LOWER TRENT CONSERVATION
714 Murray Street, R.R. 1, Trenton, Ontario K8V 0N1
Tel: 613-394-4829 Fax: 613-394-5226 Website: www.ltc.on.ca Email: information@ltc.on.ca
Registered Charitable Organization No. 107646598RR0001

NOTICE OF HEARING BOARD MEETING
LOWER TRENT CONSERVATION
TO BE HELD AT
Administration Office, 714 Murray Street, Trenton / Virtually Join the Meeting
On
Thursday, July 13, 2023, at 1:00 PM
For
O. Reg. 163/06 Permit Application #RP-23-055 and #RP-23-108

APPLICANT: **for RP-23-055:** Jewell Engineering Inc. for 2852243 Ontario Inc.

for RP-23-108: Jewell Engineering Inc for Mr. Trumble

LOCATION: **for RP-23-055:** 37B Durham Street North, Northumberland County, Geographic Township of Cramahe, Concession 2, Part Lot 29

for RP-23-108: 2420 Shelter Valley Road, Northumberland County, Geographic Township of Haldimand, Concession 3, Part Lot 12

AGENDA

1. Meeting called to order by the Chair
2. Motion for the Board of Directors to sit as the Hearing Board

There are two Hearings to be conducted:

3. Opening Remarks by Chair for **RP-23-055**
4. Disclosure of pecuniary interests
5. Staff Report and Presentation — Page # 3
6. Applicant Presentation — Page # 353
7. Additional Information Sharing
   a. Additional Questions from the Board
   b. Comments or Question from the Applicant
   c. Comments or Questions from Staff
8. Deliberation (In-Camera if required)
9. Motion on the Hearing Board Decision for RP-23-055

10. Opening Remarks by Chair for **RP-23-108**

11. Disclosure of pecuniary interests

12. Staff Report and Presentation Page # 367

13. Applicant Presentation Page # 445

14. Additional Information Sharing

a. Additional Questions from the Board
b. Comments or Question from the Applicant
c. Comments or Questions from Staff

15. Deliberation (In-Camera if required)

16. Motion on the Hearing Board Decision for RP-23-108

17. Motion to adjourn the Hearing Board

PLEASE CONTACT THE OFFICE IF YOU WILL BE UNABLE TO ATTEND THIS MEETING

Kelly Vandette 613-394-3915 ext. #215
kelly.vandette@ltc.on.ca

LOWER TRENT CONSERVATION

STAFF REPORT

Date: June 23, 2023
To: Lower Trent Conservation Hearing Board
Re: Ontario Regulation 163/06 Application for Permission RP-23-055 to Develop/Alter Two Watercourse Features
Prepared by: Gage Comeau, Manager, Watershed Management, Planning and Regulations

---

DATE

June 23, 2023

DATE RECEIVED

Permit application received - March 7, 2023
Permit application submission deemed complete – May 24, 2023
Request for Hearing received - May 26, 2023

APPLICANT

2852243 Ontario Inc. (OWNER)
Amanda Redden– Jewell Engineering Inc. (AGENT)
(Project Description letter, Copy of application, Hydrology & Hydraulic Analysis, Revised Environmental Impact Study/Fisheries Assessment, Slope Stability Assessment letter report, Watercourse relocation plan, DFO Review letter report and Proposed Watercourse engineer design drawings, ***Appendices 1 – 8***)

LOCATION

37B Durham Street North, Village of Colborne – Eastfields Subdivision Lands, Geographic Township of Cramahe, Concession 2, Part of Lot 29
(Map attached, see ***Appendix 9***)

OVERVIEW

Lower Trent Region Conservation Authority (LTC) received an application for the alteration of two watercourse features and development within the regulated area associated with two tributary streams of Colborne Creek. The proposed watercourse alterations (see **Appendix 6**) involves removing a portion of a smaller tributary stream (noted as reach 3A in the EIS, see **Appendix 4**) and the removal and realignment of a portion of the other tributary stream (noted as reach 2, in EIS, see **Appendix 4**), both watercourse features traverse the middle of the property and flow to the South- South West. Further, a portion of the tributary stream noted as Reach 2, will be piped and another section will have the embankments altered.

The purpose of removing and relocating the watercourse features are to allow for a larger development area for a residential plan of subdivision. Technical submission materials have identified that the proposed relocation will offer many benefits including; decreased erosion and

sediment transport downstream, efficient management of multiple drainage routes, and creating a more natural channel that will assist with improving the water quality and aquatic habitat. The proposed works; however, do not comply with LTC's Ontario Regulation 163/06 Policy Document (February 2022) and a permit cannot be issued by staff.

PROPOSAL

The proponent is seeking approval from LTC to remove and redirect portions of the two intermittent watercourse features in order to increase the development area for future residential development on the property. The subject watercourses extend through the middle of the parcel, which is currently vacant and used for agricultural purposes.

As previously noted, the proposed watercourse alterations involve removing a portion of a smaller tributary stream (noted as Reach 3A in the EIS) and the removal and realignment of a portion of the other tributary stream (noted as Reach 2, in EIS). A portion of the tributary stream noted as Reach 2, will be piped and another section will have the embankments altered. The piped section of Reach 2 will be connected to and converge with Reach 3A.

(Detailed design plans attached, see ***Appendices 6 and 8***).

SUMMARY

LTC is responsible for the administration of Ontario Regulation 163/06 – *Lower Trent Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. In order to guide the implementation of Ontario Regulation 163/06 made pursuant to Section 28 of the *Conservation Authorities Act*, the LTC Board of Directors has approved policies, most recently updated in February 2022. Where a proposal for development or alteration follows the approved policies or is not a significant deviation from the approved policies, designated authority staff may grant permission.

The proposed watercourse alterations have the direct purpose of increasing the development area and would be a significant deviation from the current approved policies. As such, designated staff are not in a position to grant approval of the Ontario Regulation 163/06 permit application.

Key issue: A permit from LTC is required for the proposed watercourse alterations as the activity of excavating, filling and site grading are considered "development" under the Conservation Authorities Act and are to take place within a regulated area as described in Ontario Regulation 163/06. Specifically, within a river or stream valley (Section 2.1.b) of the Regulation). Furthermore, this proposal would constitute an interference with a watercourse (i.e., diversion of an existing channel) which requires permission under Ontario Regulation 163/06 (Section 5. of the Regulation) (refer to ***Appendix 10*** for a copy of O. Reg. 163/06). Given that the permit application is to allow for an activity that does not adhere to the following

policies, LTC staff are not in a position to grant permission:

Lower Trent Region Conservation Authority
Ontario Regulation 163/06 Policy Document (February 2022)

Section 7.2.1 Interference with a Watercourse

1) Interference with a watercourse shall not be permitted.

2) 2) Proposals for channelization and/or realignment will not be considered where the purpose of the proposal is to increase the development potential on the lands.

(LTC's 2022 Policies attached, see ***Appendix 11*** – Relevant sections only).

The applicant was notified that staff could not approve the permit application and of their right to a Hearing before the Authority's Board of Directors (see LTC Letter of Denial, May 26, 2023 – ***Appendix 12***).

The proponent requested LTC staff to proceed with the necessary arrangements for a Hearing (June 6, 2023 Notice of Hearing scheduled for July 13, 2023 – ***Appendix 13***).

The proponent was provided the Hearing Guidelines.
(LTC's 2022 Hearing Guidelines attached, see ***Appendix 14***).

BACKGROUND INFORMATION & CONSIDERATIONS

Planning History

In 2017, LTC received a Draft Plan of Subdivision for the subject property, the subdivision was noted as Colborne Ridge. LTC staff provided comments and recommended approval of the subdivision with conditions. The Draft Plan of Subdivision at the time of submission was for a total of 202 units (121 detached, 16 semi-detached, 20 multiple attached and 45 apartment units, see **Appendix 15 for 2017 Subdivision lot plan**)

In 2021, LTC was circulated on a resubmission for the Draft Plan of Subdivision for the Eastfields Subdivision (formerly known as Colborne Ridge Subdivision). There was a delay due to the Township investigating water and sanitary system capacity. The resubmission was completed by a new developer (2852243. Ontario Inc.) and the same documents/reports were used in the resubmission. Staff noted that are comments from the 2017 submission were still relevant and applicable. On April 22, 2022, LTC was circulated on the approved decision for the Draft Plan of Subdivision (see **Appendix 16**).

On September 6, 2022, LTC attended a meeting with the property owner, the owner's planning consultant (RFA), Northumberland County staff and Cramahe Township staff. The meeting was requested to discuss the redline

process. During this meeting, LTC staff requested further information as revisions were being made to the original subdivision plan (i.e., intensification of the number of units and the stormwater management block was moving). Following this meeting, LTC staff noticed slight issues with the reports that had been submitted and accepted in 2017 and resubmitted in 2021. Current LTC staff had concerns regarding items that seemed to have been missed or not addressed by staff at the time of the 2017 submission nor the 2021 resubmission.

On December 8, 2022, LTC was circulated on the Redline amendment to the Draft Plan of Subdivision. A new set of technical reports and information was provided as part of the submission. The purpose of the Redline application was to revise the overall road network, the type and positioning of 212 residential units and the location of the stormwater and parkland blocks. Within this new submission, an Environmental Impact Study (EIS) addendum showed the presence of a watercourse feature that traversed the property flowing from the East and flowing west through a wetland feature that was mapped as part of the previous EIS that was completed for the 2017 submission. This watercourse feature was not mapped during the original EIS. Additionally, the Redline submission illustrated the realignment of the watercourse that was illustrated in the EIS addendum. Through the design process for the Redline application for the subdivision, the applicants determined that the previous proposal was not adequate to meet their needs.

Following a full and thorough review of the Redline submission, LTC staff were not confident in the previously accepted EIS. As such, a site visit was completed to review the property and verify the information shown in the EIS addendum. While attending the site, two unmapped watercourse features were observed. LTC Staff comments regarding this submission requested a deferral in order to properly assess the regulated features on the subject property (i.e., identify the watercourse locations). Additionally, staff noted that a watercourse alignment would not be supported by staff and that if a permit was submitted, the owner/agent could request a Hearing when the permit is formally denied by staff.

On March 7, 2023, a permit application was made for the watercourse alterations on the subject property. On the same day, LTC Staff provided a checklist of reports and information required for a complete permit application.

On April 17, 2023, LTC staff were circulated on a second Redline submission, which provided the information that was requested previously. The revised plans showed the lot plan accommodating the 212 total units without an alteration or realignment to the watercourse features (see **Appendices 17-18**). LTC provided comments in support of the second Redline submission on May 4, 2023.

Following the submission of our Planning comments on May 4, 2023, LTC staff received the remainder of the documents required for the permit application. The permit was deemed complete on May 24, 2023.

It is staff's understanding that the secondary submission for the Redline application was made to avoid delays while concurrently proceeding with the permit application. A modification to the Redline application to reflect the proposed watercourse alteration (if approved) would not merit a full recirculation.

DEVELOPMENT & INTERFERENCE WITH A WATERCOURSE

The proposed works would include earth works that would involve excavating and site grading within the valley associated with the existing watercourses. Once the proposed works are constructed and stabilized, flows will be diverted from the existing watercourses through the new channel and the existing watercourse feature will be backfilled. These "development" activities require written permission, with or without conditions, from LTC. Overall, the proposal constitutes a watercourse interference as it is to involve the diversion of existing watercourses. Interference with a watercourse requires written permission, with or without conditions, from LTC.

Ontario Regulation 163/06 states that the Authority (i.e., LTC) may grant permission for development in a river or stream valley if, in its opinion, the control of flooding, erosion, pollution or the conservation of land will not be affected by the development. Further, Ontario Regulation 163/06 states that the Authority (i.e., LTC) may grant permission to in interfere with a watercourse. The technical submissions and design details have demonstrated that the proposed alterations can proceed without affecting the control of flooding, erosion, pollution or the conservation of land. However, LTC's permitting policies as described indicate that realigning a watercourse to allow for a larger development area is generally not an acceptable watercourse interference.

STAFF CONCLUSION

The proposal requires a permit from LTC pursuant to Ontario Regulation 163/06 and does not conform to LTC's Ontario Regulation 163/06 Regulation Policy Document (see ***Appendix 11***).

JEWELL ENGINEERING

April 26, 2023

Lower Trent Conservation
714 Murray St
R.R.#1 Trenton ON K8V 0N1

Attn: Gage Comeau
Regulation & Enforcement Officer

Re: Eastfields Subdivision – Watercourse Realignment
Permit No. RP-23-055
Jewell File No. 210-5024

Mr. Comeau:

Jewell Engineering Inc (Jewell) was retained by Fidelity Group of Companies (Fidelity) to prepare this project description provided to support the Watercourse Realignment permit (RP-23-055) submitted for the Eastfields Subdivision.

The site is currently vacant undeveloped land and has draft plan approval for the Eastfields Subdivision.

An unmapped watercourse traverses the site, draining from northeast to southwest. The watercourse commences at Durham St North at the confluence of the existing roadside ditches and a 450mm road cross culvert. Drainage from these features converges at the east site boundary and flows across the site through the active agricultural lands before entering a wooded/wetland area. From here drainage continues southwest until it reaches Colborne Creek at the Kensington Ave crossing. See attached excerpt from the Environmental Impact Study Review completed by Cambium Inc (Cambium). As shown, six distinct reaches were identified within the watercourse on the subject site.

The proposed watercourse realignment is summarized on the attached sketch and includes realignment of reaches 2 and 3A.

No modifications are proposed downstream of Reach 3A within the natural wooded/wetland area.

BELLEVILLE
(HEAD OFFICE)
1—71 Millennium Pkwy.
Belleville ON K8N 4Z5
Tel: 613-969-1111
info@jewelleng.ca

TOLL FREE
1-800-966-4338

KINGSTON
208—4 Cataraqui St.
Kingston ON K7K 1Z7
Tel: 613-389-7250
kingston@jewelleng.ca

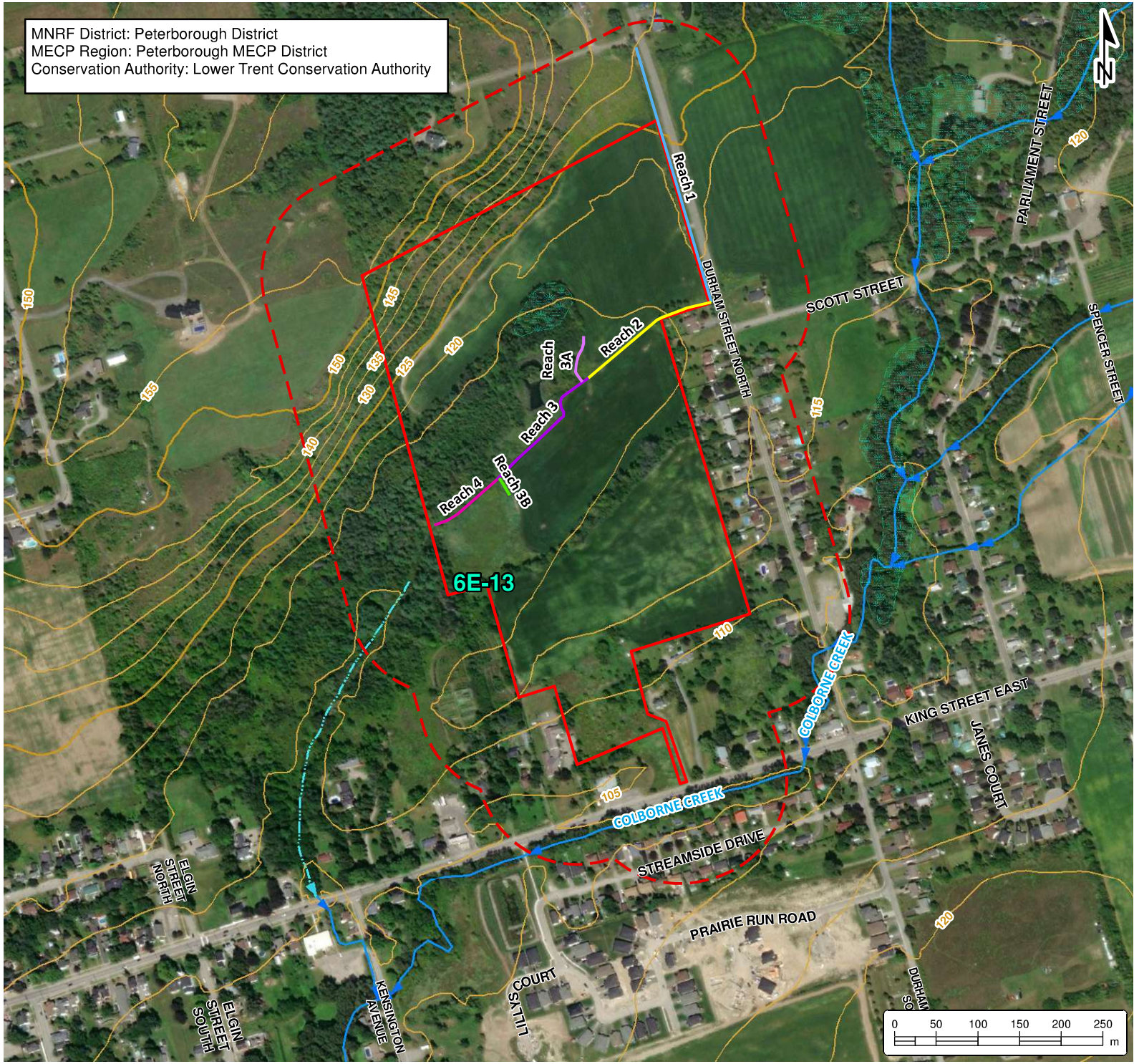
OAKVILLE
214-231 Oak Park Boulevard
Oakville, ON L6H 7S8
Tel: 905-257-2880
oakville@jewelleng.ca

www.jewelleng.ca

Based on historical aerial imagery, it is Cambium's understanding that the feature on site is of man-made origin and has a relatively low sensitivity (channelized, limited substrates/habitat features, choked with in-channel vegetation, contains phragmites). The Environmental Impact Study Review completed by Cambium provides a detailed summary of mitigation measures that, if adhered to, will appropriately mitigate any potential negative impacts associated with the watercourse realignment work.

