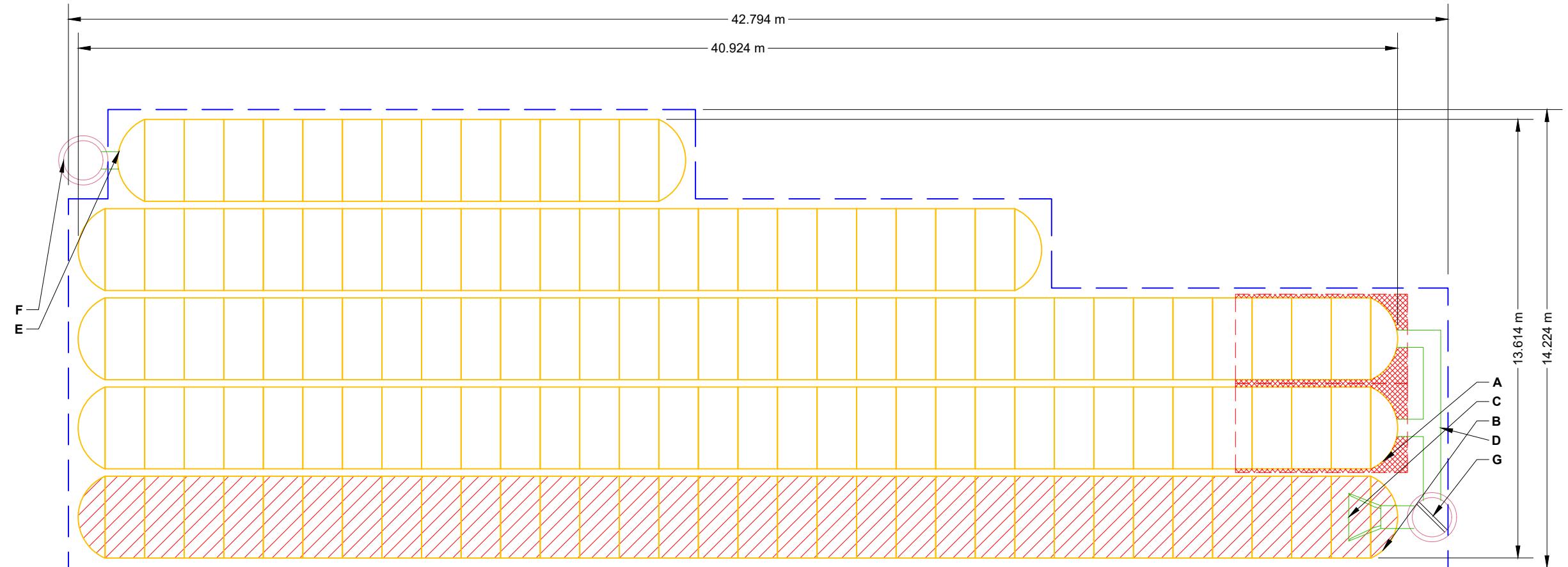
NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 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-3500/MC-4500 CONSTRUCTION GUIDE".
 - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 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.

PROPOSED LAYOUT		PROPOSED ELEVATIONS		PART TYPE	ITEM ON LAYOUT	DESCRIPTION	*INVERT ABOVE BASE OF CHAMBER		
		MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	230.961				INVERT*	MAX FLOW	
132	STORMTECH MC-4500 CHAMBERS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	229.589						
10	STORMTECH MC-4500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	229.437	PREFABRICATED END CAP	A	450 mm BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP18B / TYP OF ALL 450 mm BOTTOM CONNECTIONS	50 mm		
305	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	229.437	PREFABRICATED END CAP	B	600 mm BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	57 mm		
230	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	229.437						
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	229.437						
662.5	INSTALLED SYSTEM VOLUME (m ³) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	229.132	FLAMP	C	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MCFLAMP			
		TOP OF MC-4500 CHAMBER:	228.827	MANIFOLD	D	450 mm x 450 mm BOTTOM MANIFOLD, ADS N-12	50 mm		
		600 mm ISOLATOR ROW PLUS INVERT:	227.360	PIPE CONNECTION	E	450 mm BOTTOM CONNECTION	50 mm		
		450 mm x 450 mm BOTTOM MANIFOLD INVERT:	227.353	CONCRETE STRUCTURE	F	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		113 L/s OUT	
		450 mm BOTTOM CONNECTION INVERT:	227.353	CONCRETE STRUCTURE	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		311 L/s IN	
506.6	SYSTEM AREA (m ²)	BOTTOM OF MC-4500 CHAMBER:	227.303						
114.0	SYSTEM PERIMETER (m)	BOTTOM OF STONE:	227.073	W/WEIR					



**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

NOTE

- 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.

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

SCALE = 1 : 150

ADS

SCAL

5

SHEET

2 OF

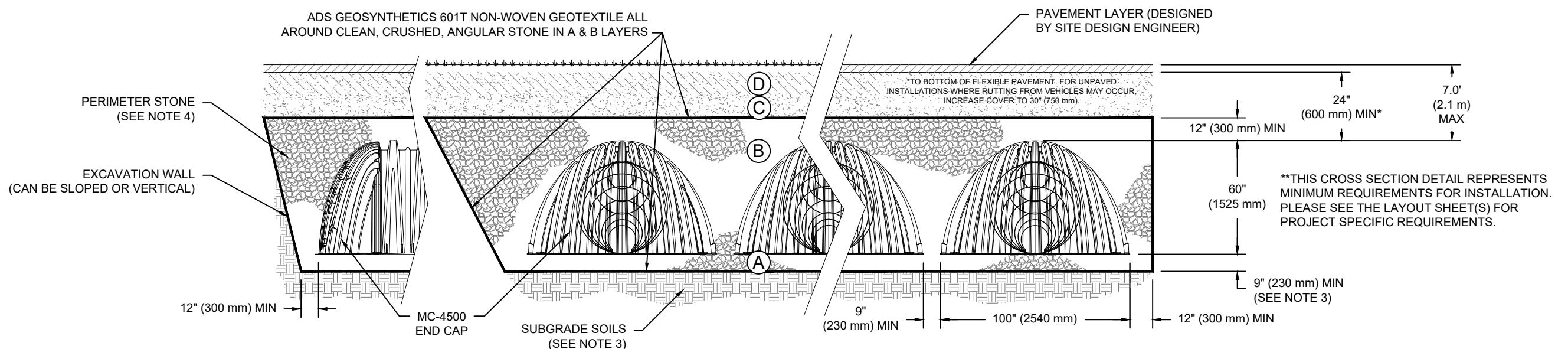
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO THE PROJECT ENGINEER OF RECORD ("PEO") OR OTHER PROJECT REPRESENTATIVE. THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION WITHOUT THE EOR'S PRIOR APPROVAL. FOR SHALL REVIEW THIS DRAWING PRIOR TO BIDDING AND/OR CONSTRUCTION. 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.

ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 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 COMPACTION 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:

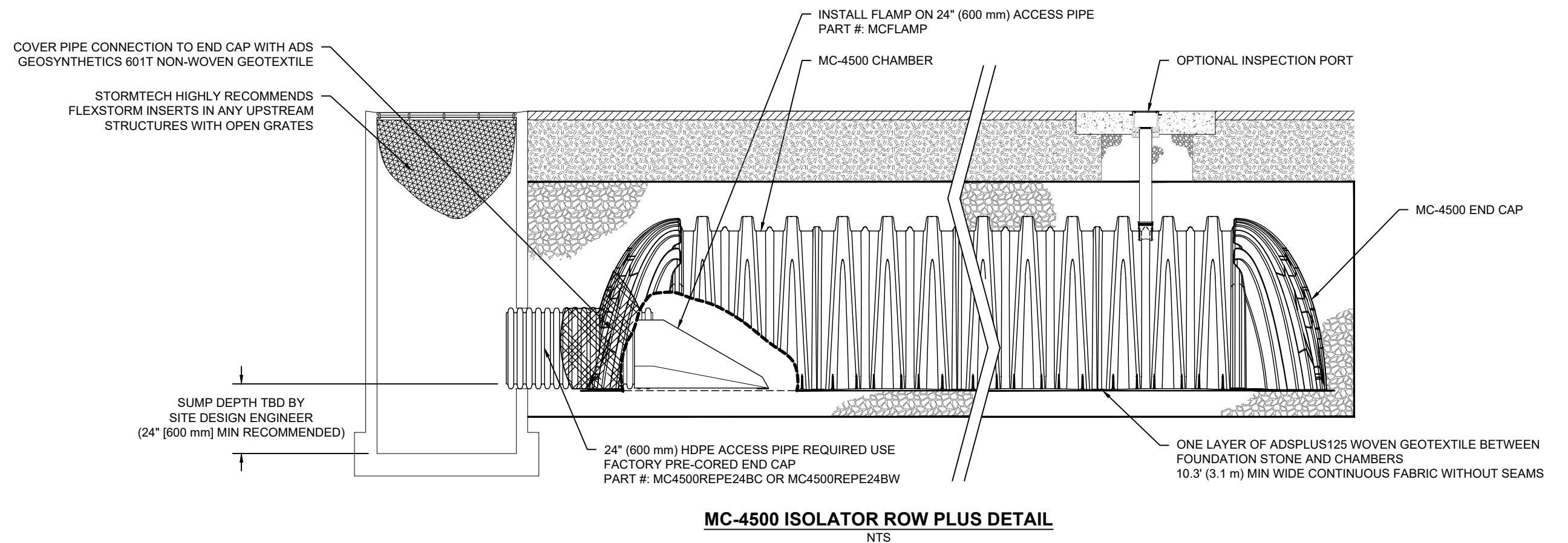
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERS 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-4500 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.

RAILWAY DEVELOPMENT - EAST	
SITE - SITE A	
DEHLI, ON, CANADA	DRAWN: SF
DATE: 08/21/2025	CHECKED: N/A
PROJECT #:	DRAWN BY:
DATE:	CHK:
THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE PROJECT ENGINEER OF RECORD TO COPY OR OTHER PROJECT REPRESENTATIVE TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.	
 ADS Geosynthetics	
StormTech Chamber System	
4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473	SHEET 3 OF 5



MC-4500 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.

RAILWAY DEVELOPMENT - EAST		
SITE - SITE A		
DEHLI, ON, CANADA		
DATE: 08/21/2025	DRAWN: SF	CHECKED: N/A
PROJECT #:	CHEMTECH #:	
DATE	DWN	CHK
THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE ENGR TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.		

ADS

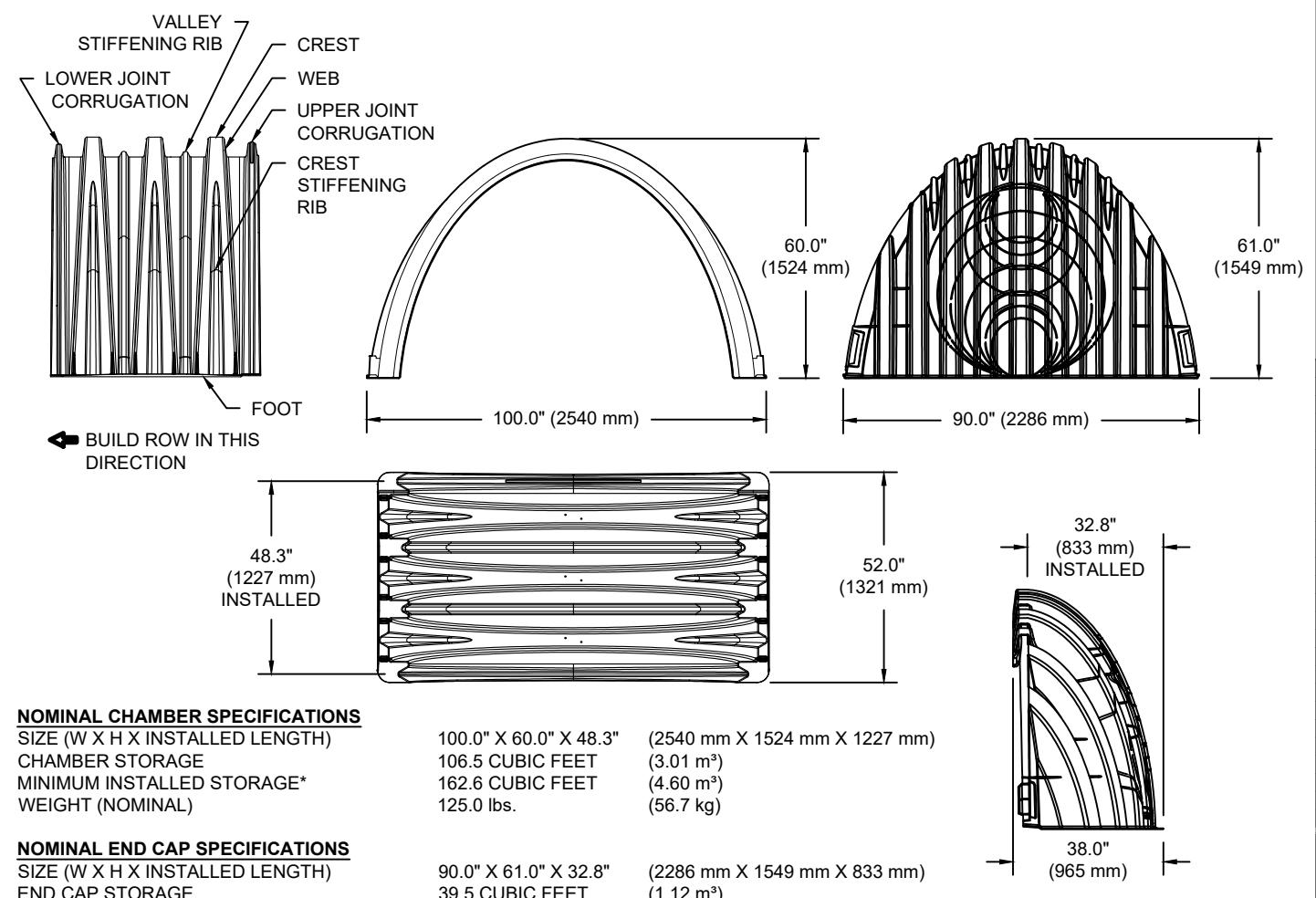
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

StormTech®

Chamber System

MC-4500 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3" (2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET (3.01 m ³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET (4.60 m ³)
WEIGHT (NOMINAL)	125.0 lbs. (56.7 kg)

NOMINAL END CAP SPECIFICATIONS

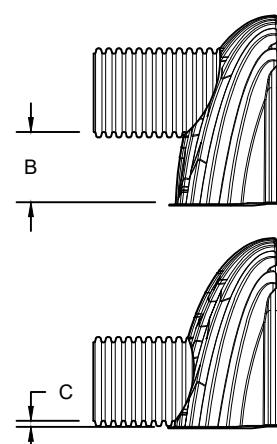
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8" (2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET (1.12 m ³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET (3.26 m ³)
WEIGHT (NOMINAL)	90 lbs. (40.8 kg)

*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
MC4500IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC4500IEPP06B		---	0.86" (22 mm)
MC4500IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC4500IEPP08B		---	1.01" (26 mm)
MC4500IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC4500IEPP10B		---	1.33" (34 mm)
MC4500IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC4500IEPP12B		---	1.55" (39 mm)
MC4500IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC4500IEPP15B		---	1.70" (43 mm)
MC4500IEPP18T		29.36" (746 mm)	---
MC4500IEPP18TW	18" (450 mm)		
MC4500IEPP18B		---	1.97" (50 mm)
MC4500IEPP18BW			
MC4500IEPP24T		23.05" (585 mm)	---
MC4500IEPP24TW	24" (600 mm)		
MC4500IEPP24B		---	2.26" (57 mm)
MC4500IEPP24BW			
MC4500IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC4500IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC4500IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT 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-4500 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.



4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

StormTech®
Chamber System

SHEET

5 OF 5

RAILWAY DEVELOPMENT - EAST	SITE - SITE A
DEHLI, ON, CANADA	DRAWN: SF
DATE: 08/21/2025	CHECKED: N/A
PROJECT #:	THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION. IT IS THE PROPERTY OF THE PROJECT ENGINEER OF RECORD. COPIES OF THIS DRAWING MAY NOT BE MADE WITHOUT THE PROJECT ENGINEER'S APPROVAL. THE PROJECT ENGINEER IS RESPONSIBLE FOR THE ACCURACY AND COMPLETENESS OF THE INFORMATION CONTAINED HEREIN.

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	



ADS
SiteAssist™
FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR APP



RAILWAY DEVELOPMENT - EAST SITE - SITE C

DELHI, ON, CANADA

DC-780 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH DC-780.
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".
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 50 mm (2").
 - 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 THE DC-780 CHAMBER SYSTEM

1. STORMTECH DC-780 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH DC-780 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN 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 COMPAKTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE; AASHTO M43 #3, 357, 4, 467, 5, 56, OR 57.
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. 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 DC-780 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER DC-780 CHAMBERS IS LIMITED:
 - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
 - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
 - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 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 THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY 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.

PROPOSED LAYOUT		PROPOSED ELEVATIONS		*INVERT ABOVE BASE OF CHAMBER				
				PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
48	STORMTECH DC-780 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	239.945					
6	STORMTECH DC-780 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	236.897					
152	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	236.744	PREFABRICATED EZ END CAP	A	600 mm BOTTOM PREFABRICATED EZ END CAP, PART#: SC740ECEZ / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	3 mm	
230	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	236.744	PRE-CORED END CAP	B	300 mm TOP PRE-CORED END CAP, PART#: SC740EPE12TPC / TYP OF ALL 300 mm TOP CONNECTIONS	317 mm	
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	236.744					
120.7	INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	236.439					
		TOP OF DC-780 CHAMBER:	236.287	PRE-CORED END CAP	C	300 mm BOTTOM PRE-CORED END CAP, PART#: SC740EPE12BPC / TYP OF ALL 300 mm BOTTOM CONNECTIONS	30 mm	
		300 mm x 300 mm TOP MANIFOLD INVERT:	235.843	FLAMP	D	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: SC80024RAMP (TYP 2 PLACES)		
		300 mm x 300 mm TOP MANIFOLD INVERT:	235.843	MANIFOLD	E	300 mm x 300 mm TOP MANIFOLD, ADS N-12	318 mm	
181.0	SYSTEM AREA (m²)	300 mm BOTTOM CONNECTION INVERT:	235.556	MANIFOLD	F	300 mm x 300 mm TOP MANIFOLD, ADS N-12	318 mm	
86.0	SYSTEM PERIMETER (m)	600 mm ISOLATOR ROW PLUS INVERT:	235.528	PIPE CONNECTION	G	300 mm BOTTOM CONNECTION	30 mm	
		600 mm ISOLATOR ROW PLUS INVERT:	235.528	NYLOPLAST (INLET W/ ISO PLUS ROW)	H	750 mm DIAMETER (610 mm SUMP MIN)		130 L/s IN
		BOTTOM OF DC-780 CHAMBER:	235.525	NYLOPLAST (INLET W/ ISO PLUS ROW)	I	750 mm DIAMETER (610 mm SUMP MIN)		65 L/s IN
		BOTTOM OF STONE:	235.295	NYLOPLAST (OUTLET)	J	750 mm DIAMETER (DESIGN BY ENGINEER)		57 L/s OUT

RAILWAY DEVELOPMENT - EAST SITE - SITE C
DEHLI, ON, CANADA

DATE: 11/14/2025 DRAWN: SF
PROJECT #: CHECKED: N/A

DATE DWN CHK

11/14/2025 SF N/A

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

ADS SCALE = 1 : 150

StormTech
Chamber System

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.

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS/STORMTECH UNDER THE DIRECTION OF THE PROJECT ENGINEER OF RECORD. COPIES OF OTHER PROJECT REPRESENTATIVE DRAWINGS ARE THE PROPERTY OF THE OWNER. THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING 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.

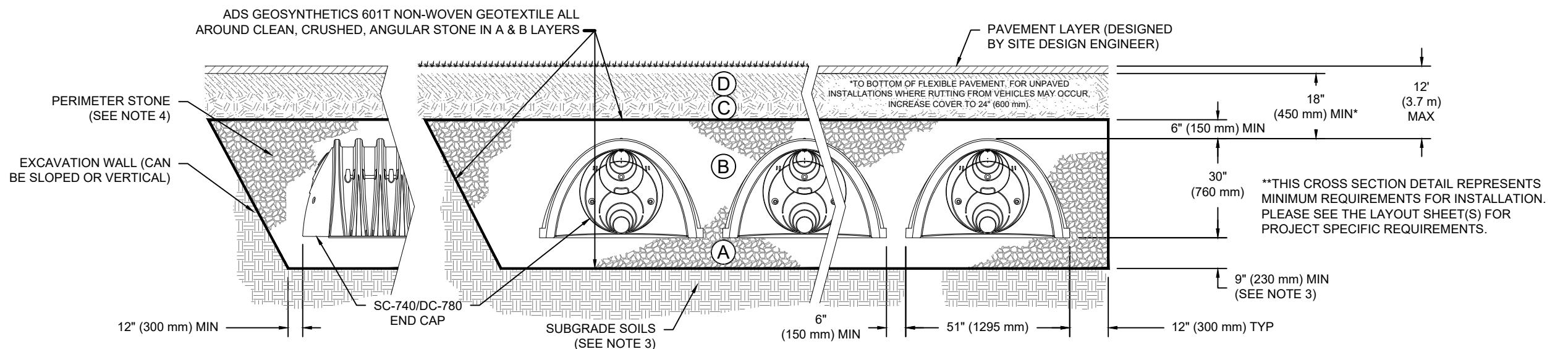
SHEET
2 OF 6

ACCEPTABLE FILL MATERIALS: STORMTECH DC-780 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 18" (450 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 COMPACTION AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
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 COVERAGE 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".
2. DC-780 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 2".
 - 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.