Consideration has been given to maintaining the existing watercourse feature and altering the draft plan accordingly. However, disturbance of the watercourse would still be necessary for the crossing of Street B. The minor realignment proposed on either side of the Street B crossing allows for a more orderly progression of development and will provide a higher value watercourse section once completed (will not be choked with in-channel vegetation, no phragmites, etc.). The proposed realignment will also provide a larger, undivided area for active parkland use.

Amanda Redden, P.Eng.
Jewell Engineering Inc.



ENVIRONMENTAL IMPACT STUDY

2852243 ONTARIO INC., FIDELITY ENGINEERING & CONSTRUCTION
Part of Lot 182, Reid Plan and
Part of Lot 29, Concession 2,
Township of Cramahe, Ontario

LEGEND

- Watercourse, Intermittent
- Watercourse, Permanent
- Contour 5m Interval (Major)
- Contour 5m Interval (Minor)
- Unevaluated Wetlands
- Ecodistrict
- Adjacent Lands (120m)
- Site

Drainage Feature:

- Reach 1
- Reach 2
- Reach 3
- Reach 3A
- Reach 3B
- Reach 4

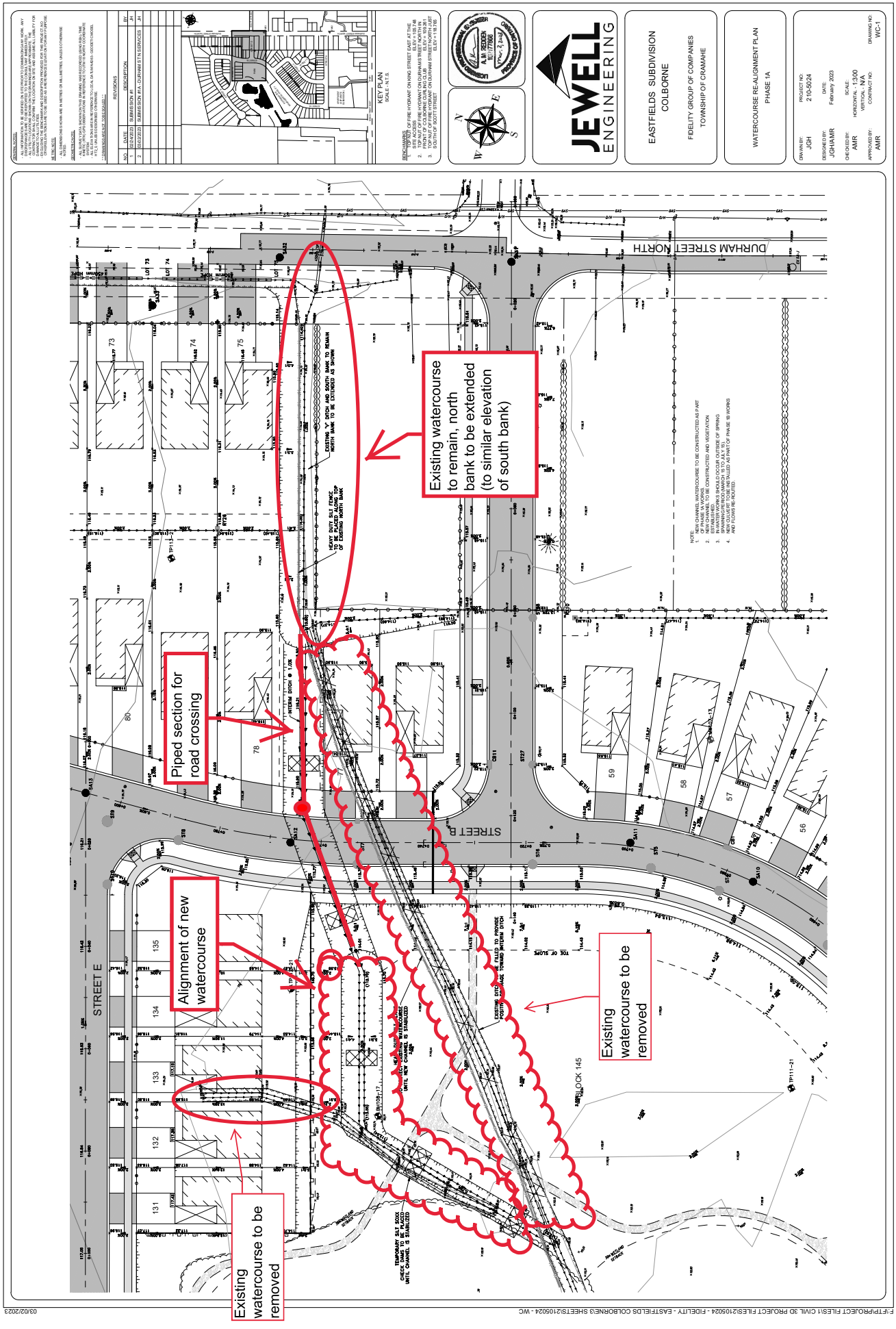
Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

CAMBIUM
194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

SITE DRAINAGE FEATURES

Project No.: 6697-003		Date: February 2023 Rev.:	
Scale: 1:6,500		Projection: NAD 1983 UTM Zone 18N	
Created by: DBB	Checked by: KD	Figure:	1

O:\GIS\MXDs\6600-6699\6697-003 Fidelity Engineering & Construction - EIS Review - Eastfields Colborne Res Dev\2023-03-16 FIG 1 - Site Drainage Features.mxd


Existing watercourse to remain, north bank to be extended (to similar elevation of south bank)
Piped section for road crossing
Alignment of new watercourse
Existing watercourse to be removed
Existing watercourse to be removed
DURHAM STREET NORTH
STREET B
STREET E
JEWELL ENGINEERING
EASTFIELDS SUBDIVISION
COLBORNE
FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE
WATERCOURSE RE-ALIGNMENT PLAN
PHASE 1A
KEY PLAN
SCALE N.T.S.
REVISIONS
DESIGNED BY: JGH/AMR
CHECKED BY: AMR
APPROVED BY: AMR
PROJECT NO: 21-05024
DATE: February 2023
SCALE: HORIZONTAL - 1:300 VERTICAL - N/A
DRAWING NO: WC-1
CONTRACT NO:

LOWER TRENT
CONSERVATION

714 Murray Street, R.R. 1, Trenton, Ontario K8V 0N1
Tel: 613-394-4829 Fax: 613-394-5226 Website: www.ltc.on.ca Email: information@ltc.on.ca
Registered Charitable Organization No. 107646598RR0001

Application

Development, Interference with Wetlands & Alterations to Shorelines & Watercourses
(Pursuant to Ontario Regulation 163/06)

Please read, complete each section as required, date and sign this application

Project Description		
Project Location (Civic Address): 37B Durham St N, Colborne		
Municipality: Cramahe		
Nearest Intersection: Durham St N & King St E		
Assessment Roll Number*: 14110120301161000000		
Lot: 29	Concession: 2	Ward:

*Note: The Roll Number can be found from your Property Assessment Notice, real estate agent, or online Map Viewer at www.ltc.on.ca (click on Planning & Permits)

Project Details

Description of Proposed Works:
Watercourse re-alignment for facilitation of Eastfields development.

Amount & type of fill (m^3) to be added/removed/moved:
NA

Note: Fill is defined as earth, sand, gravel, topsoil, building materials, rubble, rubbish, garbage or any other material whether similar to or different from any of the aforementioned materials, whether originating on the site or elsewhere, used or capable of being used to raise, lower, or in any way affect or alter the contours of the ground.

Proposed Start date (YYYY/MM/DD):	Anticipated Date of Completion:
2024/01/01	2024/03/31

Has a previous application to Lower Trent Conservation been filed on this property? If yes, please provide previous permit number.

- ☐ Yes
- ☒ No

Property Owner	
Name: 2852243 Ontario Inc.	
Mailing Address: 512 Purdy Rd	
City: Colborne	Postal Code: K0K 1S0
Phone #: 905-376-4804	Cell #:
Email: jpillsworth@fidelityeng.com	Fax #: 905-355-2555

Agent	
☐ Same as Property Owner	
Name: Amanda Redden	
Company/Organization: Jewell Engineering Inc.	
Mailing Address: 1 - 71 Millennium Parkway	
City: Belleville	Postal Code: K8N 4Z5
Phone #: 613-969-1111	Cell #:
Email: reddena@jewelleng.ca	Fax #:

Note: Correspondence will be sent to agent, when applicable.

Approved Permit Circulation

☒ email pdf copy ONLY ☐ mail hardcopy ONLY ☐ Pickup at LTC office ***appointment required***

Pre-application Consultation

A pre-application consultation may be in the form of a phone conversation, a meeting, email message, and/or site visit.

Have you conducted any pre-application consultation with a Lower Trent Conservation staff member to determine site issues and technical requirements for a "complete" application?

☒ **Yes (please indicate method below)** LTC File Number: PL-22-301 & PL-23-012

☐ by phone ☒ by meeting ☐ by email ☐ by site visit

☐ **No**

Further Considerations

Is there a violation on this property under Ontario Regulation 163/06?

☒ No ☐ Yes (provide details below) ☐ Don't know

If yes, please provide file # - ENF-

Are *Planning Act* or Municipal approvals required?

☐ No ☐ Don't know

☒ Yes (check all that apply)

☐ Official Plan Amendment ☐ Minor Variance ☒ Zoning ☐ Consent

☒ Draft Plan of Subdivision ☐ Building Permit ☐ Site Plan ☐ Septic ☐ Other

Do you authorize LTC to circulate approved permit to Municipal Planning & Building Officials? ☐ No ☒ Yes

Are there any other required Approvals? (e.g. MNRF, Fisheries and Oceans Canada)

☒ No ☐ Yes (please select below) ☐ Don't know

☐ MNRF ☐ Parks Canada ☐ DFO

Notice of Collection

Pursuant to the *Municipal Freedom of Information and Protection of Privacy Act,* the personal information contained on this form is collected under the authority of the *Conservation Authorities Act*. This information is used to assess applications and, where approved, issue the Development, Interference with Wetlands & Alterations to Shorelines and Watercourses permit. Information on this form may be disclosed to Government and Municipal agencies for review and comment, or to members of the public through the Freedom of Information process. Questions about the collection of information should be directed to the Chief Administrative Officer, Lower Trent Conservation, 714 Murray Street, Trenton, ON, K8V 0N1, 613-394-4829.

Any false or misleading statement made on this application will render null and void any permission granted.

I, the owner, Jim Pillsworth (Name) of 2852243 Ontario Inc (Organization (if any))

solemnly declare that to my best knowledge and belief, all of the above information, plans and submissions to be true, valid and current. I further accept the aforementioned inclusions, terms, and conditions to be binding upon the registered owner(s) of the property and all assigned agents, contractors, and/or constructors acting on my behalf. My signature acknowledges the right to exercise binding authority.

*Signature of Owner: [redacted]	Date: March 7, 2023

* Signature or written authorization from the property owner is mandatory

Signature of Agent:	Date: March 7, 2023

GENERAL CONDITIONS

1. By signing this application, consent is given to Lower Trent Conservation (herein referred to as LTC), its employees and other persons as required by LTC, to access the property for the purpose of inspection, obtaining information, and/or monitoring any and all works, activities, and/or construction pertaining to the property in addition to the works as approved under cover of any permit issued by LTC.

2. The owner and agent agree:
   a. To indemnify and save harmless LTC and its officers, employees, or agents, from and against all damages, loss, costs, claims, demands, actions and proceedings, arising out of or resulting from any act or omission of the owner and/or agent or any of their employees or contractors relating to any of the particulars, terms, or conditions of this permission;
   b. This permission shall not release the owner/agent from any legal liability or obligation and remains in force subject to all limitations, requirements, and liabilities imposed by law; and,
   c. All complaints arising from the execution of the works authorized under this permission shall be reported immediately by the owner/agent to LTC. The owner/agent shall indicate any action which has been taken, or is planned to be taken, if any, with regard to each complaint.

3. Permits granted by LTC are not transferrable and are issued to the current owner of the property only.

4. The owner/agent agrees that, should the works be carried out contrary to the terms of this permission, LTC may enter onto the property and cause the terms to be satisfied at the expense of the owner.

5. The works shall be carried out as per the approved plans and specifications submitted in support of the application and as amended by the approval of this permission.

6. The owner/agent agrees to install and maintain all sediment controls as directed by LTC staff, until all disturbed areas have been stabilized.

7. All disturbed areas shall be seeded, sodded, or stabilized in a manner acceptable to LTC as soon as possible, and prior to the expiry of this permission.

8. The owner/agent agrees to maintain all existing drainage patterns, and not to obstruct external drainage from other adjacent private or municipal lands.

9. The owner/agent agrees to contact LTC once the development has commenced so an inspection of the development can be undertaken.

10. Permits granted by LTC do not replace building permits or any other permits or approvals issued through Municipal offices and/or other levels of Government. A permit under Ontario Regulation 163/06 does not constitute LTC approval of any related *Planning Act* applications. Separate approval of all related applications must be obtained from their respective agency and LTC.

11. Permits issued by LTC are valid for a period of two (2) years from the date of issue. After a permit has expired, a new application must be submitted. The current fee schedule during submission applies.

12. It is the responsibility of the owner/agent to ensure that a valid permit is in effect at the time the work is occurring.

LANDOWNER AUTHORIZATION FORM

Subject Property		
Civic Address: 37B Durham St N, Colborne		
Municipality: Cramahe		
Assessment Roll Number: 14110120301161000000		
Lot: 29	Concession: 2	Ward:

If an application is to be submitted by a solicitor or agent on behalf of the owner(s), this Landowner Authorization must be completed and signed by the owner(s). If the owner is a corporation acting without agent or solicitor, the application must be signed by an officer of the corporation and the corporation's seal (if any) must be affixed.

If the application is to be prepared by a solicitor or agent, authorization should not be given until the application and its attachments have been examined and approved by you, the owner(s).

I/we Jim Pilsworth

hereby authorize Jewell Engineering

to provide as my agent any required authorization or consents, to submit the enclosed application to Lower Trent Conservation, and to appear on my behalf at any hearing(s) of the application and to provide any information or material required by the Lower Trent Conservation Board of Directors relevant to the application for purposes of obtaining a permit to develop, interfere with a wetland or alter a shoreline or watercourse, in accordance with the requirements of Ontario Regulation 163/06 as amended.

Signature of Owner: [redacted] Date: March 7 2023

Signature of Agent: Date: March 7, 2023

SUBMISSION REQUIREMENTS

Permit applications may be submitted by email to permits@ltc.on.ca. Application fees will be invoiced by email. If no email address is available, other payment options will be discussed. Current application fees can be found on our fee schedule at www.ltc.on.ca or contact Lower Trent Conservation at 613-394-4829. Applications will not be processed until the fee is paid in full. **The application fee is non-refundable.**

FOR OFFICE USE ONLY

Application File Number:	Permit File Number:
Subwatershed:	Regulated Feature:
Permit application rec'd:	Application complete:
Deposit Required: Ontario Land Surveyor ($500) ☐ Yes ☐ No	Coastal Engineer ($1,000) ☐ Yes ☐ No
Amendment request rec'd:	Amended application complete:

Fee Required:

☐ Routine	$100
☐ Minor	$220
☐ Standard	$550
☐ Complex (require review of 1 technical study)	$825
☐ Complex (require review of 2 or more technical studies)	$1,100
☐ Permit amendment (administrative)	$100
☐ Permit amendment (significant) - 1/2 original application fee	_____
☐ Compliance permit - double the application fee	_____
☐ Restoration agreement - double the application Fee	_____
☐ Deposit	_____

Amount Received: _____ Date Received: _____

Method of Payment: ☐ Cheque ☐ Credit Card ☐ Cash

Deposit Returned: _____ Date Returned: _____

☐ **Permission for Minor Works:**

- ☐ Undertake minor landscaping involving the placement, removal or re-grading of material up to 20m³ (minor fill)
- ☐ Minor shoreline protection up to 20m³
- ☐ Undertake watercourse or shoreline alteration involving less than 20m² (minor alteration)
- ☐ Construct a non-habitable accessory structure up to 10m²
- ☐ Construct a habitable addition up to 10m²
- ☐ Construct a deck up to 23m²
- ☐ Install a pool up to 10m²

☐ **Permission for Standard or Complex Permit:**

- ☐ Construct, reconstruct, erect or place a building or structure (greater than 10m²)
- ☐ Change building/structure so that it increases its size by 10m² or more, or increases the number of dwelling units
- ☐ Temporary or permanent placing, dumping or removal of any material originating on the site or elsewhere greater than 20m³
- ☐ Change or interfere with a wetland
- ☐ Change or interfere with a watercourse
- ☐ Shoreline protection work
- ☐ Construct a deck greater than 23m²
- ☐ Install a pool greater than 10m²

Permit Approval:

Amendment:

STORMWATER MANAGEMENT REPORT

Eastfields Subdivision

Colborne, ON

Issued for Final Approval

February 27, 2023

Prepared by

Bryon Keene, P.Eng.

Andrew Rosenthal, EIT

Belleville
1 – 71 Millennium Pkwy
Belleville, ON
K8N 4Z5
Tel: 613-969-1111
info@jewelleng.ca

Kingston
208 – 4 Cataraqui St
Kingston, ON
K7K 1Z7
Tel: 613-389-7250
kingston@jewelleng.ca

Oakville
214 – 231 Oak Park Blvd
Oakville, ON
L6H 7S8
Tel: 905-257-2880
oakville@jewelleng.ca

Revision Summary

September 2022

First submission SWM Report issued for redline draft plan revision.

February 2023

SWM Report issued for final approval.

Table of Contents

Table of Tables

Table of Figures

List of Appendices

1 Introduction and Background

Fidelity Group is proposing to construct the Eastfields development that comprises approximately 19.5ha in Colborne, ON (see Figure 1-1). The 212-unit residential development is situated west of Durham St N and north of King St E (County Road 2).

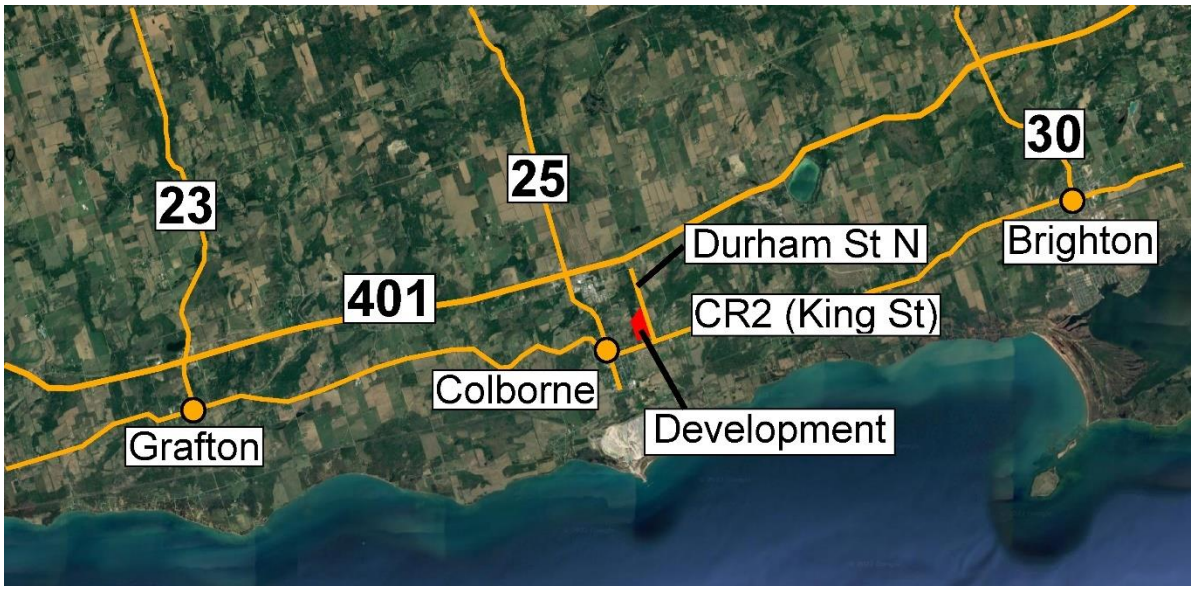


Figure 1-1: Development Site Location (Google, Maxar Tech 2018)

2 Existing Conditions

The development lands have a moderate slope (between 2 and 10 percent in many places), with the steepest lands towards the northwest. The north part of the site drains towards a wetland on site, and a smaller south portion drains towards Colborne Creek in the south. The wetland drains to the same watercourse as the lands to the south, ultimately discharging to Lake Ontario 3.5 kilometres to the southwest (see Appendix B for pre-development catchment plan). The creek has a contributing area of approximately 8.67km^2 at the confluence of the tributary to the main creek.

A portion of the existing development on Durham St N drains to the Durham St N storm sewer. Runoff in the storm sewer receives treatment through use of an OGS unit before discharging to Colborne Creek.

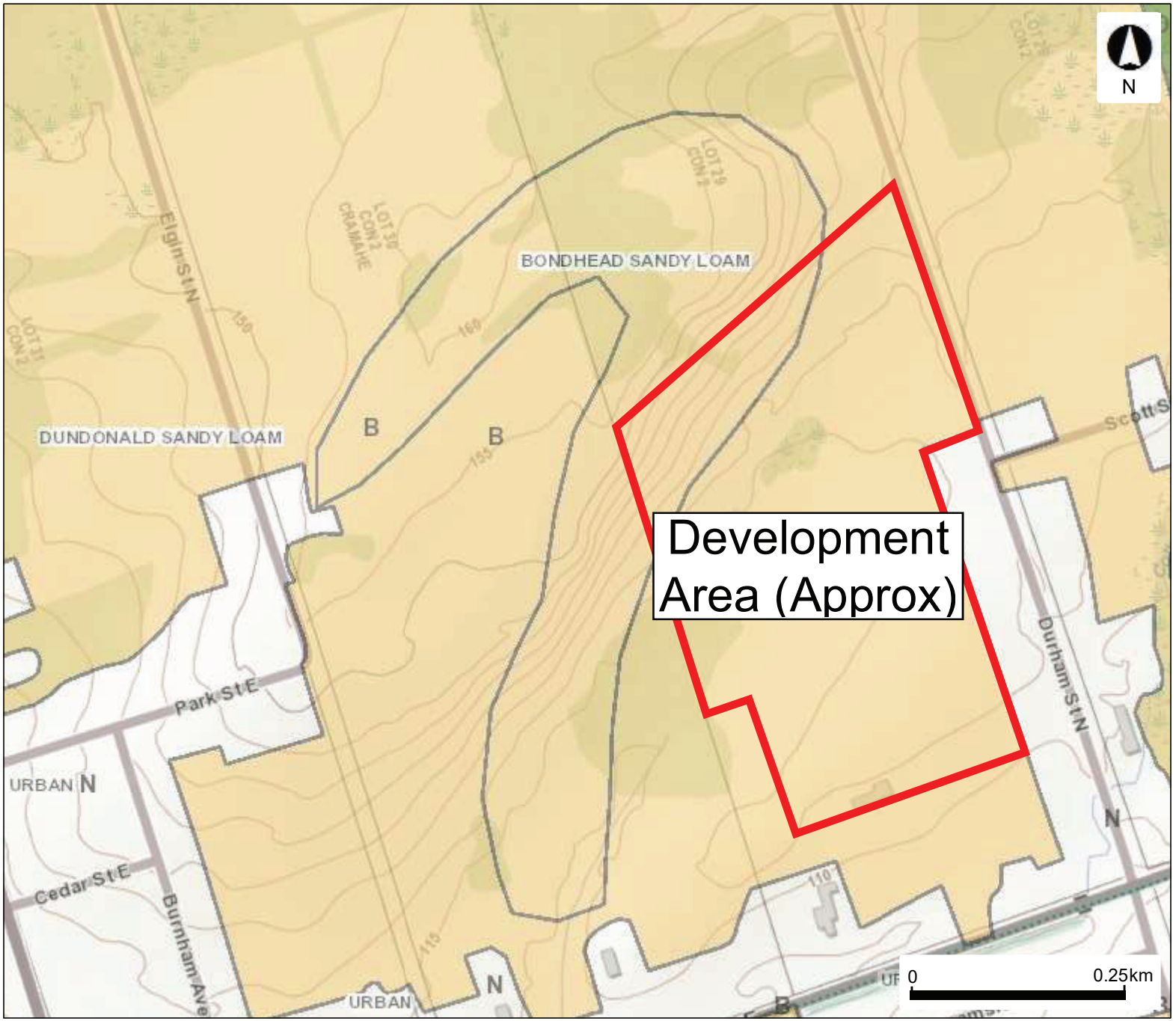
As shown in Figure 2-1 below, the lands are mostly agricultural fields with tree cover in the wetland area and to the north of the site. In total, approximately 17ha of external lands contribute to the wetland and its receiving watercourse.

Figure 2-1: Site Overview (Google, Maxar Tech 2015)

2.1 Soils

Soils descriptions were reviewed from the Soil Survey of Northumberland County (Agriculture Canada and the Ontario Agricultural College, 1974). Figure 2-2 shows the soil distribution in the Village of Colborne from OMAFRA (2022).

Eastfields - Hydrologic Soil Groups



Legend

- Soil Name Label
- Hydrologic Soil Group
  - A - High
  - B - Moderate
  - C - Slow
  - D - Very Slow

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Map Created: 9/7/2022
Map Center: 44.01258 N, -77.8813 W

Soils found on the site include:

- Bondhead Sandy Loam
    - This soil has good drainage with a mixture of sand and silt, with some clay present at depths of 10-14 inches and abundant, angular gravel below 14 inches. This soil is classed as Hydrologic Soil Group B.
- Dundonald Sandy Loam
    - This soil is primarily sand (approximately 50% in top layer and 62-78% below), with increasing amounts of gravel and pebbles at depths below 22 inches. This soil is also classed as HSG B.

Figure 2-3 (from the 1997 MTO Drainage Management Manual) outlines the classifications of Hydrologic Soils Groups.

Hydrologic Soil Group

The hydrologic soil group is used to classify soils into groups of various runoff potential.

The Soil Conservation Service (SCS) classifies bare thoroughly wet soils into four hydrologic soil groups (A, B, C and D). SCS descriptions of the four groups, modified slightly to suit Ontario conditions, are as follows: (Design Chart 1.09)

A: High infiltration and transmission rates when thoroughly wet, eg. deep, well drained to excessively-drained sands and gravels. These soils have a low runoff potential.

B: Moderate infiltration and transmission rates when thoroughly wet, such as moderately deep to deep open textured loam.

C: Slow infiltration and transmission rates when thoroughly wet, eg. fine to moderately fine-textured soils such as silty clay loam.

D: Very slow infiltration and transmission rates when thoroughly wet, eg. clay loams with a high swelling potential. These soils have the highest runoff potential.

In Ontario, soils have been found to lie between the main groups given above, and have therefore been interpolated as AB, BC, CD as appropriate, such as Guelph loam, which is classified as BC.

Figure 2-3: MTO Drainage Management Manual – Description of Hydrologic Soils Groups

2.2 Targets

Jewell consulted with Lower Trent Conservation to discuss the stormwater management objectives for the development.

The stormwater management plan focuses on three environmental objectives when considering the treatment and conveyance of stormwater runoff. The objectives are to mitigate impacts to flooding, water quality, and erosion of the receiving system.

Quantity Control

- Ensure the development doesn't increase peak flows in Colborne Creek.

Quality Control

- Follow the Ministry of Environment guidelines to provide adequate quality treatment to runoff to ensure effluent meets **Enhanced** quality control objectives.

Sediment and Erosion Control

- Minimize the potential for erosion of soils,
- Mitigate the release of sediment offsite.

3 Proposed Conditions

The development has a natural divide that splits the site into two drainage areas. The north area drains naturally towards the wetland that bisects the site, either directly to the wetland or to a channel that flows towards the west and splits the wetland down the middle. The south catchment area drains to the creek running along the south of the site before it crosses under King Street. Discharge from the wetland area will discharge into the creek where the flows are conveyed to Lake Ontario (see figures in Appendix B for pre- and post-development catchment plans).

A storm sewer network will convey the minor flows towards two quantity and quality treatment facilities (justification for the provision of quantity treatment is provided in Section 4.1). A stormwater management pond is proposed to be located at the south end of the wetland, and this pond will collect runoff from the majority of the development, plus a portion of external lands to the north. Runoff from south of the divide will receive primary grit removal through an OGS unit, and quantity treatment will be provided through an underground storage system (EZStorm units). The runoff will drain to the existing storm sewer running south along Durham St, receive final polishing through a second OGS unit, and discharge into Colborne Creek.

The quantity control facilities will limit the post-development peak flows to the pre-development levels.

Runoff exceeding the 5-Yr peak flows will be conveyed along the streets to the SWMF, EZ Storm units, or the wetland

During the Timmins event, the pond will discharge to the wetland through the spillway. The EZStorm units will fill to capacity, and additional runoff will drain across the road surface to the creek downstream at King St E.

4 Hydrologic Modelling

4.1 Model Inputs

Jewell developed an OTTHYMO model to determine the impact of the development on the flows in the creek. Three pre-development catchments were established using the following inputs to model the pre-development conditions:

Table 4-1: Pre-Development OTTHYMO Inputs

Catchment	Area (ha)	Slope (%)	RC	CN	Longest Flow (m)	Tp (hr)
101a	12.80	8.5	0.25	62	528	0.35
101b	21.11	1.2	0.25	71	850	0.85
100	8.90	4.8	0.25	65	330	0.33

Catchments 101a and 101b flow towards the wetland discharging to Node A, and catchment 100 discharges to Colborne Creek to the south.

The three NASHYD catchments were divided in the post-development model (Table 4-2). The undeveloped areas remained as NASHYD catchments (undeveloped areas, or areas with low imperviousness), whereas STANDHYD inputs were used to model developed areas (Table 4-3). STANDHYD inputs focus on percent imperviousness, length of impervious area, and initial abstraction. Note that Block 143 (apartment block) has been modelled as undeveloped land and included in Catchment 607. Due to the topography of this catchment, an independent SWM plan will be required for the apartment block as part of the Site Plan Application.

Table 4-2: Post-Development NASHYD Inputs

Catchment	Area (ha)	Slope (%)	RC	CN	Longest Flow (m)	Tp (hr)	Minor to	Major to
600	5.11	8	0.25	62	381	0.31	Pond	
601	3.97	14	0.25	62	297	0.22	Wetland	
602	2.04	9	0.25	65	250	0.24	Wetland	
603	5.79	2	0.30	70	354	0.42	Wetland	
606	1.28	16	0.30	62	253	0.19	Wetland	
607	5.35	4	0.25	65	205	0.29	Durham/King St	
608	1.38	16	0.30	62	206	0.17	Pond	Wetland
Wetland	4.05	1	0.20	58	310	0.56	Node A	

Jewell used a runoff coefficient of 0.25 to represent the pre-development catchments. Several catchments deviate from 0.25 for the following reasons:

- 603 – Raised to 0.30 due to steeper slope to north and little vegetated cover
- 606, 608 – Raised to 0.30 due to steep slope to north (approx. 16%)
- Wetland – Set to 0.20 to reflect the low rational method runoff coefficients for lakes and wetlands (0.05), and flat topography (1-2%)

Table 4-3: Post-Development STANDHYD Inputs

Catchment	Area (ha)	XIMP %	TIMP %	Length (m)	Imp IA (mm)	Perv IA (mm)	Minor to	Major to
100	3.76	50	60	158	2	5	Pond	
200	0.46	30	40	55	2	5	Pond	Wetland
201	3.10	30	40	144	2	5	Pond	
300	0.66	20	30	66	2	5	Wetland	
301	0.18	20	30	35	2	5	Wetland	
302	0.90	25	37	77	2	5	Wetland	
303	0.53	10	15	59	2	5	Wetland	
400	0.35	30	40	48	2	5	Pond	EZStorm
401	0.19	20	30	36	2	5	Pond	EZStorm
402	1.91	40	50	113	2	5	EZStorm	
604	0.44	15	30	54	2	5	Pond	
605	0.71	15	30	69	2	5	EZStorm	
Pond	0.76	58	66	71	2	5	Wetland	

The pervious and impervious lengths were calculated using the following formula:

$$L = \sqrt{\frac{10{,}000 * A}{1.5}}$$

Where:
L is the length of pervious and impervious cover in metres, and
A is the area of the catchment in hectares.

The model uses Horton's Infiltration to represent the permeability of the soil throughout the rainfall event. The values used in the model come directly from the MTO Drainage Management Manual Chart 1.13, HSG C:

- F_0 = Initial infiltration rate = 125 mm/h
- F_C = Final infiltration rate = 5 mm/h

- DCAY = Decay constant = 2, 1/h
- F = Accumulated moisture at beginning of event = 5mm
- DPSP = Depression storage over pervious area = 2mm

Although the site is covered in HSG B soil, Jewell used the HSG C parameters as a conservative estimate of post-development runoff.

Jewell shifted the catchment 602 hydrograph by 5 minutes (one timestep in OTTHYMO) to account for routing through the ~300m channel along Durham St.