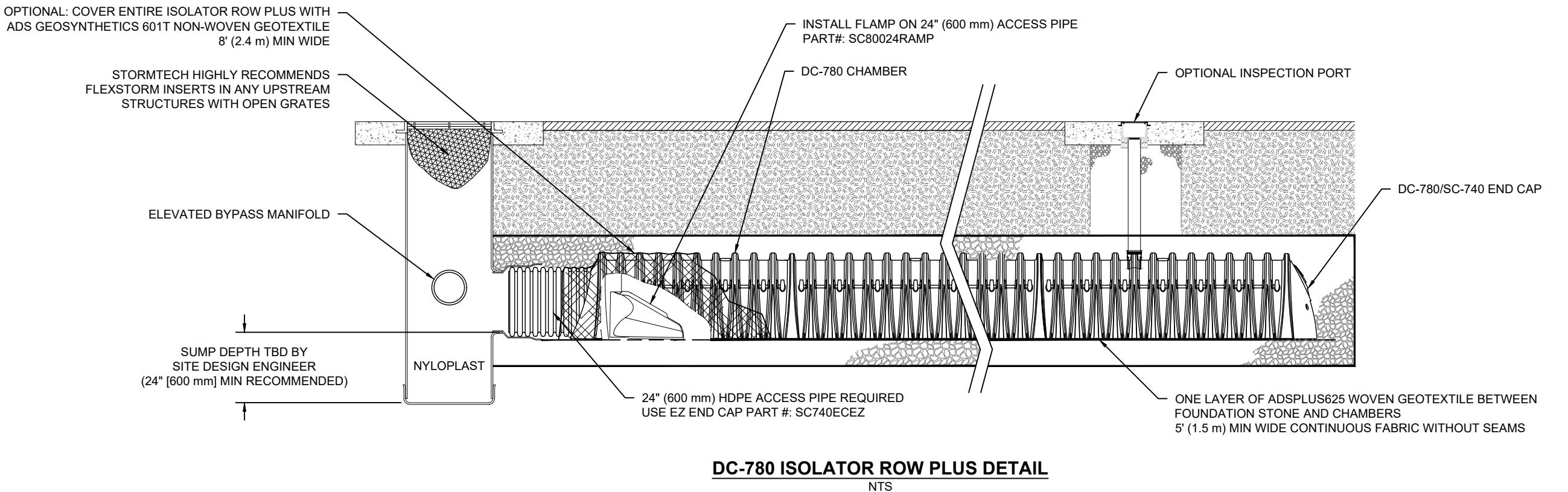
StormTech®
Chamber System

440 TRUEMAN BLVD
MILLIARD, OH 43026
3300-733-7473

ADS

SHEET

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADSTORMTECH 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, OR 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.



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.

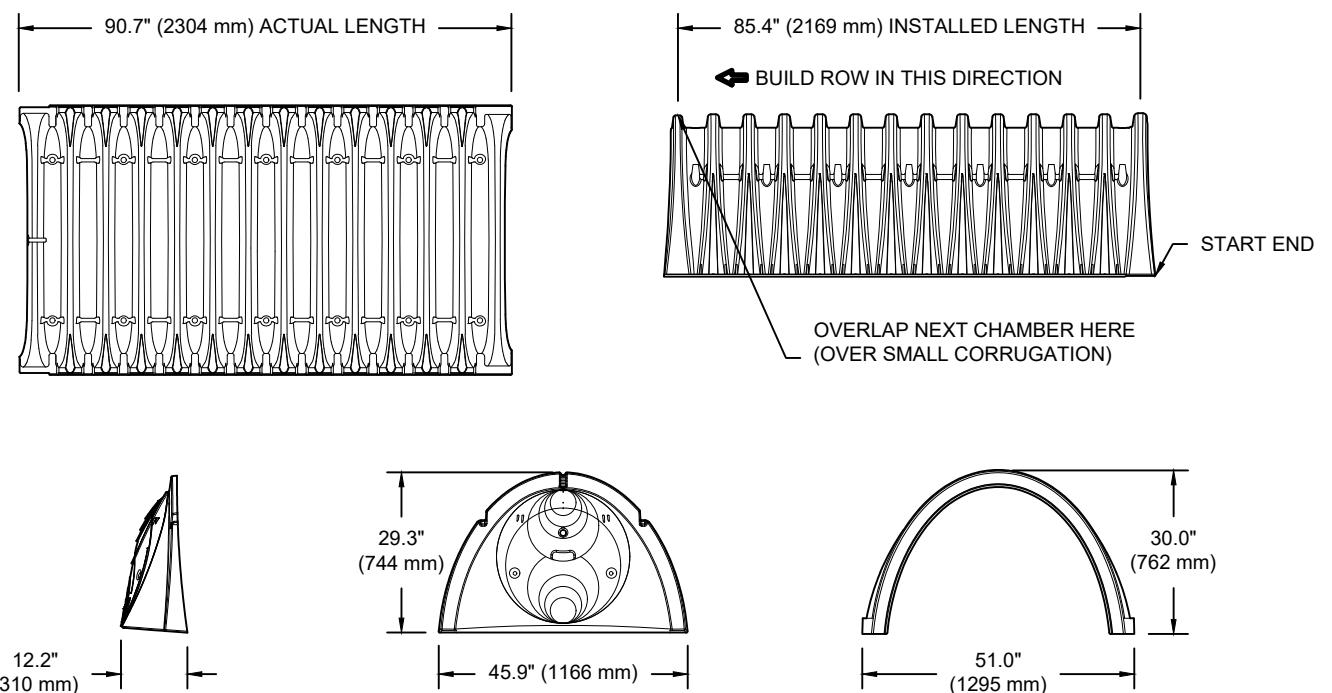
STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

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.

DC-780 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	46.2 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	78.4 CUBIC FEET	(2.20 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

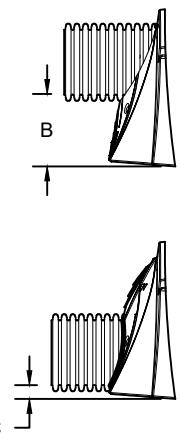
NOMINAL END CAP SPECIFICATIONS

<u>NOMINAL END CAP SPECIFICATIONS</u>		
SIZE (W X H X INSTALLED LENGTH)	45.9" X 29.3" X 9.6"	(1166 mm X 744 mm X 244 mm)
END CAP STORAGE	2.6 CUBIC FEET	(0.07 m ³)
MINIMUM INSTALLED STORAGE**	14.4 CUBIC FEET	(0.40 m ³)
WEIGHT	11.7 lbs.	(5.3 kg)

* ASSUMES 6" (152 mm) STONE ABOVE 9" (229 mm) BELOW, AND 6" (152 mm) BETWEEN CHAMBERS

**ASSUMES 6" (152 mm) STONE ABOVE, 9" (229 mm) BELOW, AND 6" (152 mm) BETWEEN CHAMBERS
**ASSUMES 6" (152 mm) STONE ABOVE, 9" (229 mm) BELOW END CAPS, 6" (152 mm) BETWEEN ROWS, 12" (305 mm) BEYOND END CAPS

PART #	STUB	B	C
SC740EPE06TPC	6" (150 mm)	18.5" (470 mm)	---
SC740EPE06BPC		---	0.5" (13 mm)
SC740EPE08TPC	8" (200 mm)	16.5" (419 mm)	---
SC740EPE08BPC		---	0.6" (15 mm)
SC740EPE10TPC	10" (250 mm)	14.5" (368 mm)	---
SC740EPE10BPC		---	0.7" (18 mm)
SC740EPE12TPC	12" (300 mm)	12.5" (318 mm)	---
SC740EPE12BPC		---	1.2" (30 mm)
SC740EPE15TPC	15" (375 mm)	9.0" (229 mm)	---
SC740EPE15BPC		---	1.3" (33 mm)
SC740EPE18TPC	18" (450 mm)	5.0" (127 mm)	---
SC740EPE18BPC		---	1.6" (41 mm)
SC740ECEZ*	24" (600 mm)	---	0.1" (3 mm)



ALL STUBS, EXCEPT FOR THE SC740ECEZ ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694

* FOR THE SC740ECEZ THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL; PRE-CORED END CAPS END WITH "PC"

RAILWAY DEVELOPMENT - EAST

SIE - SIE C
DEI HI ON CANADA

2025 DRAWN: SF
DEUT, CH, GERM

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADJUSTORMTECH 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 FOR'S PRIOR APPROVAL. FOR SHAL REVIEW THIS DRAWING PRIOR TO BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE FOR TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAIL(S) MEET ALL APPLICABLE

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

ADS

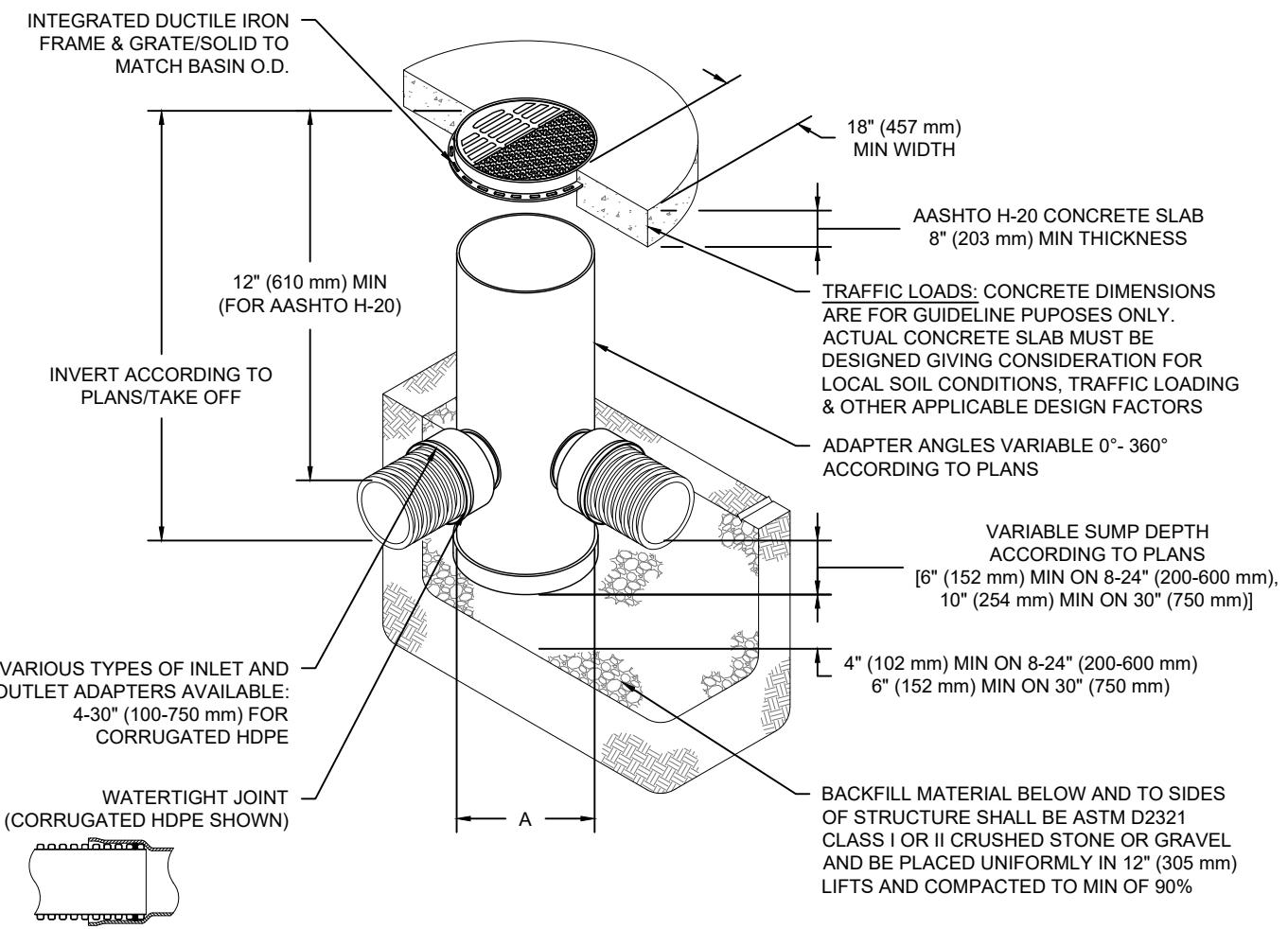
StormTec
Chamber System

SHEET

2

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

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

ADS.

SHEET

6 OF 6

RAILWAY DEVELOPMENT - EAST SITE - SITE C DEHLI, ON, CANADA		
DATE: 11/14/2025	DRAWN: SF	CHECKED: N/A
PROJECT #:	CROSS SECTION	
DATE	DW	CHK

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS/STORMTECH UNDER THE DIRECTION OF THE PROJECT ENGINEER OF RECORD. COPIES OF THIS DRAWING SHALL NOT BE MADE OR COPIED OTHER THAN BY THE PROJECT ENGINEER OF RECORD. 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.



ACC
ARCHAEOLOGICAL
CONSULTANTS CANADA

Stage 1 & 2 Archaeological Assessment

Proposed Railway Development

401 Main Street, Part of Lots 187, 188, and 189, South Side of Talbot Road East,
Town of Delhi, Geographic Township of Middleton, Norfolk County, Ontario

Original Report

Prepared for:

Ontario Ministry of Citizenship and Multiculturalism

Prepared by:

Archaeological Licensee: Kristy O'Neal, M.A., P066

Archaeological Consultants Canada

1042 Garner Road West, Unit A101
Ancaster, ON L9G 3K9

www.onarch.ca

info@onarch.ca

289.683.7844

PIF #: P066-0593-2025

Project No. 234-12-25

October 3, 2025

EXECUTIVE SUMMARY

Archaeological Consultants Canada (ACC) was contracted by the Proponent to conduct a Stage 1 & 2 archaeological assessment, including background research and property survey, for a residential development including townhouses, commercial areas, parking areas and roads. An archaeological assessment was conducted during the pre-approval process and was required under the *Planning Act, R.S.O 1990*. The assessed area, or the “subject property”, is located at municipal address 401 Main Street and is legally described as Part of Lots 187, 188 and 189, South Side of Talbot Road East, Geographic Township of Middleton, County of Norfolk, Ontario (Figure 1). The subject property measures 4.33 hectares (ha). The Proponent verified the subject property limits as defined within this report and provided a plan of survey confirming the boundaries (Figures 2 & 3).

The Stage 1 & 2 assessment was conducted under Professional Archaeological License P066, held by Kristy O’Neal. Fieldwork was conducted under the direction of Leah Peacock (Applied Research License R1273), and Melanie Chan (Applied Research License R1434). The Ontario Ministry of Citizenship and Multiculturalism (MCM) assigned Project Information Form (PIF) number P066-0593-2025 to this project. The licensee of ACC received permission from the Proponent to access the property and to conduct all required archaeological fieldwork activities including the removal of artifacts, as necessary.

Stage 1 background research indicated that the subject property has general archaeological potential due to the following factors:

- The subject property is located within the town of Delhi in 1877 historical mapping
- The subject property is located adjacent to several early historical transportation routes, including roads within the town of Delhi.
- Big Creek is located within 230 m of the subject property.
- There are 4 registered archaeological sites within one km of the subject property.
- A commemorative marker for the first train station is located within the subject property.

The subject property measures 4.33 ha. A visual property inspection determined that the entirety of subject property has been previously disturbed by modern and historic construction activities and has low to no archaeological potential. Judgmental test pits were placed to confirm disturbance throughout the property. No artifacts or other archaeological resources were identified during the Stage 2 archaeological assessment.

The following recommendation is provided for consideration by the Proponent and by the MCM:

1. No artifacts or other archaeological resources were identified during the Stage 1 & 2 archaeological assessment of the subject property. The subject property has now been



Stage 1 & 2 Archaeological Assessment
401 Main Street
Town of Delhi, County of Norfolk, ON

fully assessed according to MCM's 2011 *Standards and Guidelines for Consultant Archaeologists*. No further archaeological assessment of the subject property is required.



TABLE OF CONTENTS

EXECUTIVE SUMMARY	2
LIST OF ABBREVIATIONS	6
PROJECT PERSONNEL	7
1.0 PROJECT CONTEXT	8
1.1 Development Context	8
1.2 Historical Context	9
1.2.1 Background Research	9
1.2.2 A Cultural Chronology for Southern Ontario	9
1.3 Archaeological Context	13
1.3.1 Natural Environment	13
1.3.2 Current Land Use	13
1.3.3 Previous Archaeological Investigations	13
1.3.4 Historical Plaques and Monuments	15
1.3.5 Archaeological Master Plans	15
1.3.6 Cemeteries	15
2.0 FIELD METHODS	17
3.0 RECORD OF FINDS	19
3.1 Soils	19
3.2 Archaeological Resources	19
3.3 Documentary Record	19
4.0 ANALYSIS AND CONCLUSIONS	20
4.1 Assessing Potential for Archaeological Resources	20
4.2 Analysis and Discussion	21
5.0 RECOMMENDATIONS	23
6.0 ADVICE ON COMPLIANCE WITH LEGISLATION	24
7.0 CLOSURE	25



8.0 BIBLIOGRAPHY AND SOURCES	26
9.0 IMAGES	29
10.0 FIGURES	32

LIST OF TABLES

1. General Cultural Chronology for Southern Ontario	10
2. Registered Archaeological Sites within 1 km of the Subject Property	14
3. Daily Fieldwork Conditions	17
4. Inventory of Documentary and Material Record	19

LIST OF FIGURES

1. Location of the Subject Property on a Topographic Map
2. Plan Drawing of the West Portion of the Subject Property
3. Plan Drawing of the East Portion of the Subject Property
4. Location of the Subject Property on Tremaine's 1856 Map of the County of Norfolk, Canada West
5. Location of the Subject Property on H.R. Page & Co.'s 1877 Illustrated Historical Atlas Map of Middleton Township, County of Norfolk
6. Location of the Subject Property on a Map of Norfolk County Soils
7. Current Land Use of the Subject Property
8. Aerial Imagery Showing the Results of the Stage 1 & 2 Archaeological Assessment of the Subject Property
9. Plan Drawing of the West Showing the Results of the Stage 1 & 2 Archaeological Assessment of the Subject Property
10. Plan Drawing of the East Showing the Results of the Stage 1 & 2 Archaeological Assessment of the Subject Property



LIST OF ABBREVIATIONS

The following is a list of abbreviations and acronyms used throughout this report.

ACC	Archaeological Consultants Canada
CHVI	Cultural Heritage Value or Interest
cm	centimetre
ha	hectares
km	kilometre
m	metre
MCM	Ministry of Citizenship and Multiculturalism
OASD	Ontario Archaeological Sites Database
OHA	Ontario Heritage Act
PIF	Project Information Form
%	percent



PROJECT PERSONNEL

Project Manager:	Matthew Muttart, M.A., P1208
Professional License:	Kristy O'Neal, M.A., P066
Field Directors:	Leah Peacock, B.A., R1273 Melanie Chan, B.A. R1434
Field Technicians:	Madelyn Eley Victoria Wilson Emma Jepson Emily Reist
Report Preparation:	Zack Cousineau, B.A., R1335
Graphics:	Zack Cousineau, B.A., R1335



Stage 1 & 2 Archaeological Assessment

Proposed Railway Development

401 Main Street, Part of Lots 187, 188, and 189, South Side of Talbot Road East, Town of Delhi, Geographic Township of Middleton, Norfolk County, Ontario

1.0 PROJECT CONTEXT

1.1 Development Context

Archaeological Consultants Canada (ACC) was contracted by the Proponent to conduct a Stage 1 & 2 archaeological assessment, including background research and property survey, for a residential development including townhouses, commercial areas, parking areas and roads. An archaeological assessment was conducted during the pre-approval process and was required under the *Planning Act, R.S.O 1990*. The assessed area, or the “subject property”, is located at municipal address 401 Main Street and is legally described as Part of Lots 187, 188 and 189, South Side of Talbot Road East, Geographic Township of Middleton, County of Norfolk, Ontario (Figure 1). The subject property measures 4.33 hectares (ha). The Proponent verified the subject property limits as defined within this report and provided a plan of survey confirming the boundaries (Figures 2 & 3).

The objective of a Stage 1 background study is to provide information about the subject property’s geography, history, previous archaeological fieldwork, and current land conditions. A Stage 1 study evaluates the subject property’s archaeological potential in order to recommend appropriate strategies for the Stage 2 survey.

The objective of a Stage 2 property assessment is to document all archaeological resources present on the property and to make a determination about whether these resources, if present, have Cultural Heritage Value or Interest (CHVI). Archaeological resources consist of artifacts (Indigenous stone tools, pottery and subsistence remains as well as Euro-Canadian objects), subsurface settlement patterns and cultural features (post moulds, trash pits, privies, and wells), and sites (temporary camps and special purpose activity areas, plus more permanent settlements such as villages, homesteads, grist mills and industrial structures). If any archaeological resources are present that exhibit CHVI, a Stage 2 survey will determine whether these resources require further assessment and, if necessary, recommend appropriate Stage 3 strategies for identified archaeological sites.

The Stage 1 & 2 assessment was conducted under Professional Archaeological License P066, held by Kristy O’Neal. Fieldwork was conducted under the direction of Leah Peacock (Applied Research License R1273), and Melanie Chan (Applied Research License R1434). The Ontario Ministry of Citizenship and Multiculturalism (MCM) assigned Project Information Form (PIF) number P066-0593-2025 to this project. The licensee of ACC received permission from the



ACC

ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25

8 of 43

Proponent to access the property and to conduct all required archaeological fieldwork activities including the removal of artifacts, as necessary.

All fieldwork and reporting were completed using MCM's 2011 *Standards and Guidelines for Consultant Archaeologists*. This report documents the research, the field methods and results, and the conclusions and recommendations based on the Stage 1 & 2 archaeological assessment. All documents and records related to this project will be curated at the offices of ACC, in accordance with subsection 66(1) of the *Ontario Heritage Act* (OHA).

1.2 Historical Context

1.2.1 Background Research

Stage 1 background research was conducted to determine the potential for finding and identifying archaeological resources including sites within the current subject property and to determine the necessity of conducting a Stage 2 survey. This is done by reviewing geographic, archaeological, and historical data for the property and the surrounding area. The background research was conducted to:

- amass all the readily available information on any previous archaeological surveys in the area.
- determine the locations of any registered and unregistered sites within and around the subject property.
- develop a historical framework for assigning levels of potential significance to any new sites discovered during fieldwork.

1.2.2 A Cultural Chronology for Southern Ontario

Over their thousands of years of occupation in the general region, Indigenous peoples have left behind, to a greater or lesser degree, physical evidence of their lifeway activities and settlements at many locations. Based upon a published synthesis of Indigenous cultural occupations (Wright, 1968). Table 1 is a general outline of the cultural history of southern Ontario that is applicable to the subject property. Ellis and Ferris (1990) provide greater detail of the distinctive characteristics of each time period and cultural group. This general outline uses longstanding labels that are used to describe the archaeological record in North America. Archaeological terms like Paleoindian, Archaic, and Woodland, are used here as a way to divide time and should be treated as such.