4.2 Minor System

The runoff from catchments 200, 608, 400, and 401 will be split into major and minor flows. The minor flows will enter the development's storm sewer network to the respective treatment facility, while the major flows will drain via overland flow to receive quantity treatment or drain uncontrolled.

The storm sewer system was designed following the Rational Method. The Rational Method is the accepted design tool for sizing storm sewer systems (MOE, 2008). The 5Yr design event is completed using the IDF parameters from the MTO IDF curves.

$$Q = \frac{1}{360} CiA$$

Where:

Q = Peak Flow in m^3/s
C = Runoff Coefficient
i = Rainfall Intensity in mm/hr
A = Area in hectares

The peak flows for the four catchments mentioned above are given below (Table 4-4).

Table 4-4: Determination of DUHYD Peak Flows

Catchment	C	t_c (min)	i (mm/h)	A (ha)	DUHYD (L/s)
200	0.45	16	71	0.46	126
400	0.45	15	74	0.35	32
401	0.40	15	74	0.19	16
608	0.30	15	74	1.38	85

4.3 Modelling Results

The OTTHYMO model was completed for the 25mm, 5Yr, and 100Yr events.

The 25mm event simulated was the 4hr Chicago distribution event as recommended in the SWM Planning & Design Manual (Ministry of the Environment, 2003). The 5- and 100-Yr events were simulated using the 4hr Chicago distribution, and 12- and 24-hr SCS type II distribution with the MTO IDF curves (see Appendix A).

After running the three events, Jewell concluded the following:

- The 12hr SCS type II event produced the greatest storage requirement in the pond, however all three events were stored with surplus capacity (i.e., the pond's full storage was never used).
- The 4hr Chicago event produced the greatest storage requirement in the EZStorm units, with the units filling to capacity during this event.

Since the EZStorm units had minimal surplus capacity during the 4hr Chicago event, Jewell proceeded with the 4hr Chicago event as the critical event.

The results of the OTTHYMO model indicate that the post-development uncontrolled peak flows exceed the pre-development targets as shown in Table 4-5 and Figures 4-1, 4-2 below (see OTTHYMO outputs in Appendix F for further details).

Table 4-5: Pre-Development vs Post-, Uncontrolled Peak Flows

Event	Node	Pre-Development Q (m^3/s)	Post- Development, Uncontrolled Q (m^3/s)
5Yr, 4hr Chicago	Node A	0.36	1.48
	Durham St N	0.15	0.34
100Yr, 4hr Chicago	Node A	0.97	3.06
	Durham St N	0.41	0.93

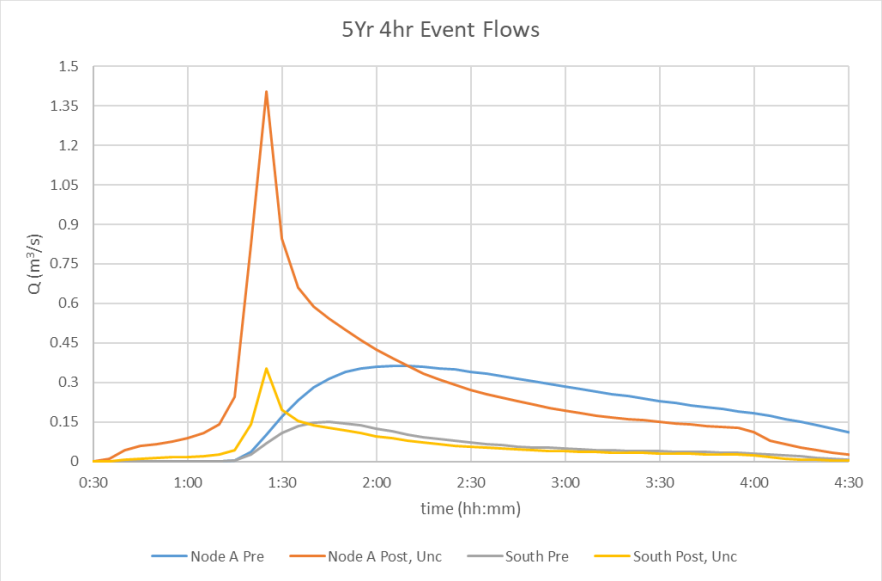


Figure 4-1: Pre-Development vs. Post-Development Uncontrolled, 5Yr 4hr Event

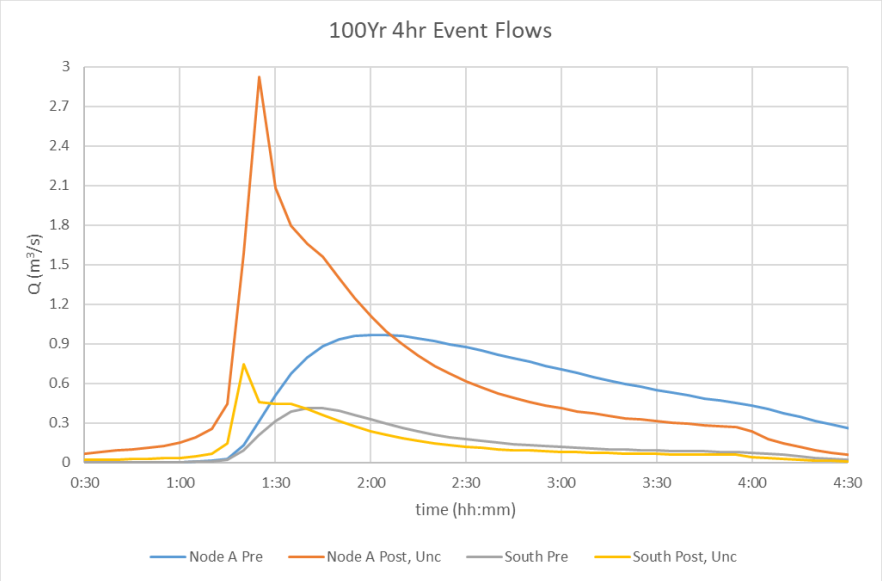


Figure 4-2: Pre-Development vs. Post-Development Uncontrolled, 100Yr 4hr Event

The uncontrolled peak flows are approx. two to four times that of the pre-development flows, which is a clear indication that quantity controls are required. Jewell recommends the construction of a stormwater management facility (wet pond), in addition to EZStorm units, to control the post-development runoff to the target flows.

5 Stormwater Management Controls

5.1 Selection of Preferred Technologies

The pre-development area draining to the wetland is approximately 34ha (roughly 15ha of which is from the development lands). Due to the large contributing area, Jewell selected a wet pond SWMF to provide both quality and quantity treatment to runoff.

The 2003 MOE SWM Planning and Design Manual stipulates that the following technologies are appropriate for contributing areas exceeding 5 hectares:

- Wet pond
- Dry pond
- Wetland

A wet pond was selected as this facility can provide ***Enhanced*** quality treatment to runoff, as well as providing the required quantity control.

For the south catchment area, Jewell selected EZStorm units for quantity control. These chambers were selected as the contributing area is approximately 2ha. Space is limited in the south area as the land is dense with development, so EZStorm chambers were selected as no surface space is used. An OGS unit will be placed upstream of the EZStorm units to provide ***Enhanced*** quality treatment.

An existing STC 300 OGS unit is located on Durham St, immediately upstream of the storm sewer discharge. Jewell recommends the removal of the existing OGS unit, and replacing it with two OGS units in series:

- A FD-5HC will be placed immediately upstream of the EZStorm units to provide grit removal for the runoff entering the underground storage. This primary polishing will prevent the accumulation of sediment in the EZStorm units.
- A second OGS will replace the existing unit on Durham St N. The second unit will be a DD-10, which will provide Enhanced treatment overall to the contributing area.

See Section 5.4 for more details.

5.2 Quantity Control Targets

The pre-development targets, indicated in the model as catchments 100 (a and b) and 101, are analyzed separately to ensure that the peak flows in the main creek, as well as the wetland, are not increased compared to pre-development levels.

Figures 5-1 and 5-2 demonstrate the facilities' ability to limit post-development peaks to the pre-development targets.

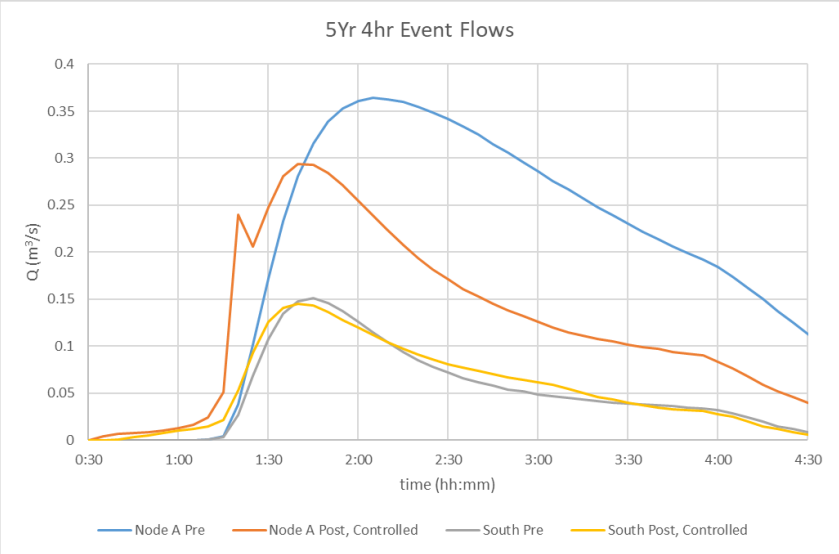


Figure 5-1: Pre-Development vs. Post-Development Controlled, 5Yr 4hr Event

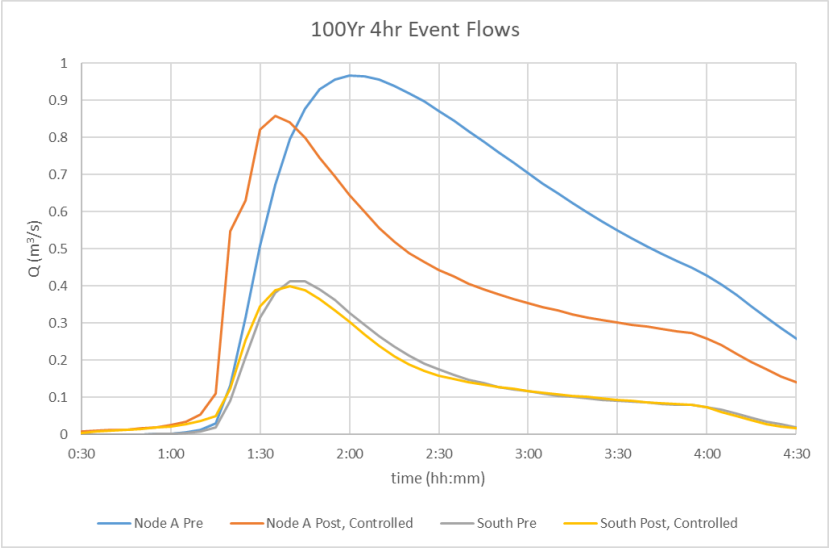


Figure 5-2: Pre-Development vs. Post-Development Controlled, 100Yr 4hr Event

Sizing for the two facilities is provided in the following section.

5.3 Facility Sizing – Wet Pond

The proposed wet pond facility will have a total volume of approximately 7,273 m^3. Three outlets will control the discharge from the facility.

- Outlet 1 – 0.11m diameter circular orifice, with invert at 112.0m
- Outlet 2 – 0.60m diameter circular orifice, with invert at 112.9m
- Outlet 3 – 2.0m broad-crested spillway, with invert at 113.5m

5.3.1 Quality Treatment

The SWMF was sized to provide quality treatment during the 25mm event. Jewell determined storage requirements for the facility with orifice and weir sizing, which is included below in Table 5-1.

Table 5-1: Pond Sizing

	Elevation (m)	Storage (m^3)		
		Required	Provided	Used
Bottom of Pond	110.8	-	-	-
Permanent Pool	112.0	1,319	2,456	-
Extended Detention	112.4	868	1,093	868
Active Storage	113.7	-	5,587	3,784
Top of Berm	114.1	-	7,273	-

The permanent pool elevation was set to 112.0m to ensure the facility could discharge to the wetland without the wetland backfilling the facility during high water conditions.

A 0.11m diameter orifice is proposed with invert at the elevation of the permanent pool which will discharge the pond at a peak rate of 13 L/s during the 25-mm event. This event will discharge over a period of 29 hours, exceeding the 24hr minimum (see Appendix C). The SMWF's contributing area will receive ***Enhanced*** quality treatment as the minimum permanent pool and minimum discharge requirements are met. The 25mm event storage peaks at a stage of approximately 112.32m.

5.3.2 Quantity Treatment

Two outlets are proposed to control the discharge above the extended detention storage. A 0.60m orifice with an invert of 112.9m will allow runoff to discharge at a greater rate than the quality control orifice, up to a stage of 113.5m where the spillway will engage. A 2.0m weir will be required to act as a spillway, and bypass flows in the event of outlet obstruction.

With the quantity controls provided, the peak discharge rates to the wetland (Node A) are as follows (Table 5-2).

Table 5-2: Node A Pre- vs Post-Development Peak Flows

Event	Node A (L/s)		Post < Pre?
	Pre-Dev.	Post-Dev.	
5Yr 4hr	364	294	✓
100Yr 4hr	967	858	✓

The SMWF will control the post-development peak of the north catchments to the pre-development peak, therefore **the quantity control target is achieved**.

5.3.3 Emergency Spillway

The pond was designed for events up to the 100Yr event. The maximum stage for the 100Yr event is 113.23m, resulting in a freeboard of 0.87m (exceeding the 0.3m minimum). For events exceeding the 100Yr event, and/or obstruction of an outlet, the freeboard will be used and the spillway will be used to a greater extent.

The pond is able to convey the entire 100Yr unattenuated peak flow (2.305 m^3/s) by conveying 2.172 m^3/s through the two orifice plates plus the broad crested weir, and spilling an additional 0.133 m^3/s broadly towards the wetland.

5.4 Facility Sizing – OGS Units, LID, and EZStorm Units

A series of OGS units, LID technologies, and EZStorm units are proposed to provide quality and quantity treatment to runoff from the south catchments. The EZStorms will treat the flows from catchment 402, as well as the major flows from 400 and 401 which cannot be directed to the wet pond due to topographic constraints.

5.4.1 Quality Treatment – OGS Unit, LID Technologies

An OGS unit (FD-5HC) is proposed to provide pre-treatment (grit removal) to the south areas. In addition to the OGS, technologies such as enhanced swales and vegetated contact will provide an overall treatment of 65% TSS removal (Table 5-3).

Table 5-3: South Catchments – Weighted TSS Removal

Area (ha)	TSS Removal			
	OGS	Swales	Vegetated Contact	Combined
0.28	72%			72%
0.34	72%			72%
0.30	72%			72%
0.49		65%	70%	89%
0.26				0%

Area (ha)	TSS Removal			
	OGS	Swales	Vegetated Contact	Combined
0.33	72%			72%
0.03	72%		70%	92%
0.055				0%
2.085			Average	65.4%

The combined treatment is calculated by

$$Treatment = 1 - [TSS_0 * (1 - A) * (1 - B) * (1 - C)]$$

where

TSS_0 is the initial TSS concentration
A is the TSS removal of Technology A (OGS unit)
B is the TSS removal of Technology B (Swales)
C is the TSS removal of Technology C (Vegetated Contact).

After receiving primary polishing and quantity control, the Eastfields runoff combines with the runoff from Durham St N, and receives final treatment in a DD-10 OGS unit. The proposed DD-10 will replace the existing STC 300 unit. In total, the contributing area to the DD-10 unit is 4.31ha.

Table 5-4: South Development - Combined TSS Removal

Area (ha)	Pre-treatment TSS Removal	Durham St N OGS – TSS Removal	Combined TSS Removal
2.085	65%	77%	92%
0.655	60%	77%	90.8%
1.57	N/A	77%	77%
Total – 4.31			**86.3%**

The areas contributing to Durham St N receive an average treatment of 86%, therefore ***Enhanced*** quality treatment is provided.

5.4.2 Quantity Treatment

The EZStorm units will be placed in the south Boulevard of Street A immediately west of the intersection with Durham St N. The units will provide a total volume of approximately 433 m^3 (2 units high, 74 long, and 7 wide), which includes the storage in the 600mm pipe downstream (connecting the EZStorm units and the control structure). The peak discharge from the storage system will be limited to 179 L/s which provides the required quantity treatment to achieve the pre-development target (Table 5-4). The stage-storage-discharge curve is provided in Appendix D.

Table 5-5: South Catchments Pre- vs Post-Development Peak Flows

Event	Durham St N (L/s)		Post < Pre?
	Pre-Dev.	Post-Dev.	
5Yr 4hr	151	145	✓
100Yr 4hr	412	399	✓

The EZStorm units will control the post-development peak of the south catchments to the pre-development peak, therefore **the quantity control target is achieved**.

5.5 Climate Change Event

Jewell ran the design event with the 2073 IDF curves to demonstrate the technologies' ability to provide quantity control for future storm events (Table 5-5). The following table summarizes the pre- and post-development peak flows in the 4hr Chicago event with the Climate Change IDFs (see detailed output in Appendix G):

Table 5-6: Climate Change Events – Peak Flows

Event	North Catchment Peak Flows, m^3/s		South Catchment Peak Flows, m^3/s		Post < Pre?
	Pre-Development	Post-Dev., Controlled	Pre-Development	Post-Dev., Controlled	
5Yr, 4hr CC	0.41	0.33	0.17	0.16	✓
100Yr, 4hr CC	1.03	0.91	0.44	0.42	✓

5.6 Conveyance Features

For the proposed development, Jewell used swales and culverts of varying specification to convey runoff. The conveyance features were sized as per Table 5-6 below.

Table 5-7: Conveyance Features Sizing

*	Location	Description**	RC	t_c	i	A	Peak Q	Slope	Capacity	Sufficient Capacity?
				min	mm/h	ha	L/s	%	L/s	
1	Catchment 402 and 605 Swale	V bottom, 0.3m deep	0.50	15	123	1.20	205	7.65	407	✓
2	Street B Culvert	750mm concrete, HW/D=1.25	0.36	37	66	12.70	836	N/A	850	✓
3	Wetland Ditch	1m flat bottom, 0.3m deep	0.36	37	66	12.84	845	0.5	975	✓
4	Catchment 302 Swale	1m flat bottom, 0.3m deep	0.56	15	123	0.51	98	2.0	545	✓

*	Location	Description**	RC	t_c	i	A	Peak Q	Slope	Capacity	Sufficient Capacity?
				min	mm/h	ha	L/s	%	L/s	
5	Catchment 600 Swale	1m flat bottom, 0.3m deep	0.25	15	123	4.00	341	1.0	386	✓
6	Catchment 601 Swale	1m flat bottom, 0.3m deep	0.25	15	123	3.50	298	1.0	386	✓

*See Appendix B, Page 2 for conveyance feature locations.
**Swales listed above have 3:1 side slopes.

The features have a capacity greater than the 100Yr peak flows as demonstrated, therefore adequate conveyance is provided.

6 Maintenance

The stormwater management features adopted by this plan include:

1) Wet Pond SWMF
2) OGS Units – FD-5HC and DD-10
3) EZStorm Units
4) Enhanced Swales
5) Vegetated Contact

During the first few years of operation, the developer will retain the responsibility of maintenance and will gain the experience of how the technologies perform at Eastfields. It will be important for this knowledge to be transferred to the municipality who will be the ultimate owners and operators of the facilities. The OGS Unit and pond forebay will help to focus sediment removal activities in locations that are accessible by the municipal road allowance. Sediment will collect in underground structures that may be easily removed by vacuum trucks.

6.1 Wet Pond SWMF

Good maintenance is important to ensure the proposed SWMF functions as designed. Some very simple maintenance practices are recommended that include both surveillance and general cleaning/trash removal. Some maintenance activities, such as sediment removal, take place at very infrequent intervals. The ability of the wet pond to collect sediment will diminish over time as the volume of sediment storage accumulates. Major maintenance of a facility is triggered when the effectiveness of TSS removal is reduced by 5%.

6.1.1 Routine Maintenance

Once per month the pond operators should perform a visual check including observations of:

- trash or debris collecting in the pond
- water level between events (comparing with expected levels)
- signs of leaks or material loss
- presence of public safety measures (ensuring they are still in place)

Pond operators should remove any trash that may be impeding the pond outlet structures. Additionally, grass and weeds should be cut as needed. During and after a large rainfall event the operator should also perform a visual check to see that pond elevations are within expected levels.

- Permanent Pool – 112.0m
- Quality Event storage – 112.4m
- Top of Active Storage – 113.23m (during 100Yr, 4hr event)
- Top of Berm – 114.10

6.1.2 Infrequent Maintenance

The pond will collect sediment in proportion to the construction activity or winter road maintenance of the upstream catchment area. Vehicle access will be provided to the forebay area to allow pumping to remove the water and sediment.

6.1.3 Troubleshooting

Some basic issues that can develop with a pond and the remedies are described below.

Symptom – Pond is not emptying

The outflow pipe may become blocked with debris and should be monitored after every large runoff event. Observe that the pond is not overfilling and that it is emptying out between events. Full storage for the 100-yr event should be 113.23m. Orifices have been selected to be as large as possible to allow smaller debris to pass through.

Symptom – Pond does not fill

The orifice and weir sizes should impose ponding during large runoff events. If the pond does not hold water during large events check to see the orifice plates have not been tampered with or removed.

Symptom – Pond routinely overfills

If the stored water discharges through the emergency spillway during typical rainfall events, the cause is blockage of the orifice plate and/or weir. The outlet structures should be checked for blockage by debris and cleaned if necessary. Grating on outlet pipes may also clog with vegetation and can also be a cause of poor outflow. The grating may be cleaned by raking.

6.2 OGS Units – FD-5HC and DD-10

An FD-5HC OGS unit will be placed immediately upstream of the EZStorm units. It has a sediment storage capacity of 0.84m^3, and an oil storage capacity of 1.14m^3.

The DD-10 OGS unit will be installed on Durham St N in place of the existing STC 300 unit, approx. 30m upstream of the discharge to Colborne Creek. It has a sediment storage capacity of 6.65m^3, and an oil storage capacity of 3.98m^3.

The units have separate access points for cleanout of oils and sediment, ensuring disposal of materials can be conducted separately. For more O&M information, the product brochure is provided in Appendix I.

6.3 EZStorm Units

Sediment deposition is expected in EZStorm chambers as polishing and infiltration of runoff occurs. Access to the units is provided through hatches, which can be used for maintenance or cleanout. Annual inspections are recommended to observe structure condition and sediment accumulation.

If debris has entered the chambers, it may block the outlet structure downstream. Chambers can be flushed from the surface using a high-pressure sewer cleaning device. Similarly, inspections are completed from the surface using a sewer inspection camera.

If maintenance staff observe that water is accumulated within the chambers more than 24 hours after an event has passed, they should check to see if the outlet structure and/or discharge pipe are obstructed. Municipal staff should lift the hatches and check for

- Accumulation of sediment
- Debris
- Retained Water

Further operations and maintenance information is included in Appendix J.

6.4 Enhanced Swales

Enhanced grassed swales rely on healthy grass cover and benefit from infiltration; therefore, the grass should be watered as necessary and mowed to keep the grass height between 75 mm and 150 mm. Other maintenance activities, such as weed control, removal of accumulated sediment, and trash removal, will need to be carried out to ensure the facilities continue to provide quality treatment to runoff. In addition, proper maintenance will ensure the swales can convey runoff without overtopping. The frequency of these maintenance activities will vary based on experience.

6.5 Vegetated Contact

Maintenance activities for vegetated areas include the following (Credit Valley Conservation and Toronto and Region Conservation Authority, 2010):

- Inspect for vegetation density (80% minimum coverage), damage by foot or vehicle traffic, accumulation of trash or sediment
- Water and mow vegetation regularly, maintain 50 to 150mm vegetation height
- Repair eroded or sparsely vegetated areas.

The main areas of vegetated contact in the development will occur as runoff drains over lawns. Property owners will mow lawns, remove trash and debris, and repair erosion as part of regular property upkeep.

7 Erosion and Sediment Control

Typical site development requires removal of some vegetated cover. While it is the intention to reduce vegetation removal, exposed soils from the work will be at risk of eroding into the receiving drainage system. Measures will need to be put in place to reduce erosion during construction, and for a period of up to one year after construction is completed. Typical sediment and erosion control measures include:

- Siltation fencing.
- Strawbale check dams.
- Rip-rap check dams.
- Filter sock inserts in catch basins.

Controls are to be placed downstream of all active work areas and upstream of protected receivers. Controls should also be placed around stockpiles of topsoil and fill materials.

Typical OPSDs provide good instruction on the correct placement and construction of the controls. The controls provide some protection if they are properly maintained, but they should be considered last-resort measures. The most effective means of control are those which prevent or reduce erosion at the source. This would include diligent stabilization of exposed areas immediately after grading is completed. Stabilization measures include sod, erosion blankets, or rip-rap and filter cloth on steep slopes, as well as topsoil and hydroseed on gently sloped areas (with slope 10% or less).

The site developer and contractor should actively maintain the new drainage works to remove accumulations of sediment within catch basin sumps.

A silt fence should be located along the upland perimeter of all sensitive features during the construction process, which should be maintained until the lands have stabilized or as directed by the municipality. There would be benefit in maintaining this silt fence for up to 2 growing seasons.

8 Conclusions

Fidelity Group is proposing to construct a development of approximately 212 residential units west of Durham St N in Colborne, ON. This development has an area of approximately 19.5 hectares. An additional 23.4 hectares of external lands are conveyed in this stormwater design. The following SWM treatment methodologies are proposed for the development:

- Main SWMF – Wet Pond (to Node A)
  - Permanent Pool – 2,456 m^3 (1,319 m^3 required)
  - Active Storage – 5,587 m^3 (3,784 m^3 used)
  - ***Enhanced*** quality treatment provided
- EZStorm units (to Durham St)
  - Maximum storage – 433 m^3 (including 600mm pipe downstream)
  - Peak discharge – 179 L/s
  - Pre-treatment provided through FD-5HC OGS unit upstream.
- Durham St OGS
  - DD-10 unit proposed to replace existing STC 300
- Block 143 (Apartment Block) – on-site SWM controls as part of future site plan application.

The post-development peak flows will be limited to the pre-development peaks, for each point of discharge.

Table 8-1: Summary of Peak Flows

Event	Node A (m^3/s)		Durham St N (m^3/s)		Post <= Pre?
	Pre-Dev.	Post-Dev.	Pre-Dev.	Post-Dev.	
5Yr, 4hr	0.36	0.29	0.15	0.15	✓
5Yr, 4hr CC	0.41	0.33	0.17	0.16	✓
100Yr, 4hr	0.97	0.86	0.41	0.40	✓
100Yr, 4hr CC	1.03	0.91	0.44	0.42	✓

Proper inspection and maintenance procedures are required to ensure the facilities function as intended.

Treatment to the south portion of the development will occur through a treatment train approach. Enhanced swales, vegetated contact, and an FD-5HC OGS unit will provide pre-treatment to runoff from the proposed development lands draining to Durham St N. Runoff from these areas will combine with Durham St N, and receive additional treatment through a DD-10 unit, which will replace the existing STC 300. An overall treatment of 86% will be provided, resulting in ***Enhanced*** quality treatment.

Erosion and sediment controls will be required to limit sediment transport to the receiving watercourse.

Prepared by

Andrew Rosenthal, EIT
Jewell Engineering Inc.

Reviewed by

Bryon Keene, P.Eng.
Jewell Engineering Inc.

9 References

Credit Valley Conservation and Toronto and Region Conservation Authority. (2010). *LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT PLANNING AND DESIGN GUIDE.*

ETV Canada. (2016). *Current Verified Technologies*. Retrieved from ETV Canada: https://etvcanada.ca/home/verify-your-technology/current-verified-technologies/

Ministry of the Environment. (2003). *Stormwater Management Planning and Design Manual.*

MTO. (2008). Highway Drainage Design Standards.

Ontario Ministry of the Environment. (2003). *Stormwater Management Planning and Design Manual.* Queen's Printer for Ontario.

Ontario Ministry of Transportation. (1997). *Drainage Management Manual.*

Toronto and Region Conservation Authority. (2010). *Low Impact Development Stormwater Management Planning and Design Guide, Version 1.0.*

APPENDIX A

MTO IDF Curves

Ontario IDF CURVE LOOKUP

Active coordinate

44° 0' 45" N, 77° 52' 44" W (44.012500,-77.879167)

Retrieved: Thu, 19 Jan 2023 16:22:56 GMT

Location summary

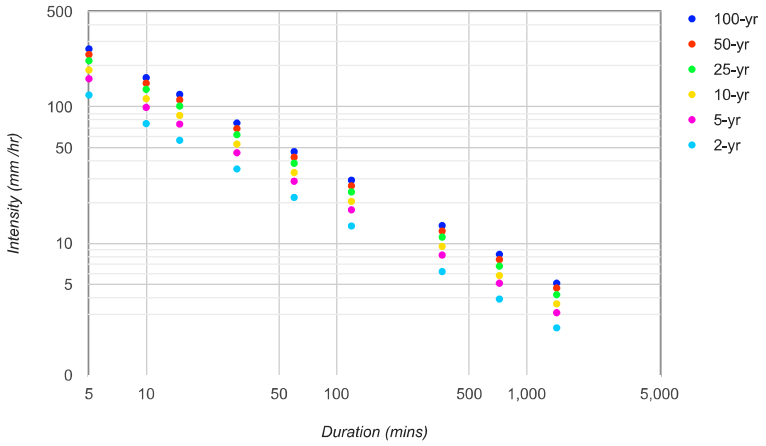
These are the locations in the selection.

IDF Curve: 44° 0' 45" N, 77° 52' 44" W (44.012500,-77.879167)

Results

An IDF curve was found.

Coordinate: 44.012500, -77.879167
IDF curve year: 2023



Coefficient summary

IDF Curve: 44° 0' 45" N, 77° 52' 44" W (44.012500,-77.879167)

Retrieved: Thu, 19 Jan 2023 16:22:56 GMT

Data year: 2010
IDF curve year: 2023

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	122.2	75.4	56.9	35.1	21.7	13.4	6.2	3.9	2.4
5-yr	160.8	99.2	74.8	46.1	28.5	17.6	8.2	5.1	3.1
10-yr	186.4	114.9	86.6	53.4	33.0	20.3	9.5	5.8	3.6
25-yr	218.2	134.5	101.4	62.5	38.6	23.8	11.1	6.8	4.2
50-yr	242.1	149.2	112.5	69.3	42.8	26.4	12.3	7.6	4.7
100-yr	265.9	163.9	123.5	76.2	47.0	29.0	13.5	8.3	5.1

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.2	12.6	14.2	17.6	21.7	26.8	37.2	46.8	57.6
5-yr	13.4	16.5	18.7	23.1	28.5	35.2	49.2	61.2	74.4
10-yr	15.5	19.2	21.6	26.7	33.0	40.6	57.0	69.6	86.4
25-yr	18.2	22.4	25.4	31.3	38.6	47.6	66.6	81.6	100.8
50-yr	20.2	24.9	28.1	34.6	42.8	52.8	73.8	91.2	112.8
100-yr	22.2	27.3	30.9	38.1	47.0	58.0	81.0	99.6	122.4

Terms of Use

You agree to the Terms of Use of this site by reviewing, using, or interpreting these data.

Ontario Ministry of Transportation | Terms and Conditions | About
Last Modified: September 2016

Ontario IDF CURVE LOOKUP

Active coordinate

44° 0' 45" N, 77° 52' 44" W (44.012500,-77.879167)

Retrieved: Thu, 19 Jan 2023 16:24:16 GMT

Location summary

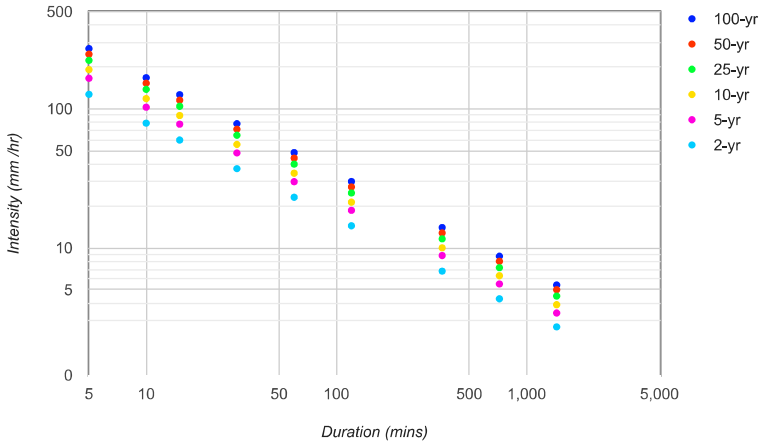
These are the locations in the selection.

IDF Curve: 44° 0' 45" N, 77° 52' 44" W (44.012500,-77.879167)

Results

An IDF curve was found.