It is likely that Ontario was occupied soon after the retreat of the Ice Age glaciers. The earliest known human occupation in the area was during the Paleoindian period (between 12,000 and 9,500 years ago) wherein small groups of nomadic peoples hunted big game such as caribou in a cool sub-arctic climate. Sites are typically found near glacial features such as the shorelines of glacial lakes or kettle ponds which would have allowed access to the low-lying environments that were favoured by caribou and other wildlife. These people were few and their small, temporary campsites are relatively rare. Paleoindian sites are recognized by the presence of

Stage 1 & 2 Archaeological Assessment
 401 Main Street
 Town of Delhi, County of Norfolk, ON

distinctive artifacts such as fluted projectile points, beaked scrapers, and gravers and by the preference for light colored chert, such as Collingwood chert. The Paleoindian Period is divided into two sub-periods, Early Paleoindian, and Late Paleoindian.

Table 1: General Cultural Chronology for Southern Ontario

PERIOD	SUBDIVISION I	SUBDIVISION II	YEARS BEFORE PRESENT	COMMENTS
PALEOINDIAN	Early Paleoindian	Fluted Point Horizon	12,000-10,500	big game hunters
	Late Paleoindian	Holcombe & Hi-Lo Horizons	10,500-9,500	small nomadic groups
ARCHAIC	Early Archaic	Side Notched Horizon	10,000-9,700	nomadic hunters and gatherers
		Corner-Notched Horizon	9,700-8,900	
		Bifurcate Horizon	8,900-8,000	
	Middle Archaic	Middle Archaic I/Stemmed Horizon	8,000-5,500	territorial settlements
		Middle Archaic II	5,500-4,500	polished ground stone tools
	Late Archaic	Narrow Point Horizon	4,500-3,500	
		Broad Point Horizon	4,000-3,500	
		Small Point Horizon (including Haldimand and Glacial Kame Complexes)	3,500-2,800	burial ceremonialism
WOODLAND	Early Woodland	Meadowood Complex	2,900-2,400	introduction of pottery
		Middlesex Complex	2,500-2,000	
	Middle Woodland	SW Ontario: Saugeen	2,300-1,500	long distance trade networks
		Western Basin: Couture	2,300-1,500	
	Transitional Woodland	SW Ontario:		
		Princess Point	1,500/1,400-1,200	incipient agriculture
		Western Basin:		
		Riviere au Vase	1500/1400-1200/1100	
	Late Woodland: Ontario Iroquois Tradition	Early: Glen Meyer	1200/100-750/700	transition to village life
		Middle I: Uren	720/700-710/670	large villages with palisades
		Middle II: Middleport	710/670-670/600	wide distribution of ceramic styles
		Late: Neutral	600-450	
	Late Woodland: Western Basin Tradition	Younge Phase	1200/1100-800	
		Springwells Phase	800-600	
		Wolf Phase	600-450	
HISTORIC	SW Ontario Iroquois	Historic Neutral	450-350	tribal warfare
	European Contact	Initial Contact	380-300	tribal displacement
		European Settlement	200 >	European settlement
		First Nations Resettlement	200 >	

(Compiled from Adams, 1994, Ellis *et al.*, 1990, Wright, 1968)

During the Archaic period (*circa* 10,000 to 2,800 years ago) people were still primarily nomadic hunters, but they adapted to a more temperate climate. Groups were dispersed during winter months and converged around watercourses from the spring to fall in large fishing campsites. The Archaic period is characterized by the appearance of ground stone tools, notched, or



ACC

ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25
10 of 43

stemmed projectile points. The Archaic Period is divided into three sub-periods, Early, Middle, and Late Archaic. During the Archaic Period, groups began to establish territorial settlements and introduce burial ceremonialism. There is a marked increase in the number and size of sites, especially during the Late Archaic period.

The Woodland period is distinguished by the introduction of pottery vessels for storage and cooking. Sites of the Woodland period (*circa* 3,000 to 400 years ago) are usually the most numerous because the population levels in southern Ontario had significantly increased, especially along the shores of Lakes Erie and Ontario. The Woodland Period is also marked by the establishment of complex long distance trading networks. The Woodland Period is divided into three sub-periods, Early, Middle and Late Woodland. During the Late Woodland Period, there was increasing sedentarism and the establishment of horticulture, a reliance on tribal warfare, and the introduction of semi-permanent villages with large protective palisades. The Late Woodland period also envelops the emergence of Iroquoian tribes and confederacies.

The historic period (from A.D. 1650 to 1900) begins with the arrival of Euro-Canadian groups. Sites of this period document European exploration, trade, and the displacement and devastation of native groups caused by warfare and infectious disease. The most common sites of this period include Euro-Canadian homesteads, industries, churches, schools, and cemeteries.

While North America had been visited by Europeans on an increasing scale since the end of the 15th century, the first European to venture into what would become southern Ontario was Étienne Brûlé. Brûlé was sent by Samuel de Champlain in the summer of 1610 to consolidate an emerging relationship between the French and the First Nations, and to learn their languages and customs. Other Europeans would subsequently be sent by the French to train as interpreters. These men played an essential role in communications with the First Nations (Gervais and Rothe, 2004:182).

The late 17th and early 18th centuries saw the growth and spread of the fur trade, with the establishment and maintenance of trading posts along the Great Lakes. In 1754, hostilities over trade and the territorial ambitions of the French and the British led to the Seven Years' War, which ended when the French surrendered in 1760 (Smith, 1987:22). In addition to cementing British control over the Province of Quebec, the British victory over the French also proved pivotal in catalyzing the Euro-Canadian settlement process.

During pre-contact and early contact times, the vicinity of the subject property would have contained a mixture of deciduous trees, coniferous trees, and open areas. In the early 19th century, Euro-Canadian settlers arrived via easily accessible colonization routes and began to clear the forests for agricultural purposes. In the 19th and early 20th centuries, the subject property and surrounding land were primarily used for agricultural purposes. Mixed farming was common, with wheat crops and beef cattle dominating the landscape (Chapman and Putnam, 1984:177).

The subject property was historically located on Part of Lots 187, 188, and 189, South Side of Talbot Road East, in the Geographic Township of Middleton, County of Norfolk. In 1791, the provinces of Lower Canada and Upper Canada were created from the former province of Quebec



ACC

ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25

11 of 43

by a British parliamentary act. Colonel John Graves Simcoe was appointed as the Lieutenant Governor of Upper Canada and was tasked with governing and directing its settlement, as well as establishing a constitutional government based on Britain's model (Coyne et al, 1895:33).

Norfolk County was first settled in 1789 by United Empire Loyalists emigrating from the United States after the American Revolutionary War (Carter, 1984). The county itself was created in 1792 by Lieutenant-Governor John Graves Simcoe, who named it after Norfolk County, England (Mika & Mika, 1984). The population of Norfolk County was 9,626 in 1841. Early settlers in the county were primarily of Dutch, British and German descent, who settled in the county to take advantage of the rich soils (Mutrie, 2004). By 1844, a total of 56,899 acres were being cultivated, and there were 50 sawmills and 10 grist mills in operation (Smith 1846:186).

Middleton Township was open to settlers in 1792, it was named after the Baron of Sydny, Thomas Townshend (Middleton, 1927). Settlement of the area increased near the end of the War of 1812, by individuals such as Frederick Sovereen, Henry Sovereen, Joseph Lawson, and the Brown family. Many of the earliest surveyed properties were lots along Talbot Street which became open to traffic in 1824 (Carter, 1984). Middleton Township is known for its three historic waterways; Little Otter Creek, Big Creek, and Venison Creek which were used in the construction of many mills.

The nearest historic community was the community of Fredericksburg, partially located within the subject property. This community was first settled around 1812 by Frederick Sovereen in who the town was named after. The village was situated between the townships of Middleton and Windham. In 1846 the population of the village was around 100 people, the village contained a store, two taverns, a blacksmith, a wagonmaker, a tailor, and two shoemakers. A mill was located on the outskirts of the village (Smith, 1846).

Historical records and mapping were examined for evidence of early Euro-Canadian occupation within and near the subject property in the mid- to late-19th century. Tremaine's 1856 *Map of the County of Norfolk, Canada West* lists Peter W. Rapelie as the owner of the portion of the subject property located within Lot 187. The majority of the property located within Lot 188 does not depict an owner; however, a small portion is located in William L. Sovereen's property in the south-central area of the Lot. No owner is listed for the small portion of the subject property located within Lot 189 (Figure 4). The subject property is approximately 230 m east of Big Creek and 400 m south of the village of Fredericksburg. James Street is located abutting the east edge of the subject property.

H. R. Page & Co.'s 1877 map of Middleton Township in the *Illustrated Historical Atlas of Norfolk County* indicates that the subject property is now partially within the Village of Delhi, previously called Fredericksburg. The subject property is now comprised of the Air Line Railway. A station is built around this time in the west of the subject property, promoting expansion towards the railway from the original location of Fredericksburg (Figure 5). Several roads within Delhi abut the subject property

It should be noted that while no structures are illustrated within the subject property on the historical atlas maps, it does not necessarily mean that one or more structures were not present at



ACC

ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25

12 of 43

that time, earlier or later. Not all features of interest were mapped systematically on the Ontario series of historical maps and atlases, given that they were financed by subscription, and subscribers were given preference regarding the level of detail provided on the maps (Caston, 1977:100). Given that the subject property fronts a historic concession road and the village of Delhi, there is the potential for 19th century buildings to be present, depending on the level of disturbance.

1.3 Archaeological Context

1.3.1 Natural Environment

The subject property is located within the Norfolk Sand Plain physiographic region (Chapman and Putnam 1984). This wedge-shaped area has a curved base along the coast of Lake Erie and tapers to a point at Brantford. The region is made up of sand deposited from meltwater of the Grand River that formed a delta of glacial Lakes Whittlesey and Warren. It is made up of light textured soils left behind by retreating glaciers that is best used for tobacco crops.

The *Soils of the Regional Municipality of Haldimand-Norfolk* (Presant and Acton, 1984) indicates that the entirety of the subject property is built-up and no to little natural soil remains (Figure 6).

Water has been identified as the major determinant of site selection and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Primary water sources include, among others, lakes, rivers, creeks, and streams. Secondary water sources include intermittent streams, creeks, springs, marshes, and swamps. Past water sources, such as raised beach ridges, relic water channels, and glacial shorelines are also considered to have archaeological potential. Swamps and marshes are also important as resource extraction areas, and any resource areas are considered to have archaeological potential. The nearest water source is Big Creek located approximately 230 m west of the subject property.

1.3.2 Current Land Use

Figure 7 provides the current land use of the subject property. The subject property is currently a overgrown railway and include portions of vacant lands along the railway. Surrounding properties include residential and commercial properties within the Town of Delhi. A tobacco plant is located to the southwest. Additional abandoned railway are located to the east and west of the subject property.

Fieldwork for the project was conducted on August 21 and September 19, 2025.

1.3.3 Previous Archaeological Investigations

1.3.3.1 Registered Archaeological Sites

Previously registered archaeological sites can be used to indicate archaeological potential. To determine if any previous assessments have yielded archaeological sites, either within or surrounding the current subject property, two main sources were consulted. These include the

Ontario Archaeological Sites Database (OASD) and the *Public Register of Archaeological Reports*, both of which are maintained by MCM.

The OASD contains archaeological sites registered within the Borden system (Borden, 1952). The Borden system divides Canada into 13 km by 18.5 km blocks based on longitude and latitude. Each Borden block is designated with a four-letter label and sites identified within the block are numbered sequentially as they are registered. The subject property is located within the *AfHc* Borden block.

According to the OASD, no archaeological sites have been registered within the subject property, however, 4 sites have been registered within one km of the subject property (MCM, 2025a). The nearest of these sites is over 300 m from the current subject property. All four sites are of Indigenous cultural affiliation and include lithic scatters and a campsite.

Table 2 lists the sites within 1 km along with the current CHVI for each site. CHVI is a term used by MCM and consultant archaeologists to describe archaeological resources that meet one or more criteria that recommend further fieldwork in MCM's *Standards and Guidelines for Consultant Archaeologists*. Under the OHA and its regulations, archaeological resources that have been determined to possess CHVI are protected as archaeological sites under Section 48 of the act. Information in Table 2 is provided by MCM through the OASD (MCM, 2025a).

Table 2: Registered Archaeological Sites within 1 km of the Subject Property

REG. #	NAME	TIME PERIOD	CULTURAL AFFILIATION	SITE TYPE	STATUS
AfHc-76		Pre-Contact	Indigenous	scatter	No Further CHVI
AfHc-66		Pre-Contact	Indigenous	camp / campsite	Further CHVI
AfHc-65		Pre-Contact	Indigenous	scatter	Further CHVI
AfHc-63		Pre-Contact	Indigenous	scatter	Further CHVI

Information concerning specific site locations is protected by provincial policy and is not fully subject to the *Freedom of Information Act*. The release of such information in the past has led to looting or various forms of illegally conducted site destruction. Confidentiality extends to all media capable of conveying location, including maps, drawings, or textual descriptions of a site location. MCM will provide information concerning site location to the party or an agent of the party holding title to a property, or to a licensed archaeologist with relevant cultural resource management interests.

1.3.3.2 Previous Archaeological Reports

A review of archaeological reports within the *Public Register of Archaeological Reports* indicated that no reports detailing previous archaeological fieldwork within the subject property have been entered into MCM's register at the time this report was written (MCM, 2025b). There are no reports detailing previous fieldwork within 50 m of the subject property within the register.



Reports were searched based on registered site information, historic lots and concessions, and nearby streets. To the best of ACC's knowledge, there are no other reports concerning archaeological work conducted within 50 m of the subject property; however, it should be noted that the MCM does not maintain a database of all properties that have had past archaeological investigations and searches of the MCM's public register do not always result in a complete listing of all archaeological work conducted in a given area.

1.3.4 Historical Plaques and Monuments

MCM's *Standards and Guidelines for Consultant Archaeologists* (MCM, 2011:17) stipulates that areas of early Euro-Canadian settlement (including places of early military pioneer settlement, pioneer homesteads, isolated cabins, farmstead complexes, early wharf or dock complexes, pioneer churches, and early cemeteries) are considered to have archaeological potential. There may be commemorative markers of their history, such as local, provincial, or federal monuments, plaques, cairns, or heritage parks. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the OHA or a federal, provincial, or municipal historic landmark or site, and properties that local histories or informants have identified with possible archaeological sites, historical events, activities, or occupations are also considered to have archaeological potential.

A commemorative marker is located within the west portion of the subject property. The first Train Station was located in the western portion of the subject property. Upon the construction of the Great Western Railway, A station was built on this location in Delhi along Main Street. The railway was built in the late 1870's and the station was built in 1880. On September 20, 1916, the original station burnt down due to one of the train's embers landing on the wooden roof. A second station was built over the previous station's location in 1918 and was later dismantled in the 1970's (Image 14).

1.3.5 Archaeological Master Plans

Archaeological site predictive models and master plans are tools used to assist in determining the probability of encountering archaeological sites. Probability models are created using consideration of variables such as distance to water, soil type, drainage, physiographic region, degree of slope, proximity to registered archaeological sites, and degree of disturbance.

While Norfolk County does not have an archaeological master plan or potential model, the *Official Plan of Norfolk County* sets out directions and policies that guide economic, environmental, and community planning decisions for the region. The plan requires archaeological and cultural heritage assessment for proposed development or site alteration in areas of archaeological potential. The plan ensures that any potential archaeological sites are identified and managed appropriately during development (Norfolk County, 2023).

1.3.6 Cemeteries

A search of the subject property and surrounding area determined that there were no cemeteries located within or near the subject property. The Bereavement Authority of Ontario's Public



ACC

ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25

15 of 43

Stage 1 & 2 Archaeological Assessment
401 Main Street
Town of Delhi, County of Norfolk, ON

Register does not list any cemeteries within the subject property (Bereavement Authority of Ontario, 2025).



ACC
ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25
16 of 43

2.0 FIELD METHODS

The subject property measures 4.33 ha. The Stage 1 & 2 assessment were conducted concurrently between August 21 and September 19, 2025, with advance permission to enter the subject property obtained from the Proponent. Weather conditions during the assessment were excellent. Table 3 provides detailed weather conditions for each day of the assessment.

Table 3: Daily Fieldwork Conditions

DATE	WEATHER CONDITIONS	FIELD DIRECTOR
August 21, 2025	24°C, passing clouds	Leah Peacock, R1273
September 19, 2025	24°C, clear	Melanie Chan, R1434

The Stage 1 assessment of the subject property began with an on-site property inspection to gain first-hand knowledge of the geography, topography, and current condition of the property. The entirety of the subject property was accessible and was inspected. Appropriate photographic documentation was taken during the visual inspection. The Stage 1 property inspection took place when the ground was fully visible, and under conditions that allowed for full viewing of archaeological potential. Coverage of the property was sufficient to identify the presence or absence of features of archaeological potential, meeting the requirements of Section 1.2 Standard 1 of the *Standards and Guidelines for Consultant Archaeologists*.

Areas of low to no archaeological potential include lands that have been previously disturbed, lands that have steeply sloping topography, and lands that are low-lying and permanently wet. 4.33 ha, 100% of the subject property, has been previously disturbed by intensive and extensive modern soil alterations, including for the construction of the railway that runs through the property. The previous location of the train station has also been heavily disturbed due to the construction and dismantling of the second train station that was located within the property from 1918 to the 1970's. As disturbance was not obvious from the stage 1 assessment in areas, Stage 2 test pit survey was conducted to ensure the entirety of the property had been disturbed.

4.33 ha, 100%, of the subject property consists of scrubland. As these lands could not be ploughed, Stage 2 archaeological assessment was conducted by test pit survey at 5 m intervals in accordance with Section 2.1.2 of the *Standards and Guidelines for Consultant Archaeologists*. Each test pit was dug by hand and was 30 centimetres (cm) in diameter and was dug to at least 5 cm into the subsoil or to a sufficient depth to confirm deep disturbance if subsoil was not preserved. Test pits were examined for stratigraphy, cultural features, or evidence of fill. Test pits were dug to within one m of all disturbances and other areas of low archaeological potential. All soil was screened through 6-millimetre mesh to maximize the potential for artifact recovery. Appropriate photographic documentation was taken, and all test pits were backfilled upon completion. As no artifacts were observed during the test pit assessment no intensified survey was conducted.

There were no weather, ground, or lighting conditions detrimental to the recovery of artifacts. As such, it is confirmed that the Stage 2 assessment met Section 2.1 Standard 3 of the *Standards and Guidelines for Consultant Archaeologists* regarding weather and lighting.

Stage 1 & 2 Archaeological Assessment
401 Main Street
Town of Delhi, County of Norfolk, ON

The entirety of the subject property was assessed. The results of the Stage 1 & 2 assessment are shown in Figures 8, 9 and 10. Images of the assessment are provided in Section 9.0.



ACC
ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25
18 of 43

3.0 RECORD OF FINDS

3.1 Soils

Test pits throughout the study area did not exhibit intact topsoil beyond a very thin layer of organic matter. Native subsoil was exhibited as orange silty clay. Disturbed soils consisted of grey commercial fill sand, various imported clays and high concentrations of gravel and aggregate likely used to support the rail line.

3.2 Archaeological Resources

No artifacts or other archaeological resources were observed during the Stage 1 & 2 assessment of the subject property.

3.3 Documentary Record

All fieldwork-related activities were documented and kept, including field notes and observations and detailed maps. Appropriate photographic records were kept of the assessment and all image descriptions were recorded in a photo log.

A detailed list of field records is presented in Table 4. All digital items have been duplicated, and all paper items have been scanned and stored as digital documents. All items are housed in the corporate offices of ACC.

Under Section 6 of Regulation 881 of the OHA, ACC will keep in safekeeping all objects of archaeological significance that are found under the authority of the license and all field records that are made in the course of the work authorized by the license, except where the objects and records are donated to His Majesty the King in right of Ontario or are directed to be deposited in a public institution under subsection 66 (1) of the Act.

Table 4: Inventory of Documentary and Material Records

PROJECT INFORMATION		
ACC project number	234-12-25	
Licensee	Kristy O'Neal	
MCM PIF numbers	P066-0593-2025	
DOCUMENT/MATERIAL	NUMBER	DESCRIPTION
field notes & photo logs	1	pages (paper, with digital copies)
maps	1	aerial imagery of subject property
	2	plan of survey of the subject property
photographs	13	digital colour photographs

4.0 ANALYSIS AND CONCLUSIONS

4.1 Assessing Potential for Archaeological Resources

Archaeological potential is defined as the likelihood of finding archaeological sites within a subject area. For planning purposes, determining archaeological potential provides a preliminary indication that significant sites might be found within the subject area, and consequently, that it may be necessary to allocate time and resources for archaeological survey and mitigation.

The framework for assigning levels of potential archaeological significance is drawn from provincial guidelines found in the *Standards and Guidelines for Consultant Archaeologists* (MCM, 2011: Sections 1.3.1 and 1.3.2). The following are features or characteristics that can indicate archaeological potential:

- previously identified archaeological sites
- water sources (It is important to distinguish types of water and shoreline, and to distinguish natural from artificial water sources, as these features affect site locations and types to varying degrees.).
 - primary water sources (e.g., lakes, rivers, streams, creeks)
 - secondary water sources (e.g., intermittent streams and creeks, springs, marshes, swamps)
 - features indicating past water sources (e.g., glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches)
 - accessible or inaccessible shoreline (e.g., high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh)
- elevated topography (e.g., eskers, drumlins, large knolls, plateaus)
- pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground
- distinctive land formation that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings.
- resource areas, including:
 - food or medicinal plants (e.g., migratory routes, spawning areas, prairie)
 - scarce raw materials (e.g., quartz, copper, ochre or outcrops of chert)
 - early Euro-Canadian industry (e.g., fur trade, logging, prospecting, mining)



- areas of early Euro-Canadian settlement. These include places of early military or pioneer settlement (e.g., pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches and cemeteries. There may be commemorative markers of their history, such as local provincial, or federal monuments or heritage parks
- early historical transportation routes (e.g., trails, passes, roads, railways, portages)
- property listed on a municipal register or designated under the OHA or that is in a federal, provincial, or municipal historic landmark site
- property that local histories or informants have identified with possible archaeological sites, historical events, activities, or occupations

Archaeological potential can be determined not to be present for either the entire property or parts of it when the area under consideration has been subject to extensive and deep land alterations that have severely damaged the integrity of any archaeological resources. This is commonly referred to as “disturbed” or “disturbance” and may include:

- quarrying
- major landscaping involving grading below topsoil
- building footprints
- sewage and infrastructure development
- activities such as agricultural cultivation, gardening, minor grading, and landscaping do not necessarily affect archaeological potential.