Coordinate: 44.012500, -77.879167
IDF curve year: 2073



Coefficient summary

IDF Curve: 44° 0' 45" N, 77° 52' 44" W (44.012500,-77.879167)

Retrieved: Thu, 19 Jan 2023 16:24:16 GMT

Data year: 2010
IDF curve year: 2073

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	127.0	78.8	59.6	37.1	23.1	14.4	6.8	4.3	2.7
5-yr	165.6	102.6	77.5	48.1	29.9	18.6	8.8	5.5	3.4
10-yr	191.2	118.3	89.4	55.4	34.4	21.3	10.0	6.3	3.9
25-yr	223.0	137.9	104.2	64.5	40.0	24.8	11.6	7.2	4.5
50-yr	246.8	152.6	115.2	71.3	44.2	27.4	12.8	8.0	5.0
100-yr	270.7	167.3	126.3	78.1	48.4	30.0	14.0	8.7	5.4

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.6	13.1	14.9	18.6	23.1	28.8	40.8	51.6	64.8
5-yr	13.8	17.1	19.4	24.1	29.9	37.2	52.8	66.0	81.6
10-yr	15.9	19.7	22.4	27.7	34.4	42.6	60.0	75.6	93.6
25-yr	18.6	23.0	26.1	32.3	40.0	49.6	69.6	86.4	108.0
50-yr	20.6	25.4	28.8	35.6	44.2	54.8	76.8	96.0	120.0
100-yr	22.6	27.9	31.6	39.0	48.4	60.0	84.0	104.4	129.6

Terms of Use

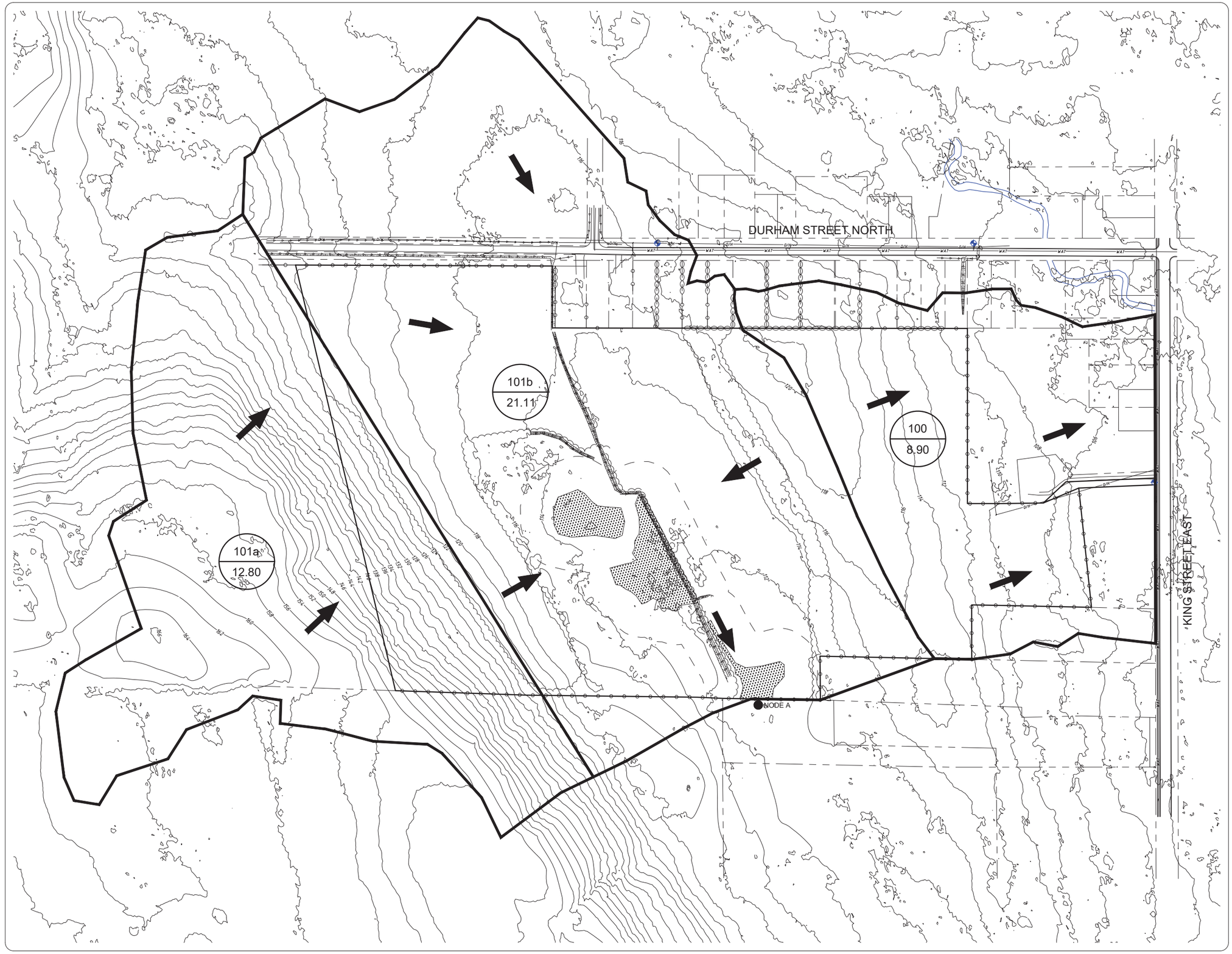
You agree to the Terms of Use of this site by reviewing, using, or interpreting these data.

Ontario Ministry of Transportation | Terms and Conditions | About
Last Modified: September 2016

APPENDIX B

Catchment Area Drawing, OTTHYMO Schematic

09/30/2022



GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES.
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

** DRAWINGS ARE NOT TO BE SCALED **

REVISIONS

NO.	DATE	DESCRIPTION	BY

LEGEND

100 / 8.90 — CATCHMENT ID # / CATCHMENT AREA (ha)

FLOW DIRECTION

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

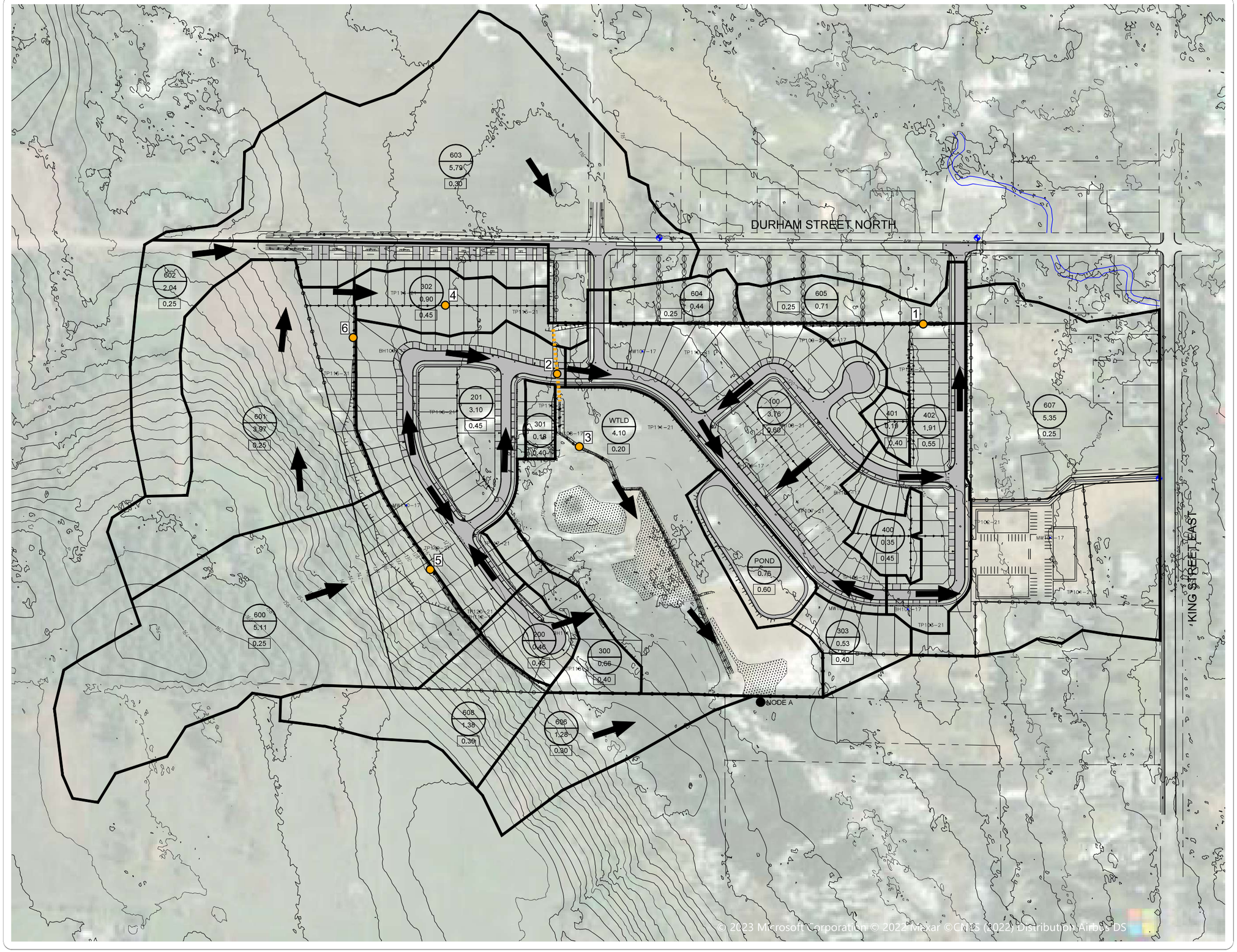
FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

CATCHMENT PLAN
PRE-DEVELOPMENT

DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: September 2022	
CHECKED BY: AMR	SCALE: HORIZONTAL - N/A VERTICAL - N/A	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: B-1

F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\2105024 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - CT

01/23/2023



GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES.
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

** DRAWINGS ARE NOT TO BE SCALED **

REVISIONS

NO.	DATE	DESCRIPTION	BY

LEGEND

- 607 / 5.30 — CATCHMENT ID # / CATCHMENT AREA (ha)
- 0.25 — RUNOFF COEFFICIENT
- FLOW DIRECTION
- SIZED CONVEYANCE FEATURE
- 750mm CONCRETE CULVERT

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

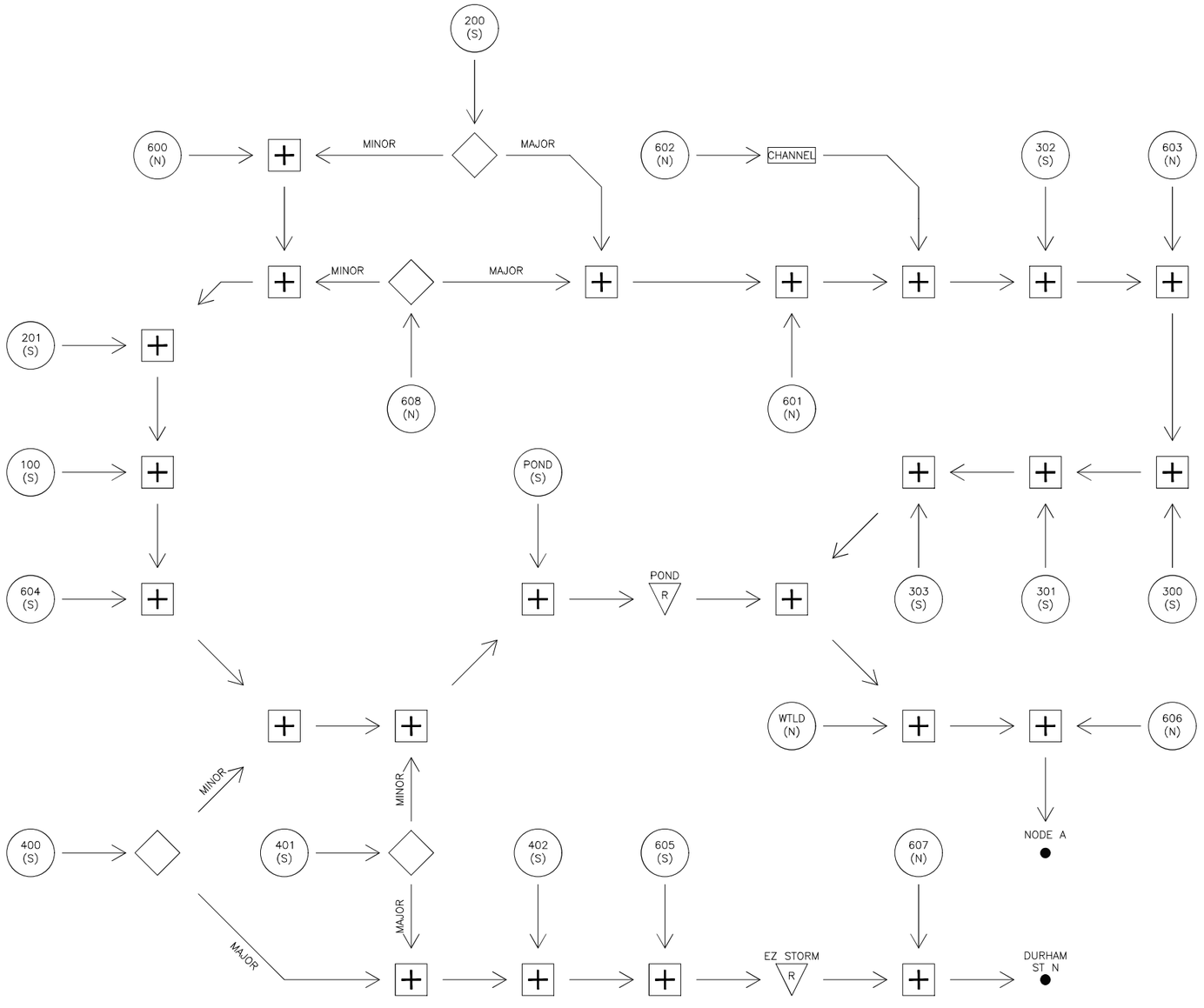
FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

CATCHMENT PLAN
POST-DEVELOPMENT

DRAWN BY: JGH	PROJECT NO: 210-5024
DESIGNED BY: JGH/AMR	DATE: January 2023
CHECKED BY: AMR	SCALE: HORIZONTAL - N/A, VERTICAL - N/A
APPROVED BY: AMR	CONTRACT NO:
	DRAWING NO: B-2

F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\210504 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - APPENDIX B

01/30/2023



GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES.
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

** DRAWINGS ARE NOT TO BE SCALED **

REVISIONS

NO.	DATE	DESCRIPTION	BY

LEGEND

- 600 (N) — CATCHMENT ID NASHYD
- 100 (S) — CATCHMENT ID STANDHYD
- R — RESERVOIR
- DRAINAGE CATCHMENT
- DUHYD

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

OTTHYMO SCHEMATIC

DRAWN BY: JGH	PROJECT NO: 210-5024		
DESIGNED BY: AJR	DATE: January 2023		
CHECKED BY: BK	SCALE: HORIZONTAL - N/A VERTICAL - N/A		
APPROVED BY: BK	CONTRACT NO:	DRAWING NO: B-3	

F:\FTP\PROJECT FILES\FIDELITY\EASTFIELDS\STORMWATER\SWM SCHEMATIC

APPENDIX C

Facility Sizing – Wet Pond

Determine Stage - Storage - Discharge Relationship

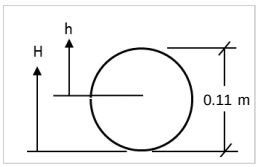
Active Storage Calculations

Full Storage Elevation (m)	**113.7**	
Depth of Active Storage (m)	**1.7**	
Bottom of Active Storage (m)	**112**	
Active Volume (cu.m)	**5,587**	*(approx)*

Select Storage Value Method **User Defined**

Select Stage Increment (m) **0.1** *(not less than 0.01 m)*

Outlet 1	Outlet 2	Outlet 3
Use Outet 1 ? **Yes**	Use Outet 2 ? **Yes**	Use Outlet 3 ? **Yes**
Orifice	**Orifice**	**Broad Crested Weir**
Formula	Formula	Formula
$Q = CA_o(2gh)^{0.5}$	Q = CAo(2gh)^(0.5)	Q = 1.67LH13/2
Invert = 112.00 m	**Invert =** 112.90 m	**Invert =** 113.50 m
Coeff = 0.60	**Coeff =** 0.60	**Length** 2.0 m
Orifice Dia = 0.110 m	**Orifice Dia =** 0.60 m	
Circular? Yes *(Select Yes or No)*		*(No End Contractions)*
Area = 0.010 m^2	Area = 0.231	
Obvert = 112.11 m	Obvert = 113.50	



					Low Flow Outlet (Orifice)			Orifice			Emergency Spillway		Total
Elevation	Length	Width	Incr Vol	Cum vol	Weir (H)	Head (h)	Flow (Q)	Head (H)	Head (h)	Flow (Q)	Head (H)	Flow (Q)	Discharge
m	m	m	m3	m3	m	m	cms	m	m	cms	m	cms	cms
112.0			0	0	0.000	-0.055	0.000	0.000	-0.300	0.000	0.000	0.000	0.000
112.1			261	261	0.100	0.045	0.005	0.000	-0.300	0.000	0.000	0.000	0.005
112.2			269	530	0.200	0.145	0.010	0.000	-0.300	0.000	0.000	0.000	0.010
112.3			277	807	0.300	0.245	0.013	0.000	-0.300	0.000	0.000	0.000	0.013
112.4			286	1,093	0.400	0.345	0.015	0.000	-0.300	0.000	0.000	0.000	0.015
112.5			294	1,387	0.500	0.445	0.017	0.000	-0.300	0.000	0.000	0.000	0.017
112.6			302	1,689	0.600	0.545	0.019	0.000	-0.300	0.000	0.000	0.000	0.019
112.7			311	2,000	0.700	0.645	0.020	0.000	-0.300	0.000	0.000	0.000	0.020
112.8			319	2,319	0.800	0.745	0.022	0.000	-0.300	0.000	0.000	0.000	0.022
112.9			328	2,647	0.900	0.845	0.023	0.000	-0.300	0.000	0.000	0.000	0.023
113.0			337	2,984	1.000	0.945	0.025	0.100	-0.200	0.004	0.000	0.000	0.029
113.1			345	3,329	1.100	1.045	0.026	0.200	-0.100	0.025	0.000	0.000	0.051
113.2			354	3,683	1.200	1.145	0.027	0.300	0.000	0.068	0.000	0.000	0.095
113.3			363	4,046	1.300	1.245	0.028	0.400	0.100	0.135	0.000	0.000	0.163
113.4			372	4,418	1.400	1.345	0.029	0.500	0.200	0.240	0.000	0.000	0.269
113.5			381	4,798	1.500	1.445	0.030	0.600	0.300	0.337	0.000	0.000	0.367
113.6			390	5,188	1.600	1.545	0.031	0.700	0.400	0.389	0.100	0.106	0.526
113.7			399	5,587	1.700	1.645	0.032	0.800	0.500	0.435	0.200	0.299	0.766
113.8			408	5,995	1.800	1.745	0.033	0.900	0.600	0.476	0.300	0.549	1.058
113.9			417	6,412	1.900	1.845	0.034	1.000	0.700	0.514	0.400	0.845	1.394
114			426	6,838	2.000	1.945	0.035	1.100	0.800	0.550	0.500	1.181	1.766
114.1			435	7,273	2.100	2.045	0.036	1.200	0.900	0.583	0.600	1.552	2.172