4.2 Analysis and Discussion

Section 1.3.1 of the *Standards and Guidelines for Consultant Archaeologists* (MCM, 2011) lists criteria indicative of archaeological potential. MCM stipulates the following requirements for Stage 2 property survey based on archaeological potential.

- No areas within 300 m of a previously identified site, water sources, areas of early Euro-Canadian settlement, or locations identified through local knowledge or informants can be recommended for exemption from further assessment.
- No areas within 100 m of early transportation routes can be recommended for exemption from further assessment.
- No areas within the property containing elevated topography, pockets of well-drained sandy soil, distinctive land formations, or resource areas can be recommended for exemption from further assessment.

Stage 1 background research indicated that the subject property has general archaeological potential due to the following factors:

- The subject property is located within the town of Delhi in 1877 historical mapping
- The subject property is located adjacent to several early historical transportation routes, including roads within the town of Delhi.
- Big Creek is located within 230 m of the subject property.
- There are 4 registered archaeological sites within one km of the subject property.
- A commemorative marker for the first train station is located within the subject property.

Given the above criteria, background archival research indicated that the subject property exhibited general archaeological potential for the discovery of both pre/post-contact Indigenous and Euro-Canadian archaeological resources therefore, a Stage 2 archaeological assessment was required.

The subject property measures 4.33 ha. A visual property inspection determined that the entirety of subject property has been previously disturbed by modern and historic construction activities and has low to no archaeological potential. Judgmental test pits were placed to confirm disturbance throughout the property.

While the subject property is currently within an urban area, historical mapping indicates it was rural until approximately the 1870s when the Air Line Railway was constructed. The construction of the railway included terraforming of the land to level the railway track. The scrubland where the previous railway station was located has also since been heavily disturbed by the construction and dismantling of a second railway station that was present in the same location for the majority of the 20th century. The West portion of the subject property has since been heavily disturbed and has remained vacant since the 1970's.

Judgmental test pit survey was conducted throughout the subject property to confirm disturbance.

No artifacts or other archaeological resources were identified during the Stage 1 & 2 archaeological assessment.



5.0 RECOMMENDATIONS

Subject to acceptance of the results and approval of the recommendations, MCM is requested to deem this report compliant with ministry requirements for archaeological fieldwork and reporting and to issue a letter accepting this report into the *Ontario Public Register of Archaeological Reports*, as provided for in Section 65.1 of the OHA.

The following recommendation is provided for consideration by the Proponent and by the MCM:

1. No artifacts or other archaeological resources were identified during the Stage 1 & 2 archaeological assessment of the subject property. The subject property has now been fully assessed according to MCM's 2011 *Standards and Guidelines for Consultant Archaeologists*. No further archaeological assessment of the subject property is required.



6.0 ADVICE ON COMPLIANCE WITH LEGISLATION

The following advice on compliance with current legislation is provided for consideration:

- a. This report is submitted to the Minister of Citizenship and Multiculturalism as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c O.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Citizenship and Multiculturalism, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.
- b. It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such a time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the *Ontario Heritage Act*.
- c. Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.
- d. The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) requires that any person discovering human remains must notify the police or coroner and the Registrar, Burials Unit, at the Ministry of Public and Business Service Delivery and Procurement.
- e. Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48(1) of the *Ontario Heritage Act* and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.

7.0 CLOSURE

This report was prepared for the exclusive use of the Proponent, unless otherwise expressly stated in the report or contract. This report documents work that was performed in accordance with the accepted professional standards at the time and location in which the services were provided.

The report is based solely on data and information collected during the archaeological assessment as described in this report. All information received from the Proponent or third parties in the preparation of this report has been assumed by ACC to be factual and accurate. ACC assumes no responsibility for any deficiency, misstatement, or inaccuracy in information received from others. ACC disclaims any obligation to update this report for events or information that becomes available to ACC after the assessment has been completed.

Conclusions made within this report consist of ACC's professional opinion as of the time of the writing of this report and are based solely on the scope and extent of work described in the report, the limited data available, and the results of the work. The conclusions are based on the conditions encountered by ACC at the time the work was performed. Due to the nature of archaeological assessment, which consists of systematic sampling, it is possible that unforeseen and undiscovered archaeological resources may be present within the assessed area. ACC does not warrant against undiscovered environmental liabilities nor that the sampling results are indicative of the condition of the entire property. No other representations, warranties, or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential archaeological resources associated with the identified property.

Any use of this report by any third party is prohibited. This report is not to be given over to any third party, for any purpose whatsoever, without the written permission of ACC, which shall not be unreasonably withheld. Any use which a third party makes of this report, in whole or in part, or any reliance on or decisions to be made based on any information and conclusions in the report, are the responsibility of the third party. ACC assumes no responsibility for losses, damages, liabilities or claims of any kind whatsoever, howsoever arising, from third party use of this report.

ACC makes no other representations whatsoever, including those concerning the legal significance of the report's findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein.



8.0 BIBLIOGRAPHY AND SOURCES

Adams, Nick

1994 *Field Manual for Avocational Archaeologists in Ontario*. Publication No.16, Ontario Archaeological Society Inc.

Bereavement Authority of Ontario

2025 *Public Register*.

<https://portal.thebao.ca/public-register/>

[Accessed October 3, 2025].

Borden, Charles E.

1952 A Uniform Site Designation Scheme for Canada. *Anthropology in British Columbia*, No. 3, 44-48.

Carter, Floreen Ellen

1984 *Place Names of Ontario*. Phelps, London.

Caston, Wayne

1997 Evolution in the Mapping of Southern Ontario and Wellington County. *Wellington County History*. 10:91-106.

Chapman, L.J. and D.F. Putnam

1984 *The Physiography of Southern Ontario*. 3rd edition. Ministry of Natural Resources

Coyne, James, C. O. Ermatinger, K. W. McKay

1895 *Historical Sketches of the County of Elgin*. Elgin Historical and Scientific Institute, St. Thomas.

Ellis, Chris & Neal Ferris

1990 *The Archaeology of Southern Ontario to A.D. 1650*. Occasional Publication No. 5. London Chapter, Ontario Archaeological Society Inc.

Energy Mines and Resources Canada

1999 *Map 40-I/14, St. Thomas*. 1:50,000 scale National Topographic System map.

Gervais, Gaetan and Kathe Rothe

2004 Champlain and Ontario (1603-35). In *Champlain: The Birth of French America*, edited by R. Litalien and D. Vaugeois, pp. 180-190. Montreal: McGill-Queen's Press.

H.R. Page & Co.

1877 *Illustrated Historical Atlas of the County of Norfolk, Ontario*. Toronto.

Presant, E.W. & C.J. Acton

1984 *The Soil Survey of The Regional Municipality of Haldimand-Norfolk*. Report No. 57 of the Ontario Soil Survey. Experimental Farms Service, Canada Department of Agriculture, and the Ontario Agricultural College, Guelph.

Middleton, Jesse

1927 *The Province of Ontario: A History, 1615-1927*. Dominion Pub. Co.: Toronto

Mika, Nick and Helma Mika

1984 *Places in Ontario: Their Name Origins and History. Part III, N-Z*. Mika Publishing Company, Belleville.

Ministry of Citizenship and Multiculturalism (MCM)

1990 *The Heritage Act, R.S.O. 1990*. Queen's Printer, Toronto.

2011 *Standards and Guidelines for Consultant Archaeologists*. Toronto.

2025a Sites within a 1 km radius of the subject property. Provided from the *Ontario Archaeological Sites Database*.

2025b Archaeological assessments completed within the subject property or within 50 m of the subject property. Provided from the *Ontario Public Register of Archaeological Reports*.

Ministry of Natural Resources and Forestry

2025 *Ontario Topographic Map*.

https://www.liaapplications.lrc.gov.on.ca/MakeATopographicMap/index.html?viewer=Make_A_Topographic_Map.MATM&locale=en-CA

[Accessed October 3, 2025].

Ministry of Northern Development and Mines

2007 *Physiography of Southern Ontario*. Chapman, L.J. and D.F. Putnam, authors. GIS map data layer distributed by the Ontario Geological Survey as Miscellaneous Release – Data (MRD) 228. Queen's Printer for Ontario.

<http://www.mndm.gov.on.ca/en/mines-and-minerals/applications/ogsearch>.

[Accessed October 3, 2025].

Mutrie, R.R.

2004 Norfolk History. Retrieved from:

<http://www.rootsweb.ancestry.com/~onnorfal/history.htm>.

[Accessed October 2, 2025]

Norfolk County

2023 *Norfolk County Official Plan*

www.norfolkcounty.ca/media/35xnhjc4/norfolk-county-official-plan.pdf#:~:text=record%20within%20the%20County%20by%20a%20licensed,as%20a%20condition%20of%20final%20planning%20approval.

[Accessed October 3, 2025].



ACC

ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25
27 of 43

Ontario Ministry of Agriculture, Food and Rural Affairs
2012 GIS Layers for Soils and Physiography in the Province of Ontario.
<http://sis.agr.gc.ca/cansis/publications/surveys/on/index.html>
[Accessed October 2, 2025].

Ontario Provincial Plaques
2025 *Plaque Web Map, Ontario Heritage Trust for the Ontario Provincial Plaque Program.*
https://www.arcgis.com/apps/mapviewer/index.html?webmap=8df7eb43fd55421fa2106e_bae4abceca
[Accessed October 2, 2025].

Smith, D. B.
1987 *Sacred Feathers: The Reverend Peter Jones (Kahkewaquonaby) and the Mississauga Indians.* Toronto: University of Toronto Press.

Smith, W.H.
1846 *Smith's Canadian Gazetteer: Comprising Statistical and General Information Respecting all Parts of the Upper Province, or Canada West.* Toronto: H. & W. Rowell.

Tremaine, George R
1856 *Tremaine's Map of the County of Norfolk, Canada West.* George R. Tremaine, Publisher.

Vallee Ltd.
2023 *Railway Development Delhi, Ontario: West Side Concept.* Project No: 23-024 PC100
2025 *Railway Land Development -Delhi.* Project No: 23-024 Z100

Wright James V.
1968 *Ontario Prehistory: an eleven thousand-year archaeological outline.* Archaeological Survey of Canada, National Museums of Canada, Ottawa.

9.0 IMAGES

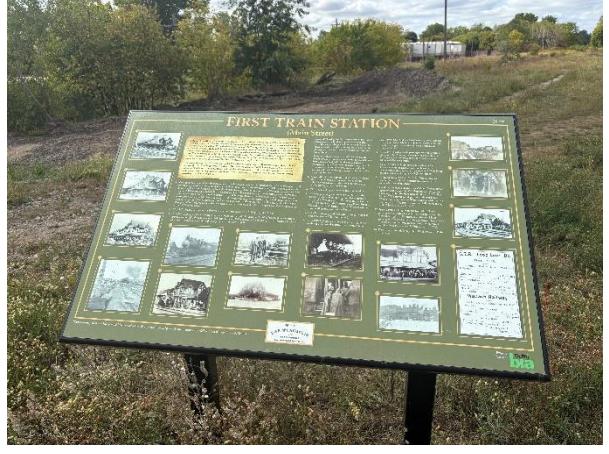
	
Image 1: Subject property showing disturbance, facing east.	Image 2: Subject property showing disturbance, facing south.
	
Image 3: Subject property, showing previously stripped soils, facing north.	Image 4: Existing rails throughout the subject property, facing west.

Stage 1 & 2 Archaeological Assessment
401 Main Street
Town of Delhi, County of Norfolk, ON

	
Image 5: Subject property, facing east.	Image 6: Subject property showing disturbance, facing west.
	
Image 7: Subject property, facing east.	Image 8: Subject property, facing west showing overgrown railway.
	
Image 9: Subject property, facing east showing overgrown railway.	Image 10: Subject property, facing east showing overgrown railway.



Stage 1 & 2 Archaeological Assessment
401 Main Street
Town of Delhi, County of Norfolk, ON

	
Image 11: Subject property, facing west showing overgrown railway.	Image 12: 1.2m deep test pit showing the extent of disturbance.
	
Image 13: Typical test pit, no intact topsoil present.	Image 14: Commemorative sign at image location 4.

10.0 FIGURES

See the following pages for detailed assessment mapping and figures.



Figure 1: Location of the Subject Property on a 1:50,000 Scale Topographic Map

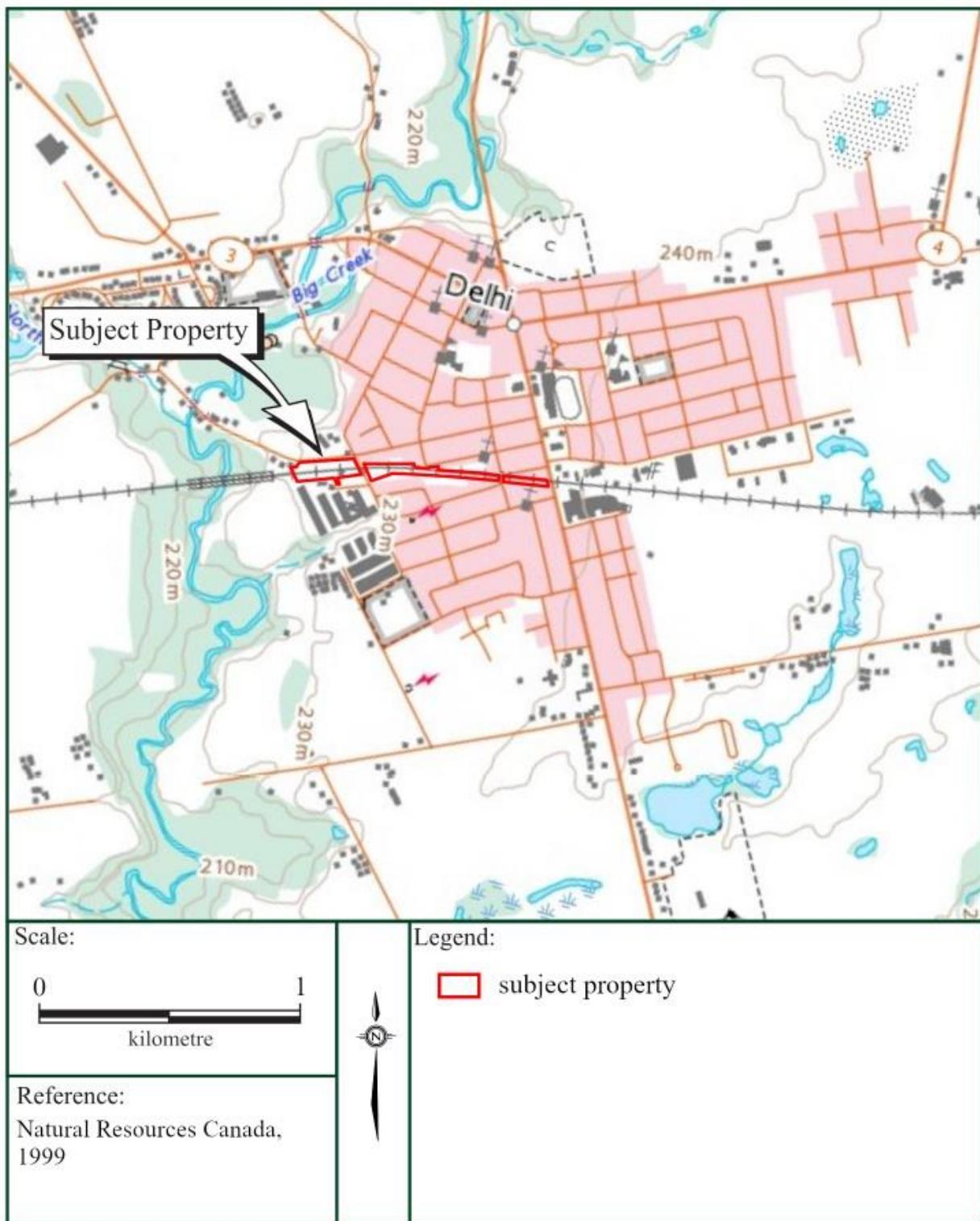


Figure 2: Plan Drawing of the West Portion of the Subject Property

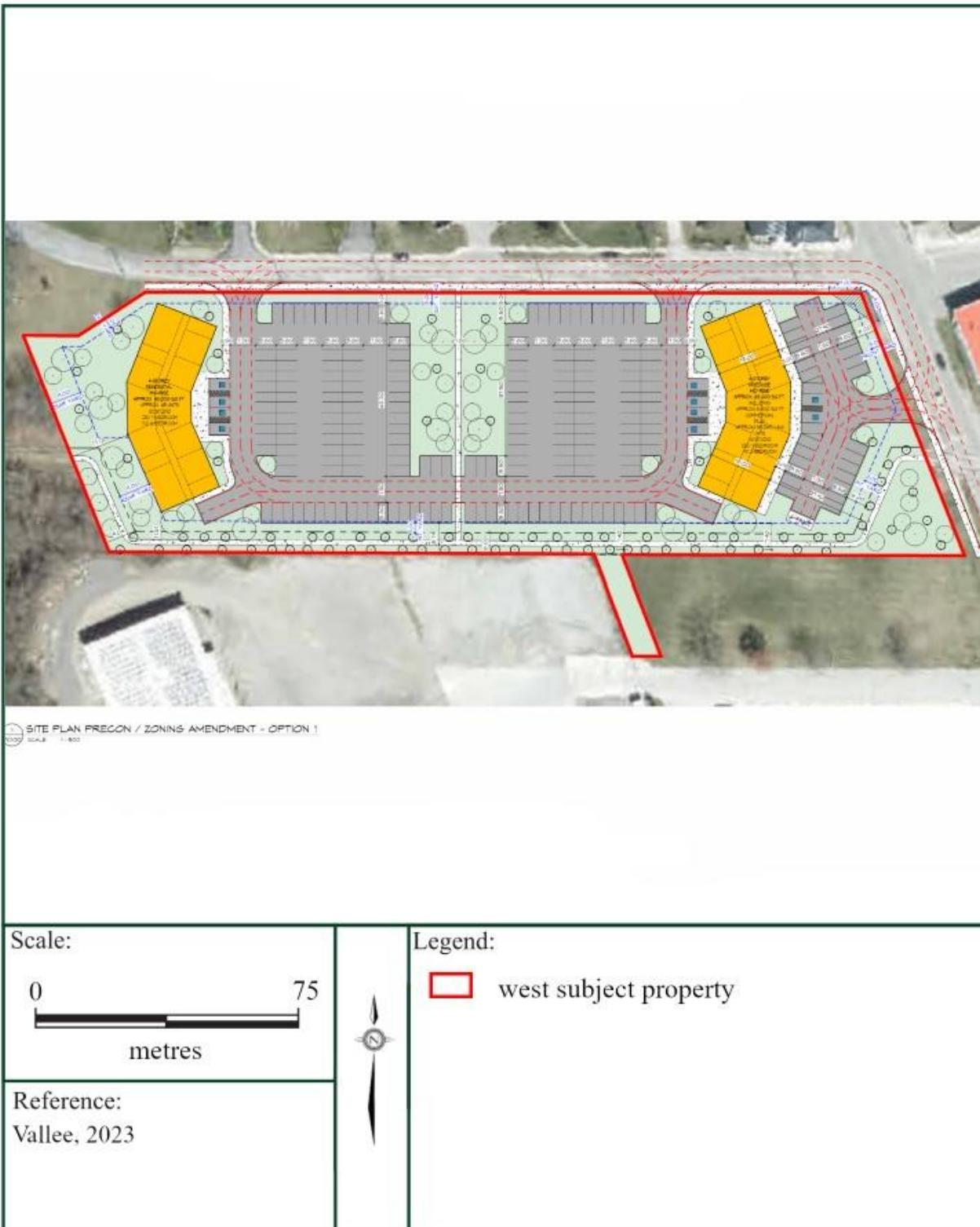


Figure 3: Plan Drawing of the East Portion of the Subject Property



Figure 4: Location of the Subject Property on Tremaine's 1856 Map of Norfolk County, Canada West