Forebay Sizing

Eastfields Development

Andrew Rosenthal, EIT
2023/02/01

Permanent Pool Dimensions

Length (m)=	90	Side Slope (X:1) =	3
Width (m)=	12	Depth (m) =	1.20
Bot Width (m) =	4.8		

Select Forebay Length (m) = 28

Assume 1/3 of Permanent Pool Length

Calculate Settling Length (m) = **10.1** OK

Equation 4.5 (MOE, 2003)

$$\sqrt{\quad}$$

Where:

r =	2.33	= L:W ratio of forebay
Q_p =	0.013	= Peak Outflow Rate during Quality Event (cms)
V_s =	0.0003	= Settling Velocity for 0.15mm dia particle

Calculate Dispersion Length (m) = **16.1** OK

Equation 4.6 (MOE, 2003)

$$\frac{\quad}{\quad}$$

Where:

Q =	1.209	= Inlet Flow Rate (cms)	Select an inlet flow rate from the incoming storm sewer. Defaults to 5-yr from Stage Discharge table
d =	1.2	= Depth of Permanent Pool in Forebay (m)	This is automatically selected from the Pond Sizing sheet
V_f =	0.5	= Maximum Velocity in the Forebay (m/s)	Given from MOE, 2003

Min. Forebay Deep Zone Bottom Width (m) = **2.0** OK

Equation 4.7 (MOE, 2003)

$$\frac{\quad}{\quad}$$

Where:

Dist = 16.1 = Dispersion Length (m) *from Equation 4.6*

Check Average Inflow Velocity < 0.15 (m/s) **0.12** OK

$$\frac{}{}$$

Where:

V =	Average Velocity in Forebay (m/s)	
Q =	1.209	= Inlet Flow Rate (cms)
A =	10.08	= Cross-sectional Area (m^2)

Check on Quality Drawdown Time

Top of Extended Detention	**112.5**	**Pond Control =**	**Orifice**
Top of Permanent Pool	**112**	**Orifice Size =**	**0.11 m**

Select Time Step (min)	**5**
Select Depth at "Empty" (m)	**0.05**
Starting Volume (m^3)	**868**

Results

Drawdown Time (min) **1735**

or **28.9 hrs**

Time	WSEL	Extended Detention	Depth	Outflow	Volume Released	Volume Remaining
min	m	m^3	m	cms	m^3	m^3
0	112.32	868.0	0.321	0.013	3.9	864.1
5	112.32	864.1	0.320	0.013	3.9	860.2
10	112.32	860.2	0.319	0.013	3.9	856.3
15	112.32	856.3	0.317	0.013	3.9	852.5
20	112.32	852.5	0.316	0.013	3.9	848.6
25	112.31	848.6	0.315	0.013	3.9	844.7
30	112.31	844.7	0.313	0.013	3.8	840.9
35	112.31	840.9	0.312	0.013	3.8	837.1
40	112.31	837.1	0.311	0.013	3.8	833.2
45	112.31	833.2	0.309	0.013	3.8	829.4
50	112.31	829.4	0.308	0.013	3.8	825.6
55	112.31	825.6	0.307	0.013	3.8	821.8
60	112.31	821.8	0.305	0.013	3.8	818.0
			. . .			
1675	112.05	140.1	0.054	0.003	0.8	139.3
1680	112.05	139.3	0.053	0.003	0.8	138.5
1685	112.05	138.5	0.053	0.003	0.8	137.7
1690	112.05	137.7	0.053	0.003	0.8	136.9
1695	112.05	136.9	0.052	0.003	0.8	136.1
1700	112.05	136.1	0.052	0.003	0.8	135.3
1705	112.05	135.3	0.052	0.003	0.8	134.6
1710	112.05	134.6	0.052	0.003	0.8	133.8
1715	112.05	133.8	0.051	0.003	0.8	133.0
1720	112.05	133.0	0.051	0.003	0.8	132.3
1725	112.05	132.3	0.051	0.003	0.8	131.5
1730	112.05	131.5	0.050	0.003	0.8	130.7
1735	112.05	130.7	0.050	0.002	0.7	130.0

APPENDIX D

Facility Sizing – OGS and EZStorm Units

Hydro First Defense® - HC

Hydro International

Rev. 12.5

Project Name:	**Eastfields**	*Report Date:*	**2023/02/23**
Street:	**Durham St N**	*City:*	**Colborne**
Province:	**ON**	*Country:*	
Designer:	**A.Rosenthal, EIT**	*email:*	**arosenthal@jewelleng.ca**

Paste

Treatment Parameters:

Structure ID:		
TSS Goal:	72	% Removal
TSS Particle Size:	NJDEP / ETV	
Area:	1.28	ha
Percent Impervious:		
Rational C value:	0.46	Calc. Cn
Rainfall Station:	Belleville, ONT	MAP
Peak Storm Flow:		L/s

RESULTS SUMMARY

Model	TSS	Volume
FD-3HC	60.0%	>90%
FD-4HC	70.0%	>90%
FD-5HC	**72.0%**	**>90%**
FD-6HC	76.0%	>90%
FD-8HC	83.0%	>90%
FD-10HC	87.0%	>90%

Model Specification:

Model:	**FD-5HC**	
Diameter:	1500	mm
Peak Flow Capacity:	566.00	L/s
Sediment Storage:	0.84	m^3
Oil Storage:	1136.00	L

Installation Configuration:

Placement:	Online		
Outlet Pipe Size:	750	mm	*OK*
Inlet Pipe 1 Size:	525	mm	*OK*
Inlet Pipe 2 Size:		mm	*OK*
Inlet Pipe 3 Size:		mm	*OK*
Rim Level:	100.000	m	Calc Invs.
Outlet Pipe Invert:		m	*OK*
Invert Pipe 1:		m	*OK*
Invert Pipe 2:		m	
Invert Pipe 3:		m	

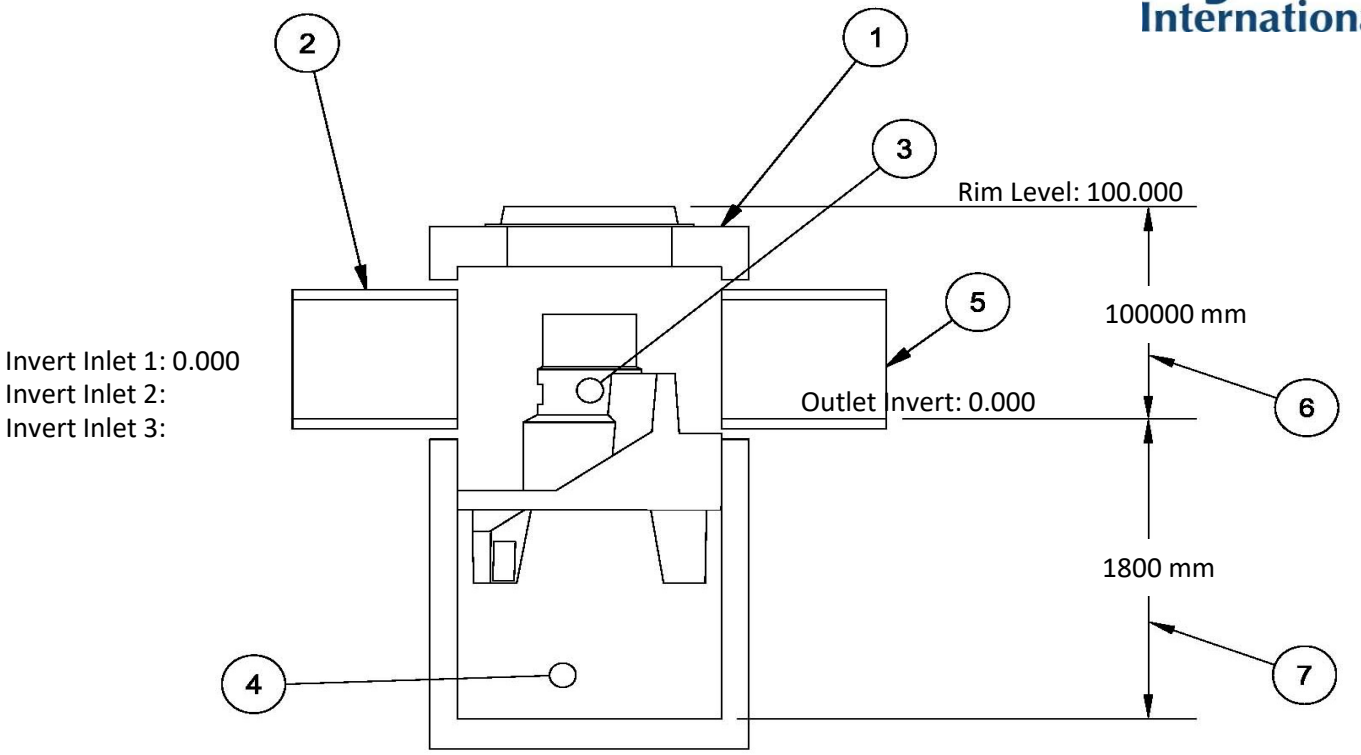
Designer Notes:

Net Annual Removal Model: FD-5HC

Intensity[1]	Fraction of Rainfall[1]	FD-5HC Removal Efficiency[2]	Weighted Net Annual Efficiency
(mm/hr)	(%)	(%)	(%)
0.50	0.4%	94.1%	0.4%
1.00	13.2%	86.7%	11.5%
1.50	14.0%	82.3%	11.5%
2.00	14.0%	79.2%	11.0%
2.50	3.6%	76.8%	2.7%
3.00	2.5%	74.8%	1.9%
3.50	8.4%	73.1%	6.2%
4.00	5.1%	71.7%	3.6%
4.50	1.6%	70.4%	1.1%
5.00	5.1%	69.3%	3.5%
6.00	4.8%	67.3%	3.2%
7.00	4.5%	65.6%	3.0%
8.00	3.5%	64.2%	2.3%
9.00	2.4%	62.9%	1.5%
10.00	2.5%	61.8%	1.5%
20.00	9.7%	54.3%	5.2%
30.00	2.8%	49.9%	1.4%
40.00	0.9%	46.8%	0.4%
50.00	0.4%	44.4%	0.2%
100.00	0.6%	36.9%	0.2%
150.00	0.1%	0.0%	0.0%
200.00	0.0%	0.0%	0.0%
Total Net Annual Removal Efficiency:			**72.0%**
Total Annual Runoff Volume Treated:			**>90%**

1. Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.
2. Based in NJDEP / ETV PSD, NJDEP Test Protocols 2013.
3. Rainfall adjusted to 5 min peak intensity based on hourly average.

Hydro First Defense® - HC



All drawing elevations are metres.

FD-5HC Specification

1	Vortex Chamber Diameter	1500	mm
2	Inlet Pipe Diameter	525	mm
3	Oil Storage Capacity	1136.00	L
4	Min. Provided Sediment Storage Capacity	0.84	m^3
5	Outlet Pipe Diameter	750	mm
6	Height(Final Grade to Outlet Invert)	100000	mm
7	Sump Depth(Outlet Invert to Sump)	1800	mm
	Total Depth	**101800**	**mm**

Notes:

Hydro Downstream Defender®

Net Annual Water Quality Worksheet

Rev. 12.5

Hydro International

Project Name:	**Eastfields**	*Report Date:*	**2023/02/23** Paste
Street:	**Durham St N**	*City:*	**Colborne**
Province:	**ON**	*Country:*	
Designer:	**A.Rosenthal, EIT**	*email:*	**arosenthal@jewelleng.ca**

Treatment Parameters

Structure ID:		
TSS Goal:	77	% Removal
TSS Particle Size:	NJDEP / ETV	
Area:	4.31	ha
Percent Impervious:		
Rational C value:	0.46 Calc Cn	
Rainfall Station:	Belleville, ONT MAP	
Peak Storm Flow:		L/s
Peak Storm Return:		yrs

RESULTS SUMMARY

Model	TSS	Volume
DD4	45.0%	>90%
DD6	60.0%	>90%
DD8	69.0%	>90%
DD10	**77.0%**	**>90%**
DD12	82.0%	>90%

Model Specification

Select Model	**DD10**		
Diameter:	3000	mm	
Peak Flow Capacity:	708.00	L/s	OK
Sediment Storage:	6.65	m^3	
Oil Storage:	3975.00	L	

Installation Configuration

Placement:	Offline		
Outlet Pipe Size:	600	mm	*750 to 600 matched invert coupler required*
Inlet Pipe 1 Size:	600	mm	*OK*
Inlet Pipe 2 Size:		mm	*OK*
Rim Level:	100.000	m	Calc Invs.
Outlet Pipe Invert:		m	*OK*
Invert Pipe 1:		m	*OK*
Invert Pipe 2:		m	

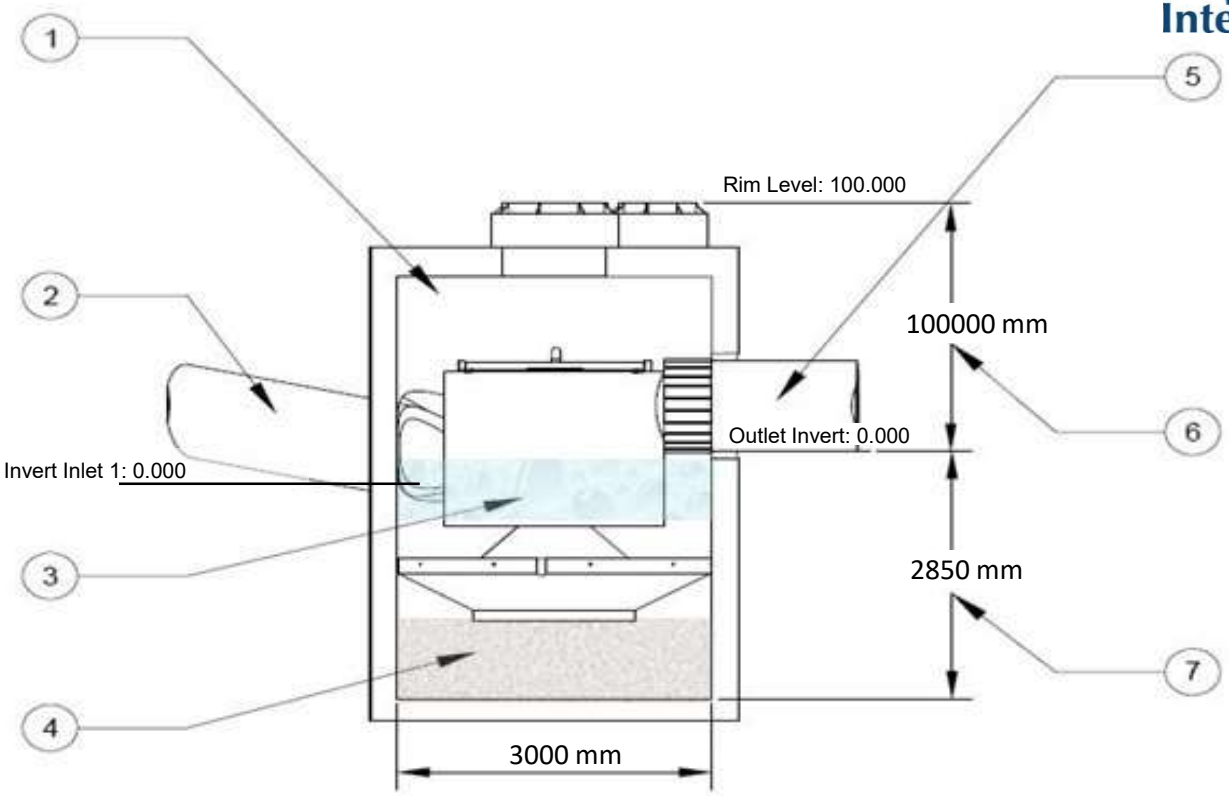
Net Annual Removal Model: DD10

Intensity[1]	Fraction of Rainfall[1]	DD10 Removal Efficiency[2]	Weighted Net Annual Efficiency[4]
(mm/hr)	(%)	(%)	(%)
0.50	0.4%	100.0%	0.42%
1.00	13.2%	100.0%	13.23%
1.50	14.0%	93.6%	13.06%
2.00	14.0%	87.2%	12.17%
2.50	3.6%	82.5%	2.93%
3.00	2.5%	78.9%	2.00%
3.50	8.4%	76.0%	6.41%
4.00	5.1%	73.5%	3.73%
4.50	1.6%	71.4%	1.12%
5.00	5.1%	69.6%	3.52%
6.00	4.8%	66.5%	3.18%
7.00	4.5%	64.1%	2.88%
8.00	3.5%	62.0%	2.18%
9.00	2.4%	60.2%	1.47%
10.00	2.5%	58.7%	1.46%
20.00	9.7%	49.5%	4.78%
30.00	2.8%	44.8%	1.24%
40.00	0.9%	41.7%	0.39%
50.00	0.4%	39.5%	0.18%
100.00	0.6%	33.3%	0.19%
150.00	0.1%	0.0%	0.00%
200.00	0.0%	0.0%	0.00%
Total Net Annual Removal Efficiency:			**77.0%**
Total Annual Runoff Volume Treated:			**>90%**

1. Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.
2. Based in NJDEP / ETV PSD, NJDEP Test Protocols 2013.
3. Rainfall adjusted to 5 min peak intensity based on hourly average.
4. Factored to account for bypass flow.