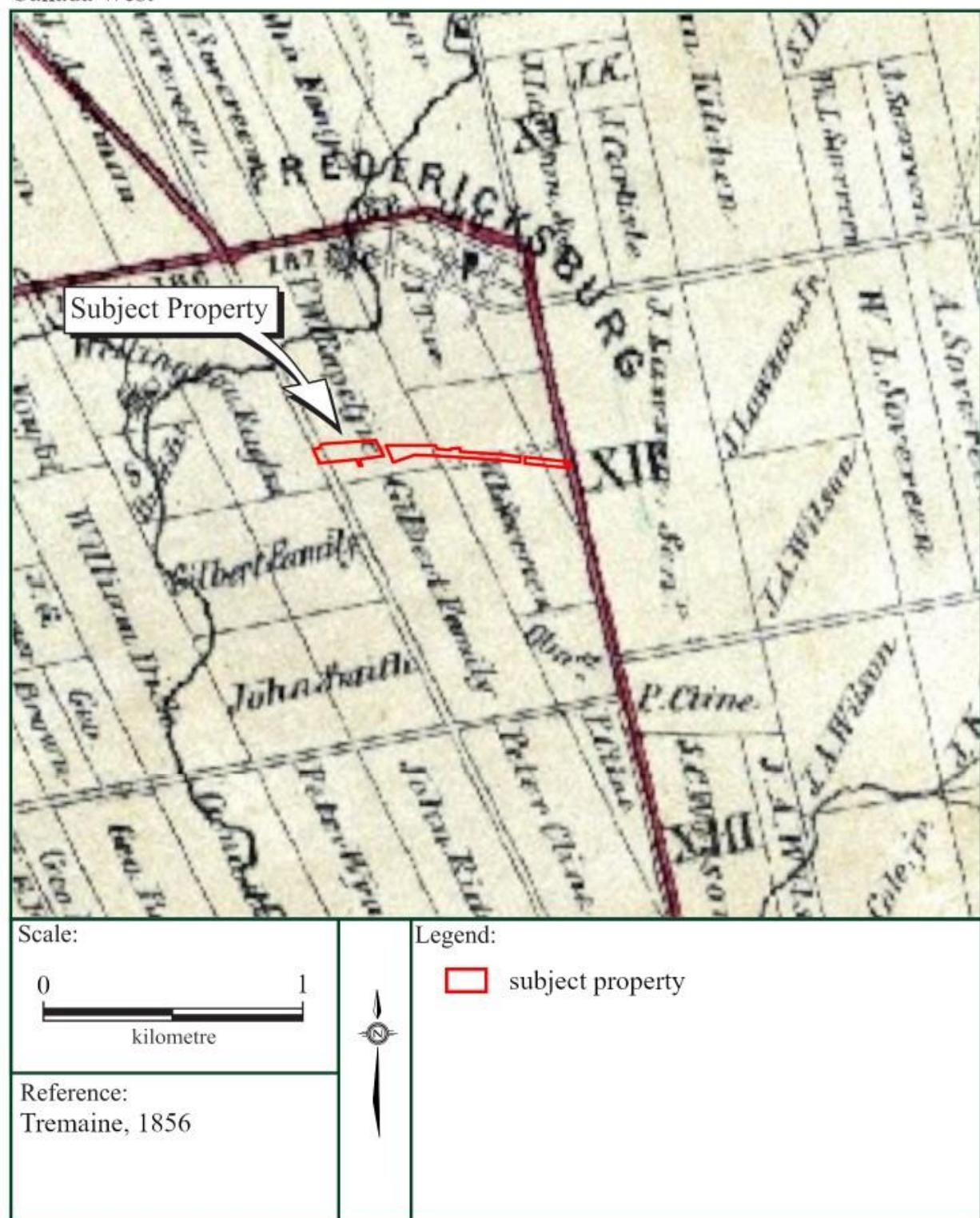


Figure 5: Location of the Subject Property on H. R. Page & Co.'s 1877 Historical Atlas Map of Middleton Township, Norfolk County

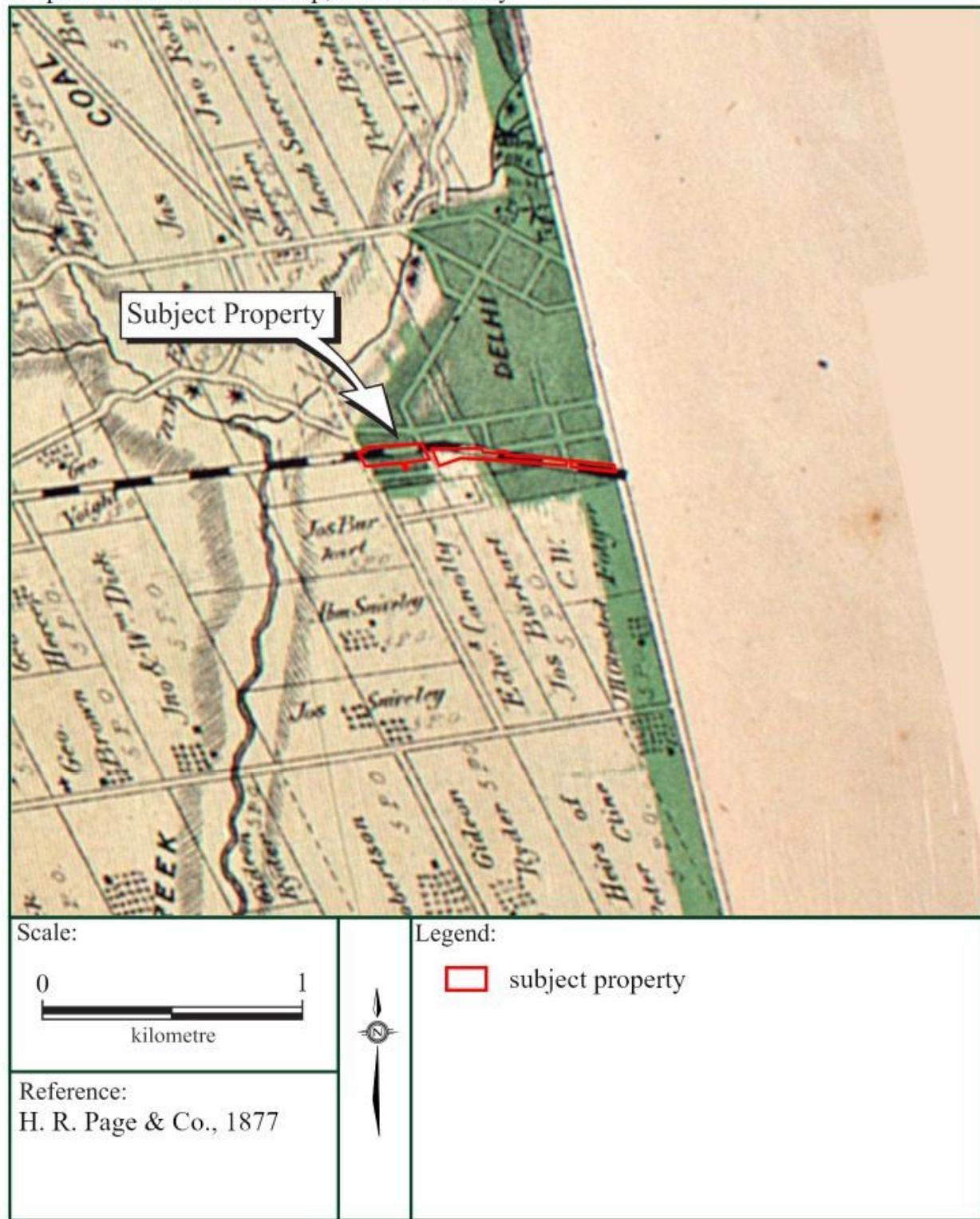


Figure 6: Location of the Subject Property on a Map of the Soils of Norfolk County

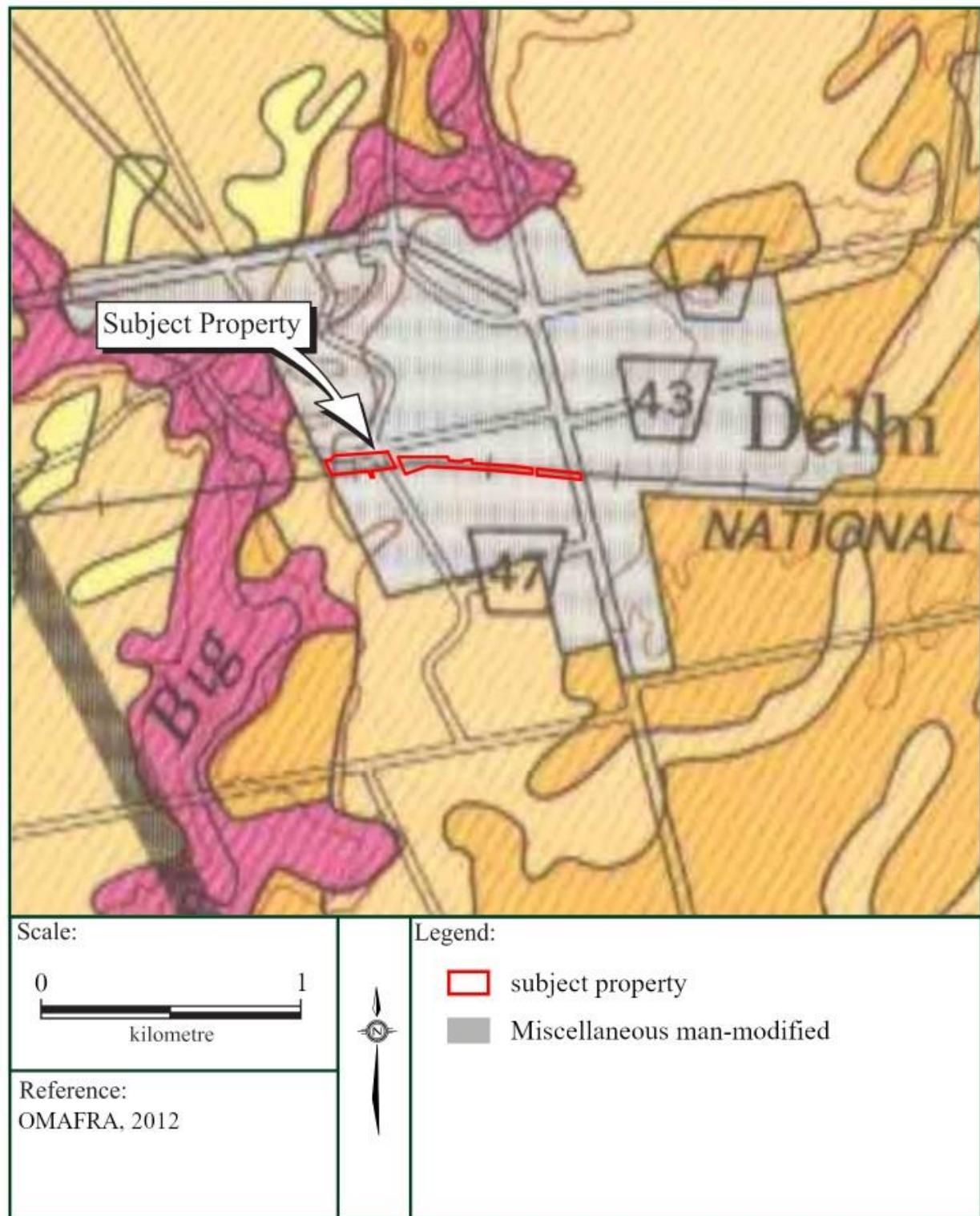


Figure 7: Current Land Use of the Subject Property



Figure 8: Aerial Photograph Showing the Results of the Stage 1 & 2 Archaeological Assessment of the Subject Property with Image Locations



Figure 9: Plan Drawing of the West Showing the Results of the Stage 1 & 2 Archaeological Assessment of the Subject Property with Image Locations

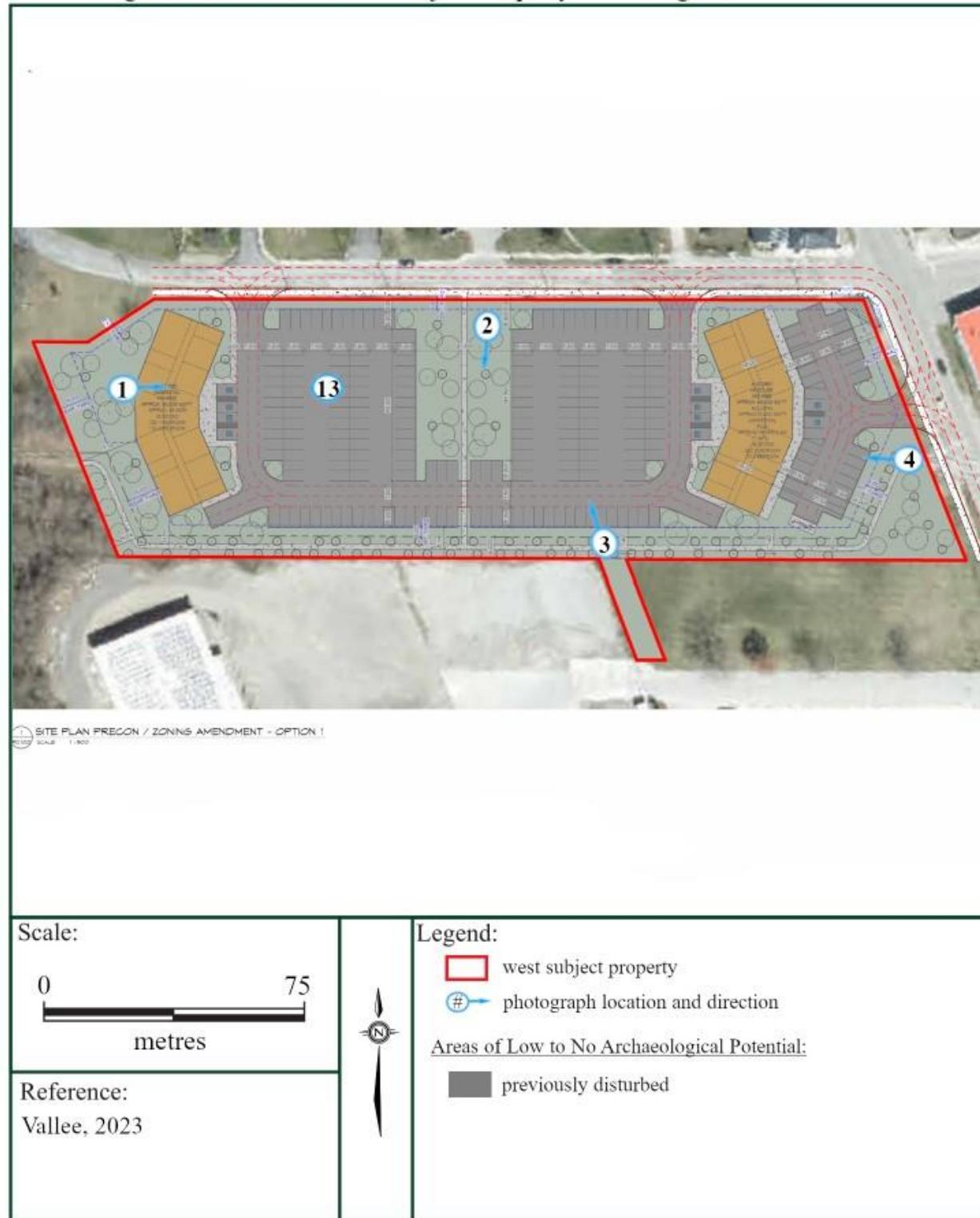


Figure 10: Plan Drawing of the East Showing the Results of the Stage 1 & 2 Archaeological Assessment of the Subject Property with Image Locations

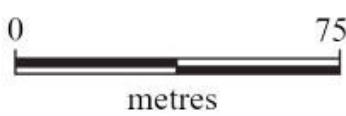
East A



East B



Scale:



Reference:
Vallee, 2025

Legend:

- red box: east subject property
- blue circle with a number: photograph location and direction

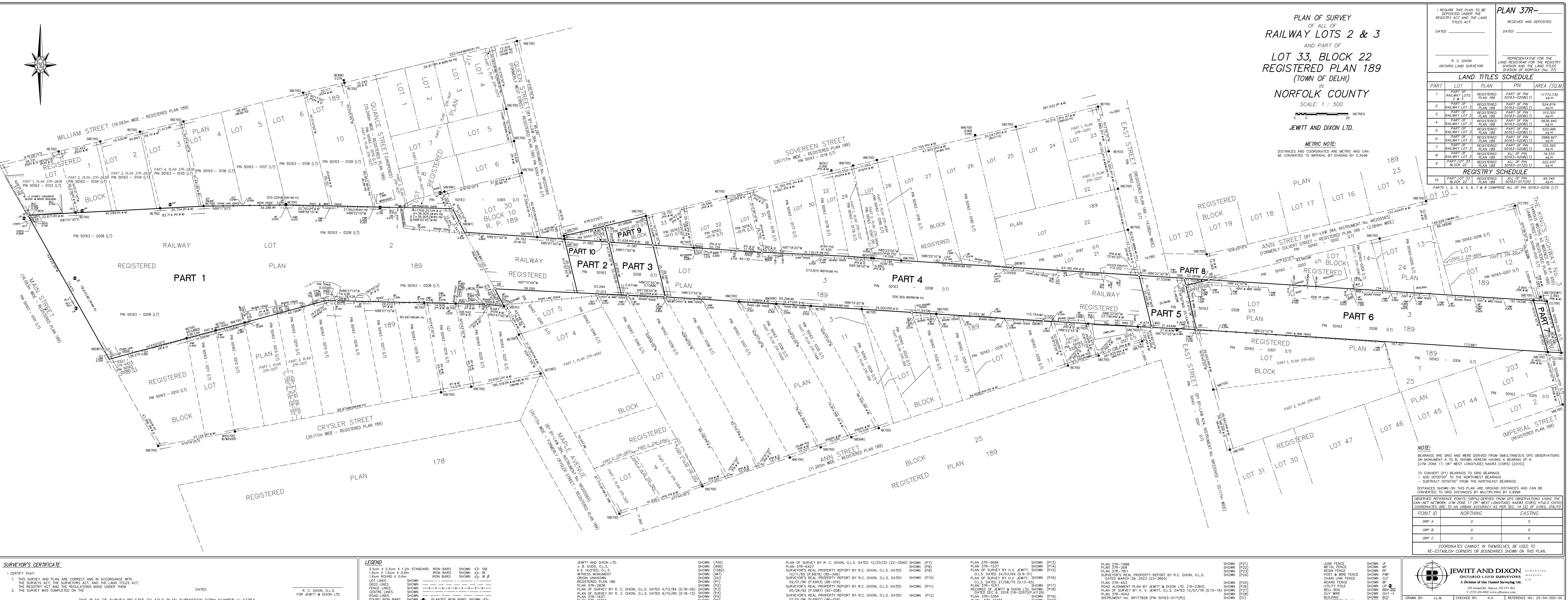
Areas of Low to No Archaeological Potential:

grey box: previously disturbed



ACC
ARCHAEOLOGICAL
CONSULTANTS CANADA

Project No. 234-12-25
42 of 43





Norfolk County Pre-Consultation Checklist

Please select the type of application required:

<input type="checkbox"/> Official Plan Amendment	<input type="checkbox"/> Draft Plan of Condominium
<input type="checkbox"/> Zoning By-law Amendment	<input type="checkbox"/> Site Plan
<input type="checkbox"/> Draft Plan of Subdivision	

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 December 11, 2024, 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.

1. Property Information and Proposal Summary

Registered owner: Allan and Jody Gee

Applicant/agent (if different than owner): G. D. Vallee Limited c/o John Vallee and Eldon Darbyson

Property address: No Civic Address

Roll Number(s): Part of 49199001066 (East Part) and all of 49299001000 (West Part)

Current Official Plan designation and Zoning: The East Part is Designated Urban Residential OP and Zoned Residential 2 (R2) Residential 1-A (R1-A). The West Part is Designated Protected Industrial OP and Zoned General Industrial (MG).

Proposal: The applicant proposes to develop the proposed West Part of the lands with a mix of commercial and residential uses, as well as develop the East Part of the lands into a condominium townhouse development.

2. Assigned File Planner

Name and Title: Andrew Wallace, Planner

Phone Number: 519-426-5870 ext. 1059

E-mail: andrew.wallace@norfolkcounty.ca

3. Required Studies and Plans for Complete Application

Submission Materials	Required?	Notes:
Planning Requirements		
Completed Application Form	<input checked="" type="checkbox"/>	
Concept Plan	<input checked="" type="checkbox"/>	
Draft Plan of Subdivision	<input type="checkbox"/>	
Building Elevations	<input checked="" type="checkbox"/>	
Building Floor Plans and Roof Plans	<input checked="" type="checkbox"/>	
Landscaping Plan	<input type="checkbox"/>	
Minimum Distance Separation Schedule	<input type="checkbox"/>	
Photometrics (Lighting) Plan	<input type="checkbox"/>	
Site Plan and Site Plan Details	<input checked="" type="checkbox"/>	
Survey/Legal Plan	<input checked="" type="checkbox"/>	
Topographical Survey	<input checked="" type="checkbox"/>	
Agricultural Impact Assessment	<input type="checkbox"/>	
Air Treatment Control Study	<input type="checkbox"/>	
Archeological Assessment	<input checked="" type="checkbox"/>	

Submission Materials	Required?	Notes:
Marine Archeological Assessment	<input type="checkbox"/>	
Draft Official Plan Amendment	<input type="checkbox"/>	
Draft Zoning By-law Amendment	<input type="checkbox"/>	
Dust, Noise and Vibration Study	<input type="checkbox"/>	Note for Applicants: This report shall be peer reviewed at the owner's expense.
Environmental Impact Study	<input type="checkbox"/>	Note for Applicants: This report shall be peer reviewed at the owner's expense.
Environmental Site Assessment and Record of Site Condition	<input type="checkbox"/>	RSC not required for first submission for a draft plan of subdivision but will be required as a condition of approval
Farm Business Registration		
Heritage Impact Assessment	<input type="checkbox"/>	
Land Use Compatibility Study	<input type="checkbox"/>	Note for Applicants: This report shall be peer reviewed at the owner's expense.
Market Impact Analysis	<input type="checkbox"/>	Note for Applicants: This report shall be peer reviewed at the owner's expense.
On-Site Sewage Evaluation	<input type="checkbox"/>	
Parking Plan	<input type="checkbox"/>	
Planning Justification Report	<input checked="" type="checkbox"/>	Not Required for site plan applications or standard draft plan of condominium
Planning Justification Brief/Letter		For minor applications.
Restricted Land Use Screening Form	<input type="checkbox"/>	
Shadow Study	<input type="checkbox"/>	
Urban Design Brief	<input type="checkbox"/>	
Other:	<input type="checkbox"/>	
Engineering Requirements		
	<input type="checkbox"/>	Comments Pending – at such time as they are completed, the Pre-Consultation meeting notes will be updated and circulated immediately

4. Detailed Comments Pertinent to the Application:

i. Norfolk County Planning and Agreement

Contact Name(s) and Title(s): Andrew Wallace, Planner

Email: andrew.wallace@norfolkcounty.ca

Comments:

I will differentiate the sites by referring to the east versus the west sites given their relative positions to Main Street. The west site seeks to change the use and OP designation of the lot to allow for the erection of two multi-storied buildings; one which would be fully residential and one which would be mixed commercial ground floor with residential above. The remainder of the site would largely form a parking lot. This proposal will require a full OPA/ZBA application to address the conflicts with current the zoning and OP designation. It should be noted that whilst the PPS 2024 allows for the removal of protected industrial land outside of a municipal review (Section 2.8.2.5), it does require adequate justification for this in terms of the impact or conflict of a proposed rezoning/redesignation with adjacent industrial uses, whether conflict could arise in the future preventing the expansion of the existing industrial uses and that there is adequate provision of protected industrial land. Whilst the 2024 Municipal Review, which included additional industrial/employment lands and the removal of this site, was adopted by Council, it has yet to be approved by MMAH and is likely open to potentially significant changes being required by MMAH. As such, this site remains within the Protected Industrial OP designation up to the point of final MMAH sign off. Any planning justification has to be undertaken based on the County's current industrial land provisions unless you submit this application after completion of the MMAH review, Council amendments and adoption, and final MMAH sign off. There is no date at this point when this is expected to happen.

Assuming there is a successful OPA/ZBA, you would then need to submit a site plan application which would be subject to agreements and conditions.

In terms of the east site, which is roughly wedge shaped, I think a little more information will be required to fully comment on this. It is proposed to be a townhouse-style condo development, with the housing units largely to the northern and western boundaries of the site, with additional parking on the southern side of the site. The main question I would have at this stage is what is the proposed tenure of the development? Is it intended to be a fully self-contained condo development with private road, or would it be a hybrid which would seek adoption of the road? I ask mainly because the proposed road, if private, appears to connect two public roads together (Main Street and Queen Street). I would be concerned with this road layout, if it is proposed to retain a private road, that it would not remain private and be used more publicly.

The lot is within the Urban Residential OP designation so no OPA would be necessary. A ZBA would be required to change the varied uses of the site to R4 to allow for the townhouse development. This would be accompanied by either a draft plan of subdivision followed by a draft plan of condo, or by a draft plan of condo, followed by site plan with condo exemption. Annette may have an opinion on the preferred option and can address that when she speaks.

Until any land swap or sale has occurred for the land south of Sydenham

Street, those 4 units should be removed from any future submission for this site.

Please see the matrix above which lists the required documents/studies/reports. It should be clarified that these two sites will form two separate planning applications. These cannot be dealt with as a single application.

Agreements Services

Annette Helmig, Agreement and Development Coordinator

Email: Annette.helmig@norfolkcounty.ca

Comments:

Depending on your proposal a subdivision agreement might be required. A condition of your site plan approval will be to enter into an agreement with the County. The agreements will be registered on title at the owner's expense. The County will also collect and hold onto performance securities for the infrastructure and landscaping works until the end of the maintenance period. The owner will also be required to secure and keep in force commercial general liability insurance coverage, prior to and during the duration of construction until after a successful site inspection and release of the performance securities. The County does not provide construction, maintenance or delivery of services on private property. These are considered internal as the property will be under private ownership and will be maintained by the condominium corporation. Contact the undersigned when you are ready to start your agreement or if you have any questions. The attached information sheets will assist you with a complete submission.

All the best with your development.

ii. Norfolk County Building

Contact Name(s) and Title(s): Scott Northcott, Building Inspector III

Email: scott.northcott@norfolkcounty.ca

Phone: 519-426-5870 extension 1848

Comments:

Apartment buildings.

At the time of site plan approval.

1. Functional servicing report to include sprinkler and standpipe in fire flow calculations.
2. Location of fire hydrants and fire department connections with dimensions to the 2024 Ontario Building Code (OBC) requirements. Location and design of access routes to the 2024 OBC requirements.
3. Location and design of barrier-free path of travel to 2024 OBC requirements. This includes exterior barrier-free path of travel to designated

accessible parking spaces, exterior passenger loading areas; if applicable, and a public thoroughfare.

At time of building permit application.

These buildings are considered a residential -Group C major occupancy with the potential for an office and personal services – Group D and/or mercantile Group E as additional major occupancies on the main floor. Design drawings are to be completed by an architect and an engineer.

1. Refer to large residential buildings permit application guidelines for a complete list of completed forms, required documents and fees for this type of application.
2. Payment of development charges
3. Payment of parkland dedication.

Townhouses

At time of site plan approval.

1. Location of fire hydrants.
2. Location of water, sanitary and storm sewers, to the OBC 2024 requirements.

At time of building permit application.

These buildings are considered a house - Group C major occupancy Design drawings are to be completed by a qualified individual with a BCIN number in house, and HVAC house, an architect, and/or a professional engineer.

1. Refer to residential buildings permit application guidelines for a complete list of completed forms, required documents and fees for this type of application.
2. Payment of development charges
3. Payment of parkland dedication.

iii. Norfolk County Zoning

Contact Name(s) and Title(s): Troy Scriven, Zoning Administrator

Email: troy.scriven@norfolkcounty.ca

Phone: 519-426-5870 extension 1000

Comments:

The west property is General Industrial and Agricultural
The east property is Service Commercial, R1-A and R2.

The proposal shall meet all relevant sections and provisions of the Norfolk County Zoning by-law including but not limited to, Section 3.0 General Provisions, Section 4.0 – Off Street Parking and Section 5.4 Residential Type 4 Zone for the condos. Additional comments will be provided at time of application when a zone has been chosen for the west property.

A zoning table shall be provided for the proposals on the site plan drawings at time of the site plan application. The zoning table needs to indicate all proposed setbacks, the building heights, building area, lot area and parking calculations. Any zoning deficiencies must also be listed in the zoning table. Parking spaces including barrier free accessible parking spaces, and access aisles shall be shown dimensioned on the site plan. Visitor parking shall be provided as per section 4.9.

iv. Norfolk County Engineering and Infrastructure Services

Contact Name and Title: Stephen Gradish, Development Technologist

Email: Stephen.gradish@norfolkcounty.ca

Comments:

Comments Pending – at such time as they are completed, the Pre-Consultation meeting notes will be updated and circulated immediately.

v. Norfolk County Fire Services

Contact Name and Title: Katie BALLANTYNE, Community Safety Officer

Email: katie.ballantyne@norfolkcounty.ca

Comments:

NCFD has the following comments for this proposal:

- Both properties:
 - o Ensure adequate access for fire department apparatus- fire access routes to be clearly identified and signed as required
 - o Notify NCFD if electric-vehicle charging or battery storage infrastructure is being provided
 - o Hydrant flow to be sufficient
- West property
 - o If required, standpipe connection(s) to be positioned in a manner that allows for easy access/connection for fire department apparatus

vi. Haldimand Norfolk Health Unit

Contact Name and Title: Alex Dobias, Health Promoter

Email: Alex.Dobias@hnhs.ca

Comments:

The health unit encourages the development of complete neighbourhoods and communities. Complete neighbourhoods can have a great impact on health and well-being and are more convenient, socially engaging, and encourage regular physical activity. Most importantly, complete neighbourhoods provide easy access to the daily life necessities for people of all ages, abilities and backgrounds. Additionally, the health unit supports residential developments that make it easier for people to choose active forms of transportation (walking,

cycling, wheeling) for short trips, including access to food, ideally within 1km.

- Specific to this development:
 - This development would contribute to the creation of a complete neighbourhood due to its convenient location.
 - This development is within 1.0km from a grocery store and leisure opportunities (i.e. soccer park).
 - This development would increase residential density in the area, a key factor influencing walkability.
 - Recommend sidewalk connectivity be considered on the east parcel from William street to Crysler Street to enhance walkability.
 - Offering safe, secure bicycle parking for residents is encouraged to facilitate opportunities for active transportation (i.e. bicycle racks outside entrance to proposed mixed use development in west parcel). Here is a link to the essentials of bicycle parking: [EssentialsofBikeParking_FINA.pdf \(apbp.org\)](https://www.apbp.org/essentialsofbikeparking)
 - A Ride Norfolk bus stop is available within 500m (Delhi Friendship Centre - 165 William St. Delhi), providing residents another means of transportation.

vii. Ministry of Transportation

Contact Name and Title: Michael Kilgore, Corridor Management Planner

Email: michael.kilgore@ontario.ca

Comments:

Thank you for providing the MTO with the opportunity to review and provide comments.

The proposed work within Norfolk County is not located adjacent to a provincial highway or within MTO's Permit Control Area, and as such, does not require MTO review, approval or permits.

As a result of this, please be advised that I will not be in attendance for the pre-con meeting being held on December 11, 2024. If you have any question or concerns, please feel free to contact me.

viii. Mississaugas of the Credit First Nation

Contact Name and Title: Abby Lee LaForme, Consultation Coordinator

Email: abby.laforme@mncfn.ca

Comments:

The Mississaugas of the Credit First Nation (MCFN), Department of Consultation and Accommodation (DOCA) submit the following comments:

The Mississaugas of the Credit First Nation hereby notify you that we are the Treaty Holders of the land on which the West & East residential and commercial development will be taking place. This project is located on the Between the Lakes Treaty No. 3, of 1792.

Therefore, the MCFN Department of Consultation and Accommodation (DOCA) requires that we be in receipt of all Environmental Study reports and that a Stage 1 Archaeological Study be conducted on the site to determine its archaeological potential and further that the Stage 1 report be submitted to MCFN DOCA for review. If it is determined that a Stage 2 is required, MCFN DOCA is expected to be involved in the field study with MCFN Field Liaison Representation (FLR) on-site participation. This study will be at the cost of the proponent.

Thank you

ix. Six Nations of the Grand River

Contact Name and Title: Tierra Henhawk, Archaeological Community Monitor
Administrative Assistant

Email: acmaa@sixnations.ca

Comments:

If the site is deemed to have archaeological potential, SNGR Archaeological Supervisor Tanya Hill-Montour will require all Archaeological Assessment Reports for the project.

Any archaeology that would proceed after the stage 1 assessment we request Six Nations archaeological monitor participation.

Nya:weh / Thank You!

5. Notes and Clauses:

1. The purpose of this document is to identify the information required to commence processing a complete application as set out in the Planning Act, R.S.O. 1990, CHAPTER P.13, as amended and the County's Official Plan.
2. Pre-consultation does not imply or suggest any decision whatsoever on behalf of staff or the County to either support or refuse the application.
3. The application should be aware that the information provided is accurate as of the date of the pre-consultation meeting. Should an application not be submitted within a year, and should other policies, by-laws or procedures be

approved by the Province, County, or other agencies prior to the submission of a formal application, the applicant will be subject to any new policies, by-laws or procedures that are in effect at the time of the submission of a formal application. **If an application is not submitted within one (1) year, another pre-consultation meeting shall be required, unless an exception is granted in writing by the Director of Planning**

4. It is hereby understood that during the review of the application additional studies or information may be required as a result of issues arising during the processing of the application or the review of the submitted studies.
5. If the County does not have sufficient expertise to review and determine that a study is acceptable, the County may require a peer review. The terms of reference for a peer review is determined by the County and paid for by the applicant.
6. Please note if performance securities are required by the County to secure any internal and external development works, a recommended condition for your planning application approval will be to enter into a development agreement with the County. The agreement will be registered on title to the subject lands, at the owner's expense. The additional requirements for an 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)
 - Owner's commercial general liability insurance certificate
 - Professional liability insurance certificate
 - Postponement of interest
 - Transfers and / or transfer easements along with registered reference plan

6. Signatures

Staff Signatures

County Planning Staff :

Date:

Planning Staff Signature:

Applicant/Owner Signature

Owner Name (print):

Applicant Name (Print):

Owner Signature:

Applicant Signature:

Date:

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 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.

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.

Endangered and Threatened Species:

Endangered and threatened species and their habitat are protected under the provinces Endangered Species Act, 2007 (ESA), O. Reg. 242/08 and 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 the Environment, Conservation and Parks (“MECP”) 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.

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

Norfolk County Engineering Design Standards

All applicants must adhere to Norfolk County's Design Criteria when undertaking a development project. Please contact Engineering and Infrastructure Services directly for a copy of Norfolk County's Design Criteria .



INSURANCE REQUIREMENTS

For the Owner Entering Into a Development Agreement

Prior to the execution of the Development Agreement, the Owner shall purchase, at its expense, obtain and keep in force, during the term of the Agreement, until the end of the maintenance / guarantee period and return of all securities, insurance coverage. The insurance policy or policies shall be in the Owner's name as shown on the property identification number.

The issuance of such insurance policy or policies shall not be construed as relieving the Owner from responsibility for any other or larger claims in excess of such policy or policies, if any, for which the Owner may be held responsible. Such insurance policy or policies shall be in a form acceptable to Norfolk County and, without limiting the generality of the foregoing, shall provide:

1. A **Commercial General Liability** insurance policy with and including the following coverages:
 - a. a limit of liability of not less than five million dollars (\$5,000,000) per occurrence;
 - b. The Corporation of Norfolk County 50 Colborne Street South, Simcoe ON N3Y 4H3 named as an additional insured
 - c. Non-owned automobile coverage with a limit of at least two million dollars (\$2,000,000) per occurrence including contractual non-owned coverage
 - d. Cross liability and severability of interest in respect of the named insured
 - e. Products and completed operations
 - f. Premises and operations liability
 - g. Contingent employers liability
 - h. Owners and contractors protective
 - i. Blanket contractual
 - j. Thirty (30) days prior written notice of any alteration, cancellation or change in policy terms, which reduces coverage, and any such notice of cancellation shall be given in writing to Norfolk County

Norfolk County reserves the right to request such higher limits of insurance or other types of policies appropriate to the Agreement as Norfolk County may reasonably require from time to time.

Proof of Insurance

The Owner shall provide the certificate of insurance or certified copies of the above referred to policies, satisfactory to Norfolk County. Provided that if a certificate is provided, all requirements as above set forth must be shown on the said certificate and notwithstanding the provision of any certificate, Norfolk County may require that the Owner provide a certified copy of the policy, if required. Such certificates or policies shall be provided prior to the commencement of any work.

The Owner shall further provide evidence of the continuance of said insurance be filed at each policy renewal date for the duration of the Agreement until the end of maintenance period. In the event any renewal premium is not paid, Norfolk County, in order to prevent the lapse of such policy, may pay the renewal premium or premiums, and the Owner agrees to reimburse Norfolk County for the cost of such renewals within ten (10) days of the account therefore being rendered by Norfolk County. Further, prior to the commencement of the Agreement, the Owner shall cause its insurance broker to confirm in writing that it will accept any request from Norfolk County to renew such insurance and will extend the term of any such insurance policy held by the Owner in accordance with such request upon payment of the renewal premium(s) by Norfolk County.

Notice

Every party to the Agreement agrees to immediately notify all other parties of any occurrence, incident, or event, which may reasonably be expected to expose any of the parties to liability of any kind in relation to the development of the Lands.

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 landscaping with 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.

\$2,919 for preparation of the site plan agreement

\$971 to remove the holding from the zoning on the property (if applicable)

\$470 for financial administration of this agreement

\$570 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)

REQUIRED INFORMATION

Development Name and Phase_____

Property Legal Description_____

Proposed Street Names_____

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 _____

SURVEYOR 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 development 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 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 time is of the essence please provide a certified cheque, otherwise it will take three weeks to clear our financial institution. 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.

KICK OFF MEETING TO DISCUSS YOUR DEVELOPMENT IS ENCOURAGED

Appropriate internal and external agencies will be invited to discuss relevant draft plan of subdivision conditions

Complete set of preliminary engineering drawings for review prior to meeting

DOCUMENTATION AND FEES REQUIRED FOR PRESERVICING AGREEMENT

Complete set of engineering drawings for detailed design review and acceptance including cost estimate, supporting reports, studies and Ministry approvals

Phasing plan

Street tree planting plan

Owner's agreement authorization

Postponement of interest from mortgagee / chargee to preservicing (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 100% to secure site or 10% of total site)

Letter of credit or certified cheque for preservicing performance securities

User fee (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)

\$2,621 for preparation of the preservicing agreement

DOCUMENTATION AND FEES REQUIRED FOR SUBDIVISION AGREEMENT

Items identified for preservicing agreement

Owner and solicitor's approval to proceed with draft agreement

Final reference plan for any transfer easements and lands to be transferred

Final preapproved 37M Plan for signature and deposit

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

Clearance letter matrix and supporting documentation demonstrating clearance

Postponement of interest from mortgagee / chargee to agreement (if applicable)

Professional liability insurance for surveyor and / or engineer

Hydro One approval to proceed

Construction estimates (100% for uncompleted works and 10% for completed works)

Letter of credit or certified cheque for subdivision 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)

\$4,902 for preparation of the subdivision agreement

\$971 to remove the holding from the zoning on the property (if applicable)

\$470 for financial administration of this agreement

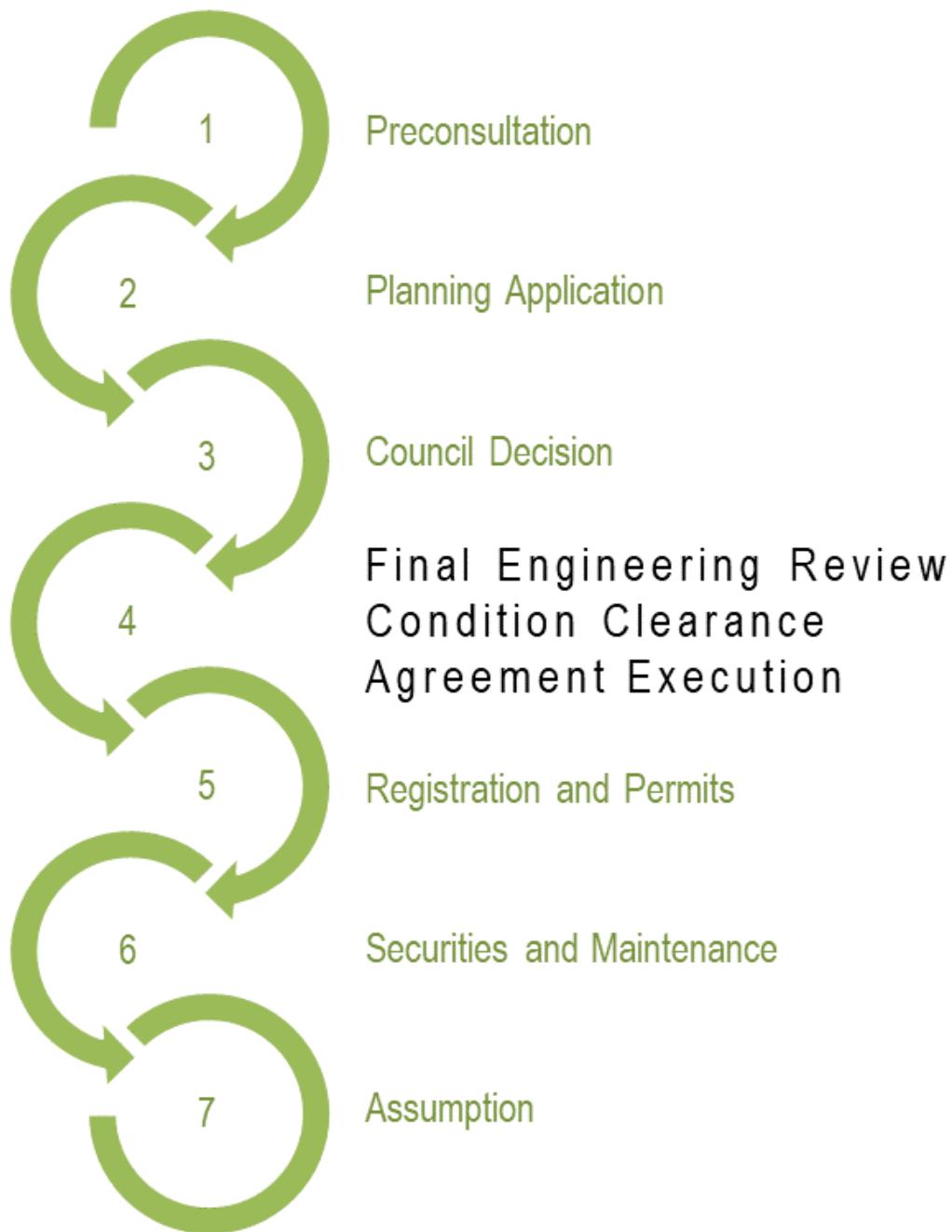
\$570 per tree cash-in-lieu of trees

\$1,818 recirculation - engineering review for second and subsequent submission

5% land appraisal cash-in-lieu of parkland as per consolidated by-law 2016-126 (if applicable)

3% of developers cost for inspection / acceptance / assumption

Development Approval Stages



INDUSTRIAL COMMERCIAL INSTITUTIONAL

Building Permit Package

A step by step guide for
making a building permit
application



Norfolk County Building Department
Community Development Division
185 Robinson Street, Suite 200 Simcoe, Ontario, N3Y 5L6
norfolkcounty.ca

Industrial, Commercial, Institutional Large Residential Permit Package

Building permits help protect you, your home, and the interests of your community by making sure the project is structurally sound and follows the Ontario Building Code, municipal zoning and other applicable laws.



There are multiple steps to the building permit process. The purpose of this permit package is to highlight these steps and provide guidance to the building permit process.

STEP 1: Applicable Law.

Approvals from other agencies are required in many instances before a building permit can be processed and issued. These approvals are **NOT** administered by the Building Department. The fastest way to obtain a building permit is to ensure that all other required approvals are completed prior to permit application.

An Applicable Law Checklist is required as part of a complete application. Agency contacts are attached with this form. Our community mapping has many of these layers mapped to help you determine if additional approvals are required for your application.

Community Development Division - Building Department

185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6 • 519-426-5870 Ext. 6016

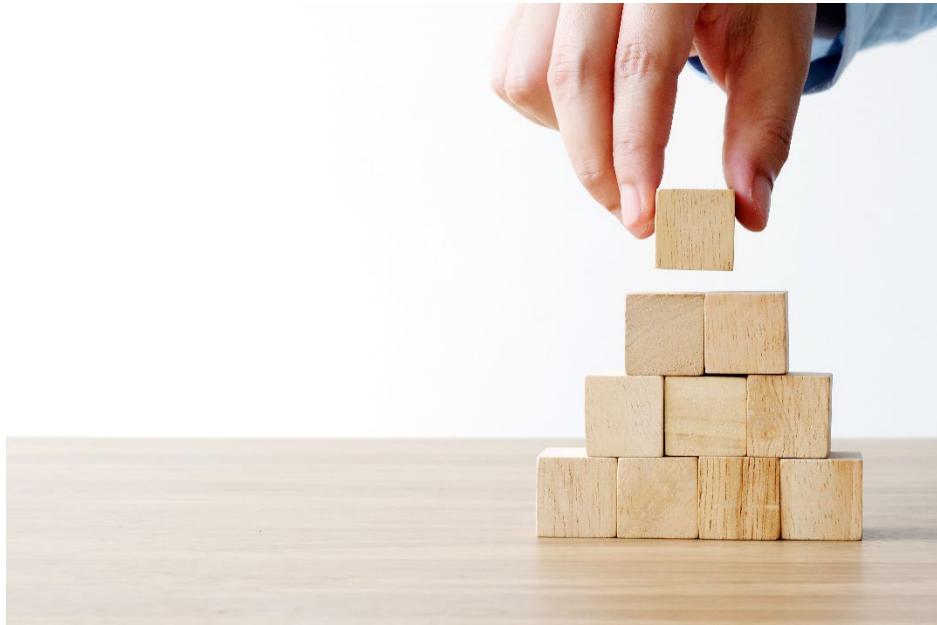
Pre-consultation meeting – Site plan approval.

Most industrial, commercial and institutional buildings are located on properties where a site plan approval is required through the Planning Act. Before you submit a planning application, please contact our office about the necessity of a pre-consultation meeting.

These confidential meetings are hosted by the Planning Department with staff from various departments (and agencies, as applicable) who will provide valuable feedback on your proposal and outline what will be required as part of a complete planning application. After the meeting, you will receive a detailed summary of the meeting which will summarize the feedback from each department. The document will also include a clear list of what you need to submit as part of a complete planning application form.

To request a pre-consultation meeting, please email the Planning Department at precon@norfolkcounty.ca. You can also call us at (519) 426-5870 ext. 1842.

For more information on the process, please see the [Norfolk County Planning Website](#).



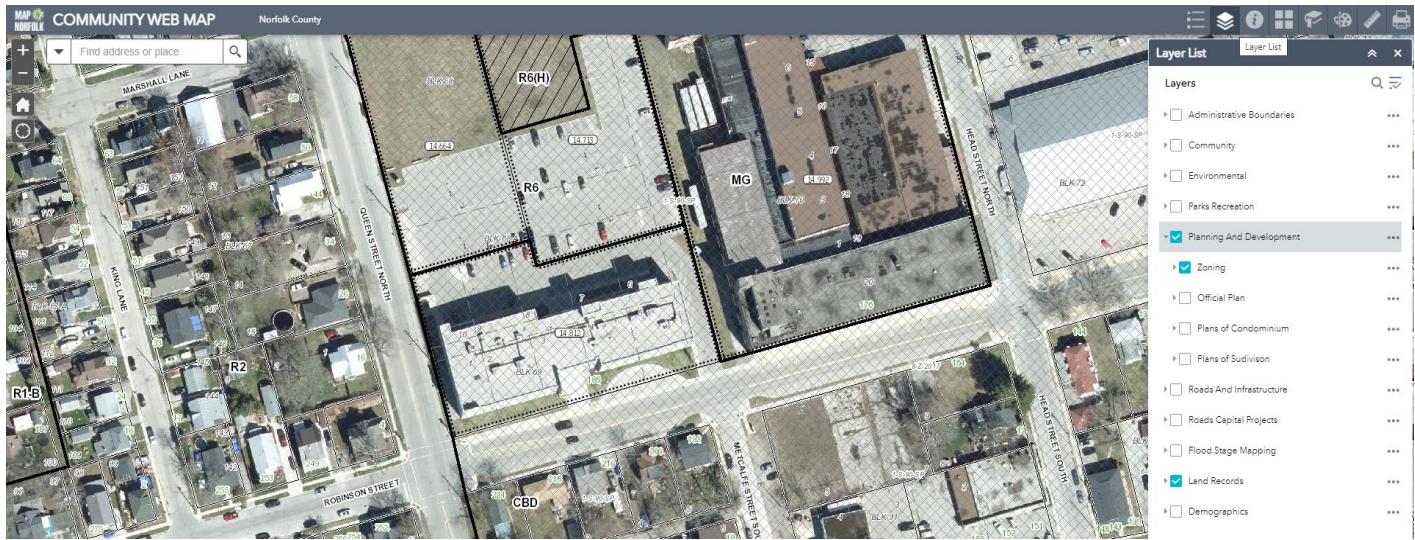
Site Plan Control.

Site Plan Control is a tool utilized by the County to ensure that specific development proposals meet the Official Plan and Zoning By-law objectives. Essentially, site plans approved under this process are very detailed and outline precisely how a particular property will be developed. Site Plan Approval is typically the last planning approval necessary before the Building Permit process.

A Site Plan Agreement is sometimes required for more complicated developments. Where a property has site plan control designation, but the proposed construction is deemed minor in nature, the applicant will need to provide a site plan waiver from the Planning Department as part of an Applicable Law review.

Zoning Requirements.

Finding the zoning associated with your property is easy with our [GIS Community Web Map](#), position over your property and turn on the zoning layer by clicking layer list, planning, zoning. [Norfolk County Zoning Bylaw](#) is available online.



To confirm your project conforms to the Zoning By-law you will need to provide a plot plan indicating:

- Property lines and lot dimension,
- Location of building and all other structures on the lot,
- Location of all steps and landings,
- Distance from dwelling to property lines,
- Parking spots with dimensions,
- Location of septic system.

If your proposed building / structure does not comply with the zoning requirements, a planning application will be required. Zoning and Planning approval is required as part of a complete permit application.

Planning Department: planning@norfolkcounty.ca or 519-426-5870 ext. 1842.
Zoning: zoning@norfolkcounty.ca or 519-426-5870 ext. 1000.



Community Development Division - Building Department

185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6 • 519-426-5870 Ext. 6016

Lot Grading.

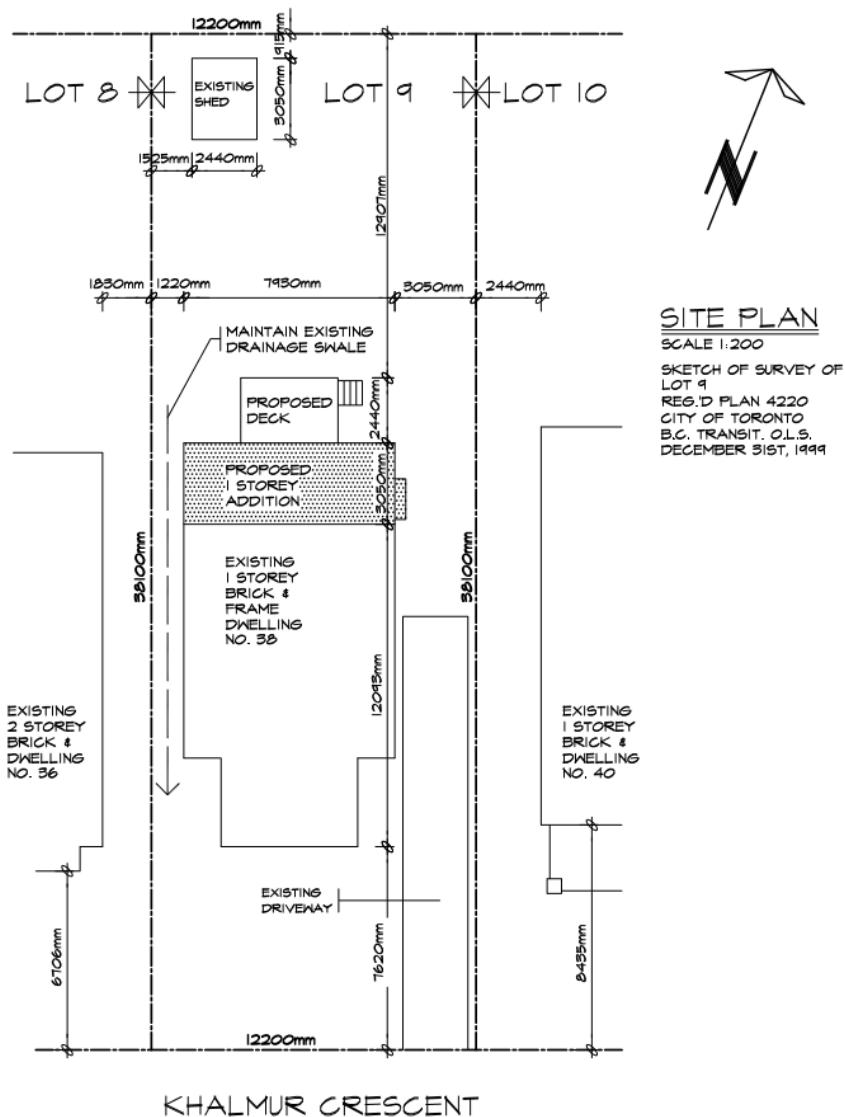
Where a property has been issued a site plan waiver, and the footprint of the building is increasing in size, a lot grading is required.

Proposed grading plans and lot grading form shall be submitted with all building permit applications, under [Norfolk County Grading and Drainage By-law](#).

Proposed grading plans needs to identify:

- all surface features;
- existing and proposed structures;
- changes in grade and slopes in percent between such changes; and
- include sufficient information regarding adjacent properties to confirm conformance with this By-Law with respect to drainage onto those properties.

An exemption may be considered for a lot in a rural area (complete form, fee applies)



STEP 2: Preparing your application.

A building permit application consists of many documents. The forms attached are to be completed, signed, and dated.

Who can design the building?

There are many factors to determine who can complete drawings and design documents for these types of buildings. Your design team can be made up of qualified individuals with a Building Code Identification number (BCIN), an architect, and/or Professional Engineers. If you are unsure what qualifications a designer needs for your specific project, reach out to a building inspector for more information.

Building Department staff cannot make recommendation on a specific designer or design company.

Drawings and Documents.

Drawings are to be legible and to scale. Use a ruler or computer aided drafting (CAD) software to complete your drawings. Provide enough information and detail to ensure compliance with the Ontario Building Code.

The [Ontario Building Code](#) is available online under the 'regulations under this act' tab.

Building Department staff are not permitted by law to provide design advice. It is the responsibility of the property owner or authorized agent to complete a design that meets the requirements of the Ontario Building Code (OBC) and the Building Code Act (BCA).

Building Permits – Application Checklist.

Completed Forms.

- Building Permit Application Form.
- Signed Commitment to General Review.
- Property Owner Consent Form, if application is not completed by the property owner,
- Applicable Law Checklist and supporting documents.
- Lot grading form (projects with a site plan waiver).

Required Documents.

- Approved Site Plan approval plot plan.
- Drawings of the building.
 - Architectural,
 - Structural,
 - Electrical,
 - Mechanical,
 - Plumbing.
- Building Code Matrix.
- Completed SB-10 report (energy efficiency).

Community Development Division - Building Department

185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6 • 519-426-5870 Ext. 6016

- Septic System or Sewage Works.**
 - Sewage system is under 10,000 litres/day daily design flow for the whole site. (separate application through Norfolk County)
 - Sewage Works is over 10,000 litres/day daily design flow for the whole site. ECA to be obtained from The Ministry of Environment, Conservation, Parks.
Contact: *Christopher O'Connor*.
Phone: 1-800-668-4557, Cell: 905-515-9618
Email: Chris.O'Connor2@ontario.ca

Fees.

- Building Permit fee.
- Plumbing fee.
- Occupancy fee.
- Civic address (where applicable).
- Water / Sanitary / Storm Connection Permit (where applicable).
- Development charges (if applicable).

Septic Permits - Application Checklist.

Completed Forms.

- Building Permit Application Form.
- Schedule 1: Designer Information.
- Schedule 2: Sewage System Installer Information.

Required Documents.

- Septic System Permit Application Information Package / Worksheets.
- Percolation time ('T' time) report from a licensed testing agency.

Fees.

- Septic Permit fee.

STEP 3: Applying.

Online Portal: Visit [Norfolk Permits Portal](#) and make your application online.



Building Department

[Apply for a Building Permit](#)
[Status and Fees](#)

In Person: Visit our service counter located at 185 Robinson Street, Suite 200 Simcoe Ontario.

Our Permit Coordinators will review your application and provide in writing any item which may be missing from the application and a cost break down for the permit fees and payment options.

Step 4: Plans Review.

A Building Inspector will contact you in writing if there are building code concerns or missing information from your application.

A building permit is issued once all documentation has been received, fees are paid in full, and your plans are checked for compliance with zoning by-law and the building code.

Step 5: Inspections

Once you have obtained a building permit, a building inspector needs to attend your site at several milestones in the construction process. For more information, please check the inspection section of Norfolk County's Building Department website. Once all inspections are complete and passed your permit is closed.

Need Help? If you have any question on the building permit process or plans required, please contact permits@norfolkcounty.ca or 519-426-5870 ext. 6016

Updated October 2022

NEW RESIDENTIAL HOUSE, SEMI-DETACHED TOWNHOUSES

Building Permit Package

A step by step guide for
making a building permit
application



Norfolk County Building Department
Community Development Division
185 Robinson Street, Suite 200 Simcoe, Ontario, N3Y 5L6
norfolkcounty.ca

New Residential Permit Package Houses, Semi-detached, Townhomes

Building permits help protect you, your home, and the interests of your community by making sure the project is structurally sound and follows the Ontario Building Code, municipal zoning and other applicable laws.



There are multiple steps to the building permit process. The purpose of this permit package is to highlight these steps and provide guidance to the building permit process.

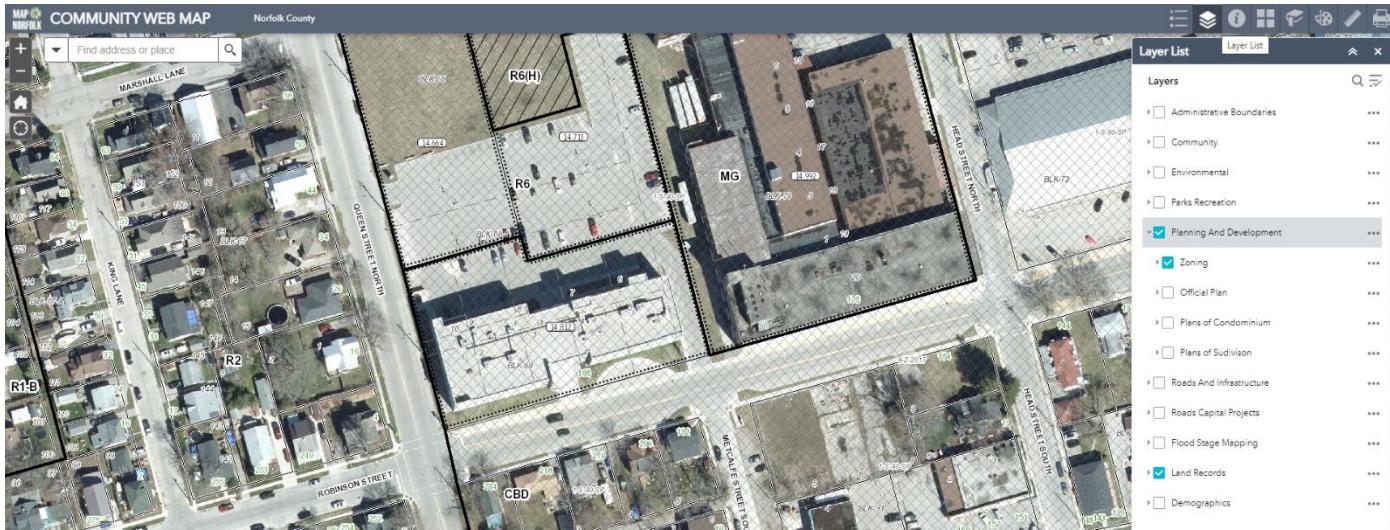
STEP 1: Applicable Law.

Approvals from other agencies are required in many instances before a building permit can be processed and issued. These approvals are **NOT** administered by the Building Department. The fastest way to obtain a building permit is to ensure that all other required approvals are completed prior to permit application.

An Applicable Law Checklist is required as part of a complete application. Agency contacts are attached with this form. Our community mapping has many of these layers mapped to help you determine if additional approvals are required for your application.

Zoning Requirements.

Finding the zoning associated with your property is easy with our [GIS Community Web Map](#), position over your property and turn on the zoning layer by clicking layer list, planning, zoning.



[Norfolk County Zoning Bylaw](#) is available online.

To confirm your project conforms to the Zoning By-law you will need to provide a plot plan indicating:

- Property lines and lot dimensions,
- Location of building and all other structures on the lot,
- Location of all steps and landings,
- Distance from dwelling to property lines,
- Parking spots with dimensions,
- Location of septic system.

If your proposed building / structure does not comply with the zoning requirements, a planning application will be required. Zoning and Planning approval is required as part of a complete permit application.

Planning Department: planning@norfolkcounty.ca or 519-426-5870 ext. 1842.

Zoning: zoning@norfolkcounty.ca or 519-426-5870 ext. 1000.

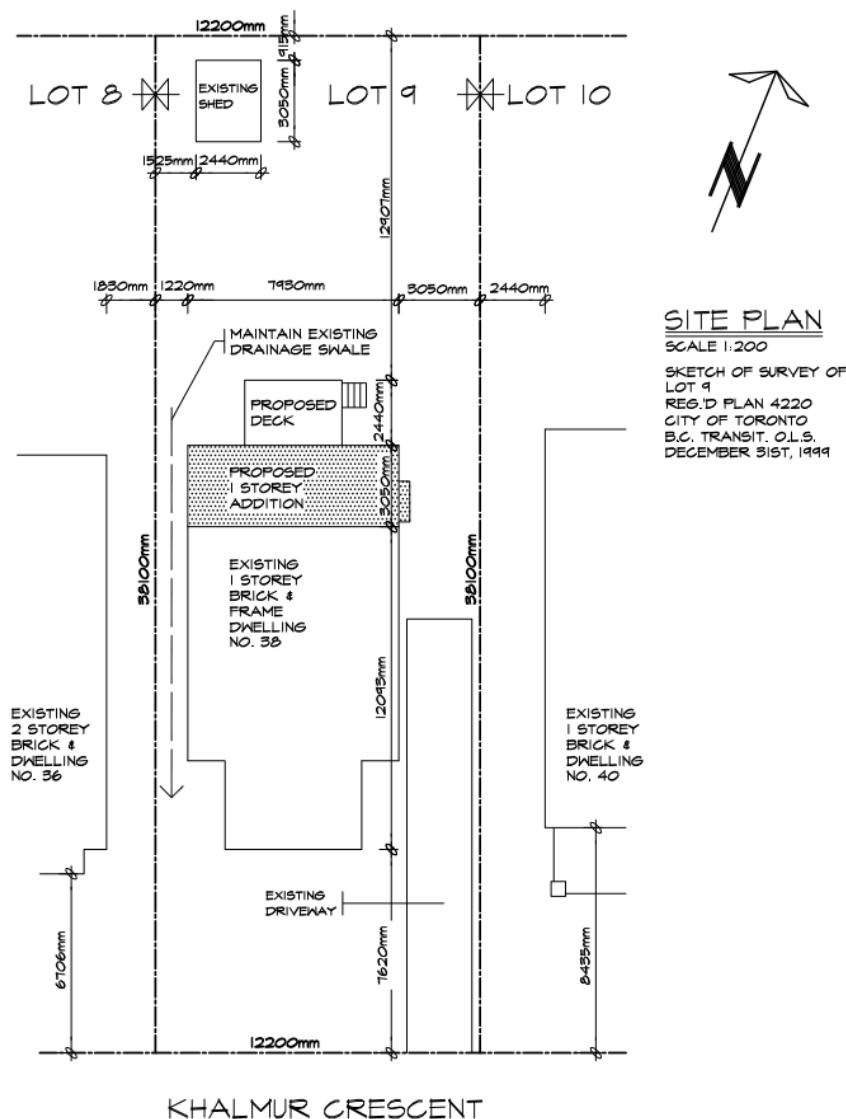
Lot Grading.

Proposed grading plans and lot grading form shall be submitted with all building permit applications, under [Norfolk County Grading and Drainage By-law](#).

Proposed grading plan needs to identify:

- all surface features;
- existing and proposed structures;
- changes in grade and slopes in percent between such changes; and
- include sufficient information regarding adjacent properties to confirm conformance with this By-Law with respect to drainage onto those properties.

An exemption may be considered for a lot in a rural area (complete form, fee applies)



STEP 2: Preparing your application.

A building permit application consists of many documents. The forms attached are to be completed, signed, and dated.

Who can design a house?

As the property owner, you can complete the design yourself for a house, or have a qualified individual with a BCIN number in House, an Architect or a Professional Engineer complete the drawings.

Buildings containing multiple dwelling units may require qualified individuals to complete the design documents. Check with a Building Inspector prior to making application.

Drawings and Documents

Drawings are to be legible and to scale. Use a ruler or computer aided drafting (CAD) software to complete your drawings. Provide enough information and detail to ensure compliance with the Ontario Building Code.

The [Ontario Building Code](#) is available online under the 'regulations under this act' tab.

Building Department staff are not permitted by law to provide design advice. It is the responsibility of the property owner or authorized agent to complete a design that meets the requirements of the Ontario Building Code (OBC) and the Building Code Act (BCA).

If you are unable to complete the application and provide the required documents, should retain a qualified designer to assist you in completing the application.

Building Permits – Application Checklist.

Completed Forms.

- Building Permit Application Form.
- Schedule 1: Designer Information.
- Applicant Authorization Form, if application is not completed by the property owner.
- Applicable Law Checklist and supporting documents.
- Lot grading form or approved exemption.
- Water, storm sewer, sanitary sewer connection permit (where required).
- Evaluation of existing on-site septic system (where required).

Required Documents.

- Plot Plan:
 - Property lines and lot dimensions,
 - Location of building and all other structures on the lot,
 - Location of all steps and landings,
 - Distance from dwelling to property lines,
 - Parking spots with dimensions,
 - Location of septic system.
- Lot Grading Plan.

Community Development Division - Building Department

185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6 • 519-426-5870 Ext. 6016

- Drawings of the Building:
 - Footing, foundations, anchorage details (where applicable),
 - Floor plans,
 - Room names, sizes and ceiling heights,
 - Door & window location and sizes,
 - Location of plumbing fixtures including laundry facilities,
 - Fire separations, fire wall design (if applicable),
 - Smoke alarms and/or fire alarm systems.
- Elevations.
- Cross sections of exterior wall from footing to roof.
- Roof truss layout or roof framing plan.
- Energy Efficiency Design Summary (EEDS), performance or prescriptive option.
- Engineered floor system layout (where required).
- Engineered beam details (i.e. LVL's, steel beams) (where required)
- Residential mechanical ventilation design summary.
- Ventilation duct design:
 - Heat Recovery Ventilator (HRV) duct sizing and layout,
 - Exhaust fan duct sizing and layout.
- Septic application (where required) This is a separate application, see septic.

Fees

- Building Permit fee.
- Plumbing fee.
- Occupancy fee.
- Lot grading exemption fee (if applicable).
- Water/Sewer/Storm connection permit fee(if applicable).
- Water meter fee (if applicable).
- Civic address fee (if applicable).
- Development charges.

Septic Permits - Application Checklist.

Completed Forms.

- Building Permit Application Form.
- Schedule 1: Designer Information.
- Schedule 2: Sewage System Installer Information.

Required Documents.

- Septic System Permit Application Information Package / Worksheets .
- Percolation time ('T' time) report from a licensed testing agency.

Fees.

- Septic Permit fee.

Community Development Division - Building Department

185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6 • 519-426-5870 Ext. 6016

STEP 3: Applying.

Online Portal: Visit [Norfolk Permits Portal](#) and make your application online.



Building Department

[Apply for a Building Permit](#)
[Status and Fees](#)

In Person: Visit our service counter located at 185 Robinson Street, Suite 200 Simcoe Ontario.

Our Permit Coordinators will review your application and provide in writing any item which may be missing from the application and a cost break down for the permit fees and payment options.

Step 4: Plans Review.

A Building Inspector will contact you in writing if there are building code concerns or missing information from your application.

A building permit is issued once all documentation has been received, fees are paid in full, and your plans are checked for compliance with zoning by-law and the building code.

Step 5: Inspections.

Once you have obtained a building permit, a building inspector needs to attend your site at several milestones in the construction process. For more information, please check the inspection section of Norfolk County's Building Department website. Once all inspections are complete and passed your permit is closed.

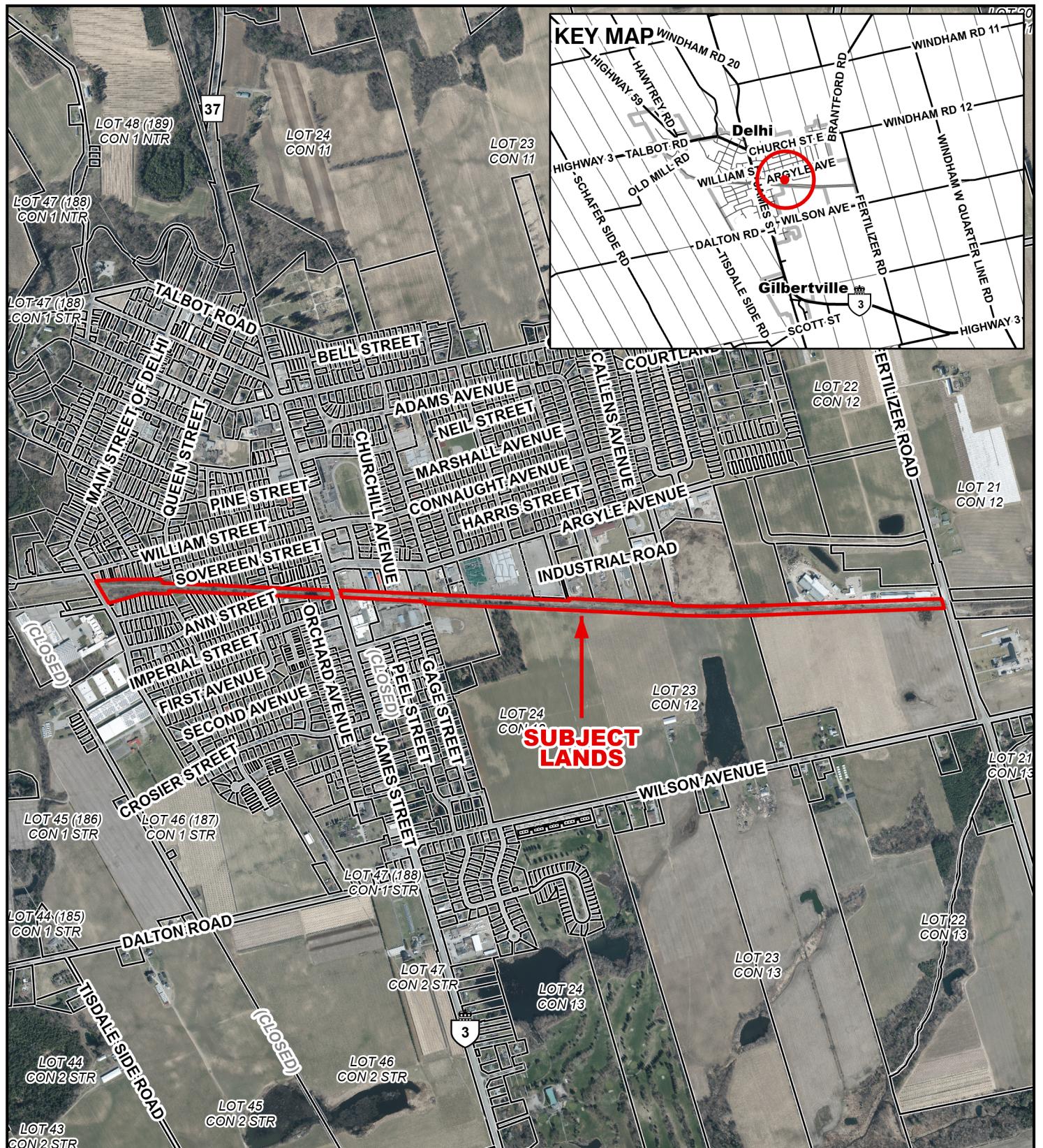
Need Help? If you have any question on the building permit process or plans required, please contact permits@norfolkcounty.ca or 519-426-5870 ext. 6016.

Updated October 2022

MAP A

ZNPL2025357

CONTEXT MAP



Legend

Subject Lands

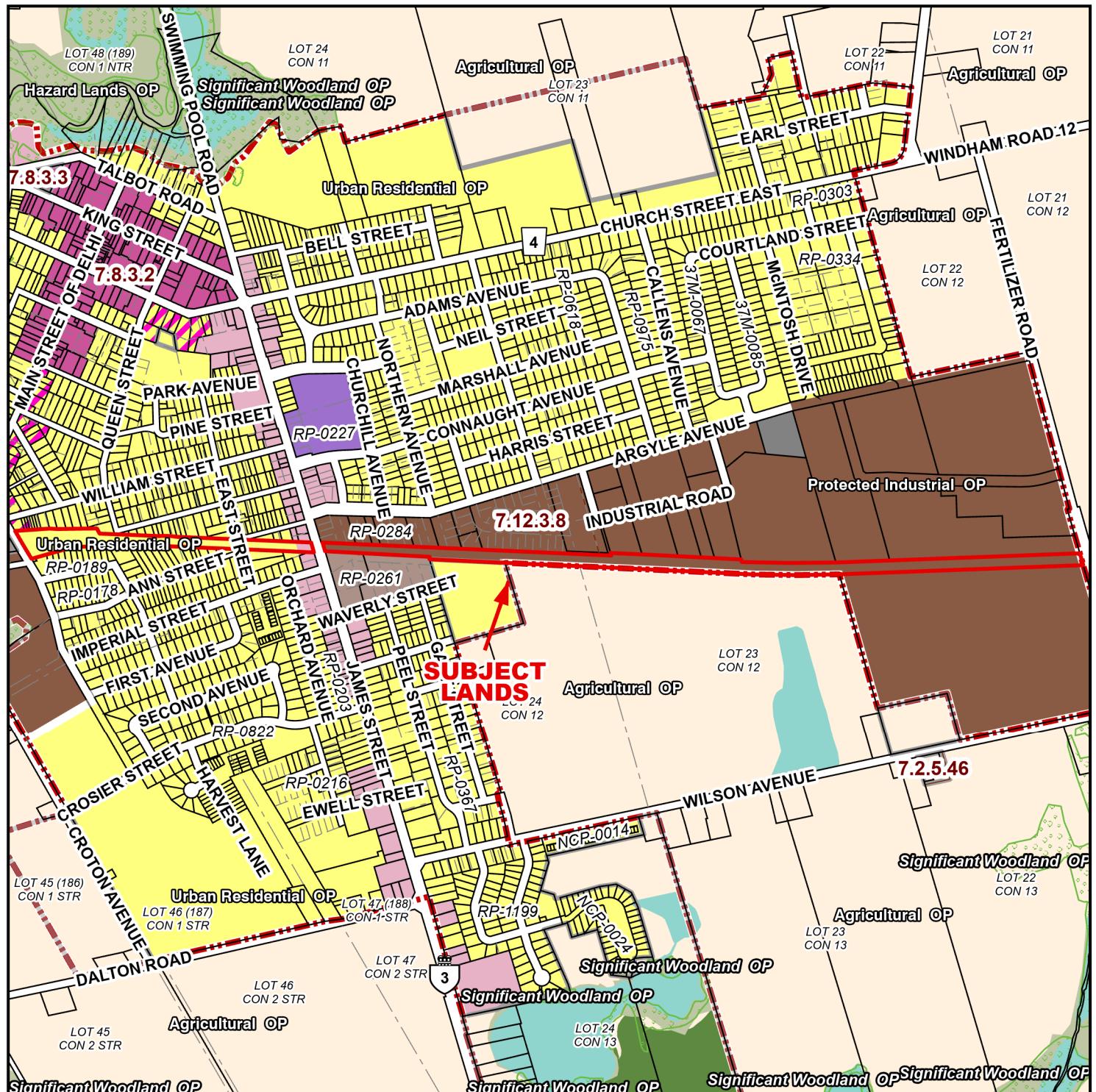
2020 Air Photo

1/22/2026



125 62.5 0 125 250 375 500 Meter

OFFICIAL PLAN MAP



Legend

 Subject Lands

Official Plan Designations

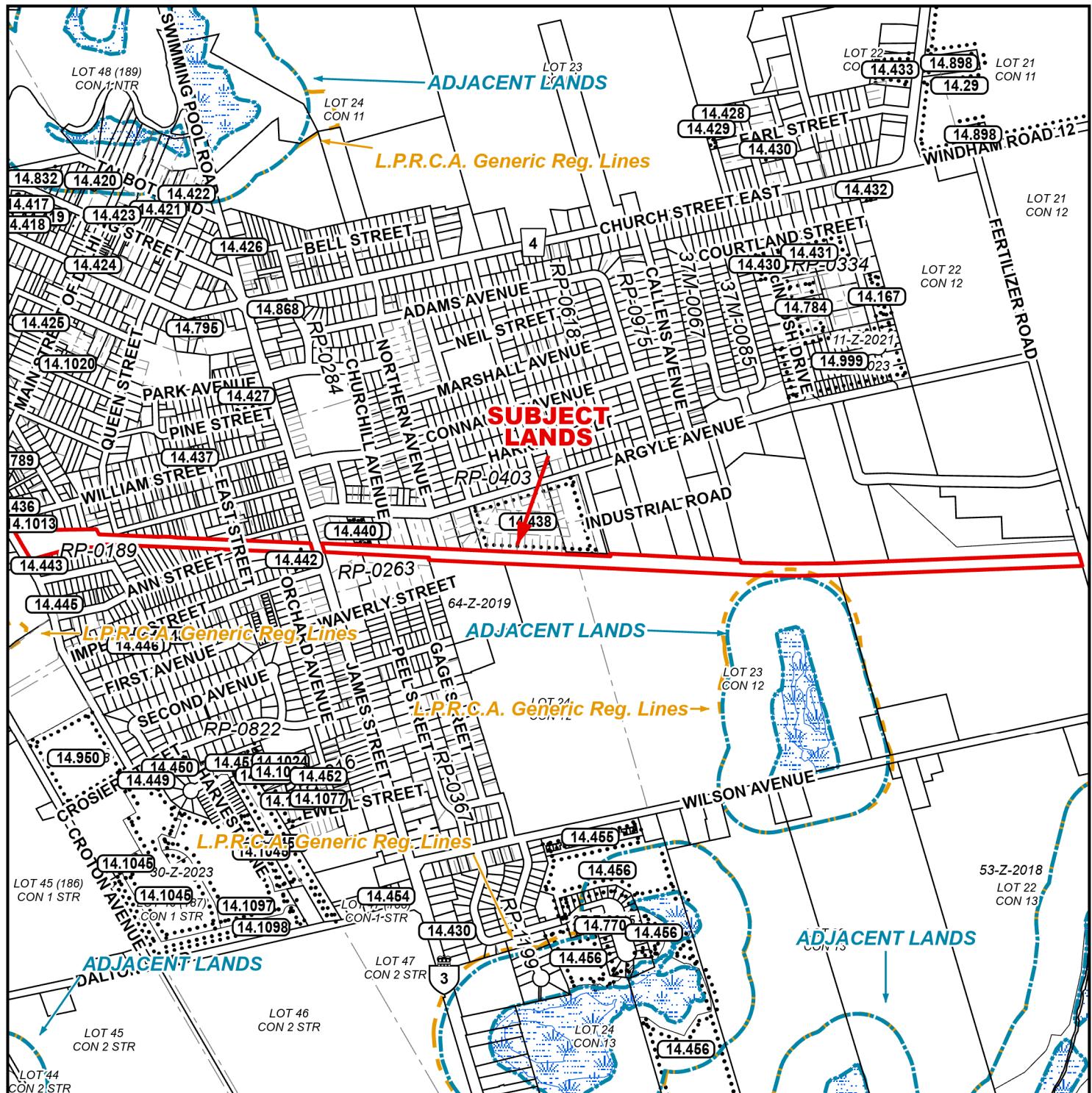
Agricultural	Protected Industrial
Hazard Lands	Industrial
Provincially Significant Wetland	Major Public Infrastructure
Urban Residential	Major Institutional
Mixed Residential/Commercial	Parks & Open Space
Downtown	Urban Area Boundary
Commercial	Significant Woodland

1/22/2026



100 50 0 100 200 300 400 Meters

PROPOSED ZONING BY-LAW AMENDMENT MAP



LEGEND

- Subject Lands
- Adjacent Lands
- Wetland
- LPRCA Generic RegLines

ZONING BY-LAW 1-Z-2014

- (H) - Holding
- A - Agricultural Zone
- CBD - Central Business District Zone
- CS - Service Commercial Zone
- IC - Community Institutional Zone
- D - Development Zone
- MD - Disposal Industrial Zone
- MX - Extractive Industrial Zone
- MG - General Industrial Zone
- HL - Hazard Land Zone
- ML - Light Industrial Zone
- IN - Neighbourhood Institutional Zone
- OS - Open Space Zone
- PSW - Provincially Significant Wetland Zone
- R1-A - Residential R1-A Zone
- R1-B - Residential R1-B Zone
- R2 - Residential R2 Zone
- R3 - Residential R3 Zone
- R4 - Residential R4 Zone
- R5 - Residential R5 Zone
- MR - Rural Industrial Zone

1/22/2026

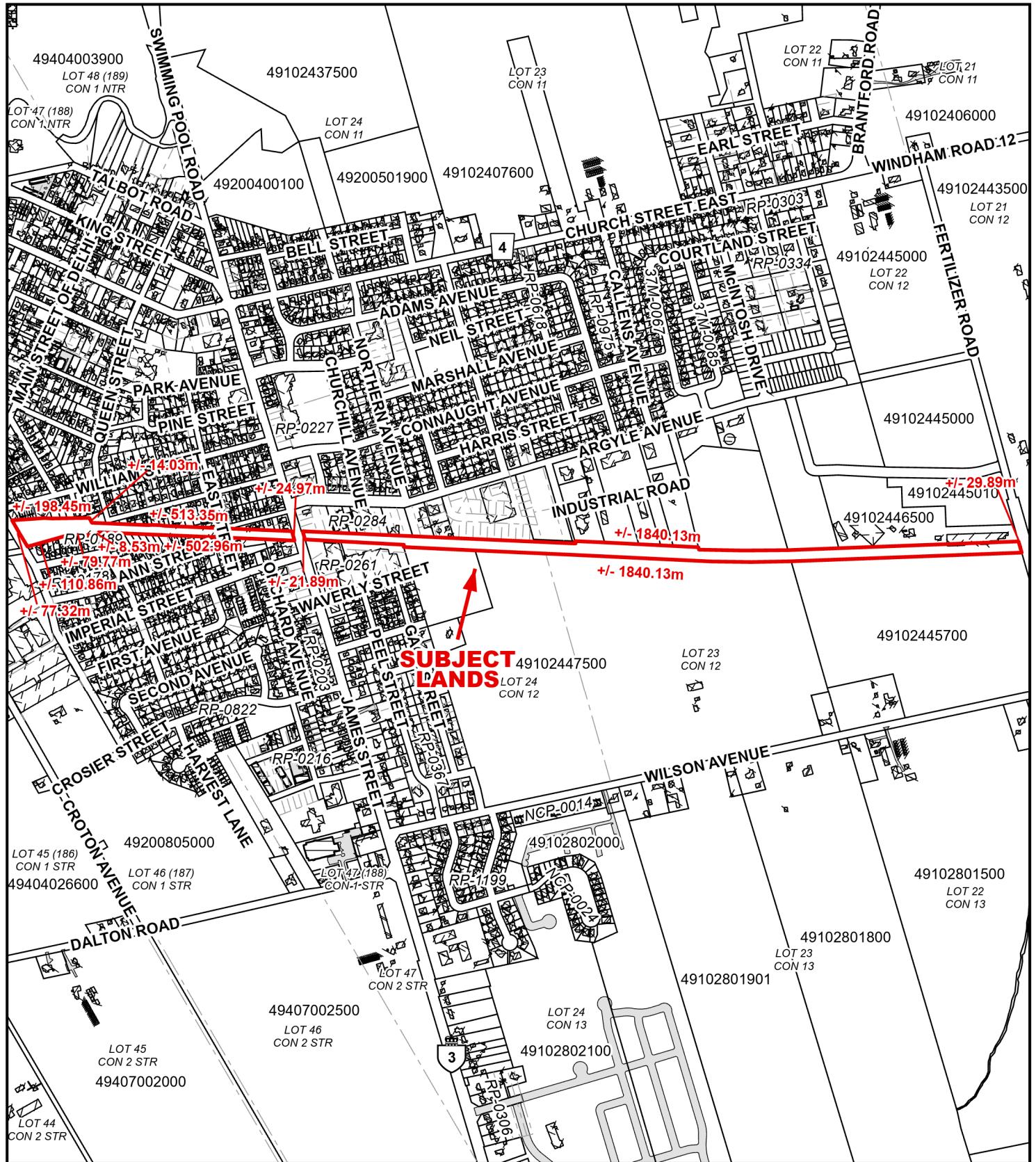


100 50 0 100 200 300 400 Meters

MAP D

ZNPL2025357

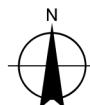
CONCEPTUAL PLAN



Legend

Subject Lands

1/22/2026

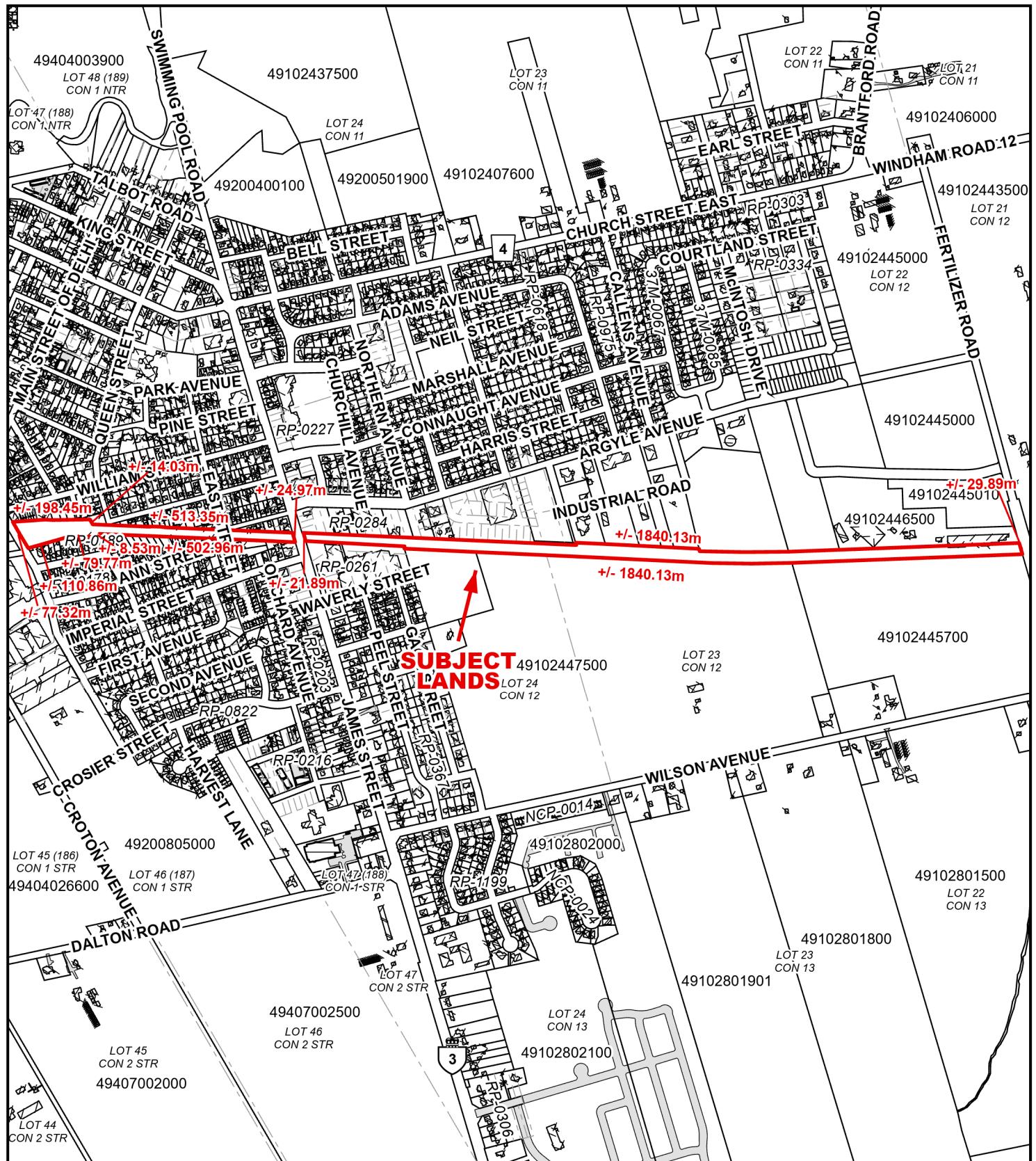


110 55 0 110 220 330 440 Meters

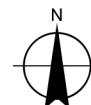
LOCATION OF LANDS AFFECTED

ZNPL2025357

CONCEPTUAL PLAN



1/22/2026



110 55 0 110 220 330 440 Meters