Designer Notes:

Hydro Downstream Defender®



All drawing elevations are metres.

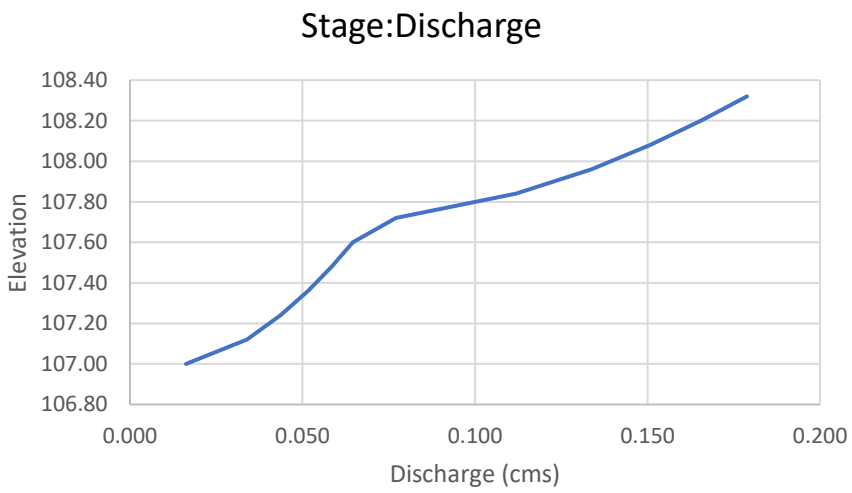
DD10 Specification

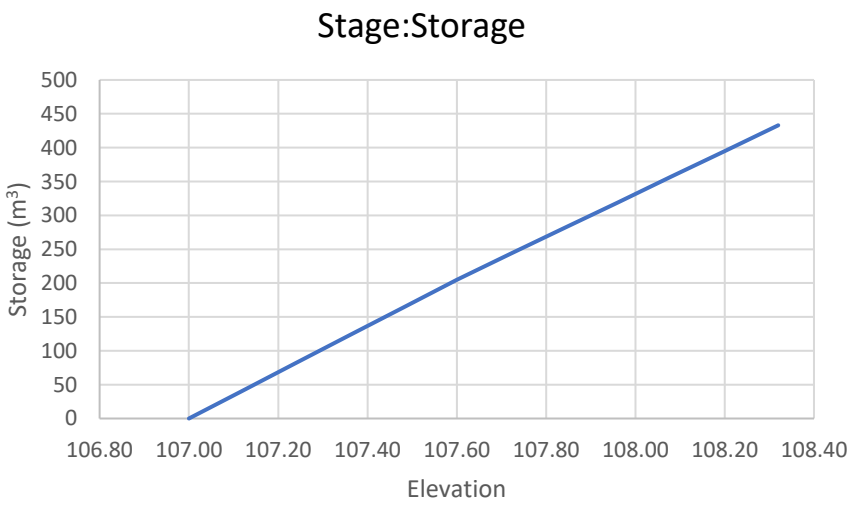
1	Vortex Chamber Diameter	3000	mm
2	Inlet Pipe Diameter	600	mm
3	Oil Storage Capacity	3975	L
4	Min. Provided Sediment Storage Capacity	6.65	m^3
5	Outlet Pipe Diameter	600	mm
6	Rim to Outlet Invert	100000	mm
7	Outlet Invert to Sump	2850	m
	Total Depth	**102850**	**mm**

Notes:

The Downstream Defender is certified by Canada ETV

Stage (m)	Storage (m^3)	Discharge (m^3/s)	Notes
106.84	-	0	Invert of 195mm orifice
107.00	0	0.016	Bottom of EZStorm storage
107.12	41	0.034	
107.24	82	0.044	
107.36	123	0.052	
107.48	164	0.058	
107.60	205	0.065	Invert of 255mm orifice
107.72	243	0.077	
107.84	281	0.112	
107.96	319	0.134	
108.08	357	0.151	
108.20	395	0.166	
108.32	433	0.179	Top of EZStorm storage





APPENDIX E

OTTHYMO Outputs – Quality Event

```
==============================================================================

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989a * * *
       O   O    T      T    HHHHH    Y    M M M  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO             01673

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.


  Input   filename: ef.dat
  Output  filename: ef.out
  Summary filename: ef.sum



DATE: 01-25-2023                       TIME: 10:10:41


COMMENTS: _____________________________________________________________


------------------------------------------------------------------------------
*
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

*
*                    Eastfields Development
*
*                    25mm Event
*                    January 30, 2023
*                    Andrew Rosenthal, EIT
*
*                    Updated catchments and logic based on detailed grading
*
*                    LGI, LGP from L=SQRT(A/1.5)
*
*******************************************************************************
*                    25mm Quality Event
*******************************************************************************

--------------------
|    READ STORM    |    Filename: QUALITY.STM
| Ptotal= 25.00 mm |    Comments: 4 Hr Chicago 25mm
--------------------
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                 .08    1.73 |  1.08    7.10 |  2.08    4.61 |  3.08    2.28
                 .17    1.83 |  1.17   10.69 |  2.17    4.21 |  3.17    2.19
                 .25    1.94 |  1.25   23.51 |  2.25    3.88 |  3.25    2.11
                 .33    2.07 |  1.33   68.86 |  2.33    3.61 |  3.33    2.04
                 .42    2.23 |  1.42   29.90 |  2.42    3.38 |  3.42    1.97
                 .50    2.41 |  1.50   17.13 |  2.50    3.18 |  3.50    1.91
```

.58	2.64	1.58	12.05	2.58	3.00	3.58	1.86
.67	2.92	1.67	9.35	2.67	2.84	3.67	1.80
.75	3.28	1.75	7.68	2.75	2.70	3.75	1.75
.83	3.74	1.83	6.55	2.83	2.58	3.83	1.70
.92	4.41	1.92	5.73	2.92	2.47	3.92	1.66
1.00	5.41	2.00	5.10	3.00	2.37	4.00	1.62

---

* Catchment 600

CALIB			
NASHYD (0001)	Area (ha)= 5.11	Curve Number (CN)= 62.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= .31		

Unit Hyd Qpeak (cms)= .63

PEAK FLOW (cms)= .02 (i)
TIME TO PEAK (hrs)= 1.75
RUNOFF VOLUME (mm)= 2.26
TOTAL RAINFALL (mm)= 25.00
RUNOFF COEFFICIENT = .09

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

SAVE HYD (0001)	AREA (ha)= 5.11
ID= 1 PCYC= 56	QPEAK (cms)= .02 (i)
DT= 5.0 min	TPEAK (hrs)= 1.75
	VOLUME (mm)= 2.26

Filename: EF600.TXT
Comments:

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

---

* Catchment 200

CALIB			
STANDHYD (0001)	Area (ha)= .46		
ID= 2 DT= 5.0 min	Total Imp(%)= 40.00	Dir. Conn.(%)= 30.00	

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	.18	.28
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	2.00	2.00
Length	(m)=	55.00	55.00
Mannings n	=	.013	.250
Max.eff.Inten.	(mm/hr)=	49.38	.00
over	(min)	10.00	235.00
Storage Coeff.	(min)=	1.92 (ii)	236.19 (ii)
Unit Hyd. Tpeak	(min)=	5.00	240.00
Unit Hyd. peak	(cms)=	.31	.01

TOTALS

```
     PEAK FLOW       (cms)=        .03          .00           .03 (iii)
     TIME TO PEAK    (hrs)=       1.42          .08          1.42
     RUNOFF VOLUME    (mm)=      23.00          .00          6.14
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =        .92          .00           .25

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .46
| ID= 2   PCYC= 35 |   QPEAK     (cms)=    .03 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   6.14
  Filename: EF200.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .126 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .46       .03      1.42    6.14
     ================================================
     MAJOR SYS.(ID= 4):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):    .46       .03      1.42    6.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 4   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.11      .02     1.75     2.26
        + ID2= 3 (0001):      .46      .03     1.42     6.14
```

```
          ================================================
          ID = 2 (0001):     5.57      .03     1.42     2.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 608
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.38   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .17

     Unit Hyd Qpeak  (cms)=    .31

     PEAK FLOW       (cms)=    .01 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=   2.23
     TOTAL RAINFALL   (mm)=  25.00
     RUNOFF COEFFICIENT   =    .09

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .085 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   1.38       .01      1.58    2.23
     ======================================================
     MAJOR SYS.(ID= 5):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):   1.38       .01      1.58    2.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 5   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  9    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 4> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 5> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 9> IS ALSO DRY
--------------------------------------------------------------------------------

--------------------
```

```
| ADD HYD   (0001) |
|   2 +  3 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     5.57      .03     1.42     2.58
        + ID2= 3 (0001):     1.38      .01     1.58     2.23
          ================================================
          ID = 1 (0001):     6.95      .04     1.42     2.51

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 201
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.10
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.24         1.86
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     144.00       144.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       420.00
     Storage Coeff.  (min)=       3.42 (ii)  420.79 (ii)
     Unit Hyd. Tpeak (min)=       5.00       425.00
     Unit Hyd. peak  (cms)=        .26          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .15          .00          .15 (iii)
     TIME TO PEAK    (hrs)=       1.50          .17         1.50
     RUNOFF VOLUME    (mm)=      23.00          .00         6.89
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .28

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.10
| ID= 2   PCYC= 51 |   QPEAK     (cms)=    .15 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=   6.89
  Filename: EF201.TXT
  Comments:

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

```
--------------------------------------------------------------------------------
*                   Add 201 to 200min, 608min, 600

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.95      .04     1.42     2.51
        + ID2= 2 (0001):     3.10      .15     1.50     6.89
          ================================================
          ID = 3 (0001):    10.05      .18     1.50     3.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 100
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  50.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.26         1.50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     158.00       158.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       445.00
     Storage Coeff.  (min)=       3.62 (ii)  444.88 (ii)
     Unit Hyd. Tpeak (min)=       5.00       445.00
     Unit Hyd. peak  (cms)=        .25          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .30          .00          .30 (iii)
     TIME TO PEAK    (hrs)=       1.50          .17         1.50
     RUNOFF VOLUME    (mm)=      23.00          .00        11.49
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*                   Add 100 to main

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (0001):     3.76      .30     1.50    11.49
        + ID2= 3 (0001):    10.05      .18     1.50     3.86
          ================================================
          ID = 2 (0001):    13.81      .48     1.50     5.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 604
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .44
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .13          .31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      54.00        54.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       235.00
     Storage Coeff.  (min)=       1.90 (ii)  233.60 (ii)
     Unit Hyd. Tpeak (min)=       5.00       235.00
     Unit Hyd. peak  (cms)=        .32          .01
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .01 (iii)
     TIME TO PEAK    (hrs)=       1.42          .08         1.42
     RUNOFF VOLUME    (mm)=      23.00          .00         2.61
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .10

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .44
| ID= 1   PCYC= 25 |   QPEAK     (cms)=    .01 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   2.61
  Filename: EF604.TXT
  Comments:

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

--------------------------------------------------------------------------------
```

```
--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .44      .01     1.42     2.61
        + ID2= 2 (0001):    13.81      .48     1.50     5.94
          ================================================
          ID = 3 (0001):    14.25      .48     1.50     5.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 400
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .35
|ID= 1 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .14          .21
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      48.00        48.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       220.00
     Storage Coeff.  (min)=       1.77 (ii)  217.67 (ii)
     Unit Hyd. Tpeak (min)=       5.00       220.00
     Unit Hyd. peak  (cms)=        .32          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .02 (iii)
     TIME TO PEAK    (hrs)=       1.33          .00         1.33
     RUNOFF VOLUME    (mm)=      23.00          .00         5.76
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .23

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .35
| ID= 1   PCYC= 29 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   5.76
  Filename: EF400.TXT
  Comments:
```

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

```
--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .032 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):    .35       .02      1.33    5.76
     ==================================================
     MAJOR SYS.(ID= 4):    .00       .00       .00     .00
     MINOR SYS.(ID= 2):    .35       .02      1.33    5.76

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):      .35      .02     1.33     5.76
        + ID2= 3 (0001):    14.25      .48     1.50     5.84
          ==================================================
          ID = 1 (0001):    14.60      .49     1.50     5.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 401
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .19
|ID= 2 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .06          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      36.00        36.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       185.00
     Storage Coeff.  (min)=       1.49 (ii)  183.16 (ii)
     Unit Hyd. Tpeak (min)=       5.00       185.00
     Unit Hyd. peak  (cms)=        .33          .02
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .01 (iii)
     TIME TO PEAK    (hrs)=       1.33          .00         1.33
     RUNOFF VOLUME    (mm)=      23.00          .00         2.99
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .12

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .
```

```
       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .19
| ID= 2   PCYC= 20 |   QPEAK     (cms)=    .01 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   2.99
  Filename: EF401.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .016 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .19       .01      1.33    2.99
     ================================================
     MAJOR SYS.(ID= 5):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):    .19       .01      1.33    2.99

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  8    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    14.60      .49     1.50     5.84
        + ID2= 3 (0001):      .19      .01     1.33     2.99
          ================================================
          ID = 8 (0001):    14.79      .49     1.50     5.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 4> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 5> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 1> IS ALSO DRY
--------------------------------------------------------------------------------
*                  Catchment 402
```

```
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   1.91
|ID= 2 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .96          .95
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     113.00       113.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       365.00
     Storage Coeff.  (min)=       2.96 (ii)  363.82 (ii)
     Unit Hyd. Tpeak (min)=       5.00       365.00
     Unit Hyd. peak  (cms)=        .28          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .13          .00           .13 (iii)
     TIME TO PEAK    (hrs)=       1.42          .08          1.42
     RUNOFF VOLUME    (mm)=      23.00          .00          9.19
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =        .92          .00           .37

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.91
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .13 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   9.19
  Filename: EF402.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add to 400, 401 major (flows to Street A)

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 1> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 = HYDROGRAPH 0001
          ID1= 1 (0001):      .00      .00      .00     5.84
        + ID2= 2 (0001):     1.91      .13     1.42     9.19
          ================================================
```

```
          ID = 3 (0001):     1.91      .13     1.42     9.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 605
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .71
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .21          .50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      69.00        69.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       270.00
     Storage Coeff.  (min)=       2.20 (ii)  270.62 (ii)
     Unit Hyd. Tpeak (min)=       5.00       275.00
     Unit Hyd. peak  (cms)=        .30          .01
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .02 (iii)
     TIME TO PEAK    (hrs)=       1.42          .08         1.42
     RUNOFF VOLUME    (mm)=      23.00          .00         2.92
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .12

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .71
| ID= 1   PCYC= 31 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   2.92
  Filename: EF605.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
```

```
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .71      .02     1.42     2.92
        + ID2= 3 (0001):     1.91      .13     1.42     9.19
          ================================================
          ID = 2 (0001):     2.62      .15     1.42     7.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.62
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .15 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   7.49
  Filename: EFSTIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| COMPUTE VOLUME   |
| ID= 2   (0001)   |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
     **** WARNING: NO STORAGE REQUIRED, RELEASE > INFLOW  PEAK

--------------------------------------------------------------------------------
************************************************************
*                    Route through EZStorm Units
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000       .000   |     .077       .024
                            .034       .004   |     .134       .032
                            .052       .012   |     .166       .040
                            .065       .021   |     .179       .043

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)      2.62       .15      1.42       7.49
     OUTFLOW: ID= 1 (0001)      2.62       .04      1.58       7.48

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 27.99
                   TIME SHIFT OF PEAK FLOW         (min)= 10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .01

--------------------------------------------------------------------------------
************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.62
| ID= 1   PCYC= 56 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.58
--------------------   VOLUME     (mm)=   7.48
  Filename: EFSTOUT.TXT
```

Comments:

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

---

* South Undeveloped, 607

CALIB					
NASHYD (0001)	Area (ha)=	5.35	Curve Number (CN)=	62.0
ID= 2 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	.29		

Unit Hyd Qpeak (cms)= .70

PEAK FLOW (cms)= .02 (i)
TIME TO PEAK (hrs)= 1.75
RUNOFF VOLUME (mm)= 2.26
TOTAL RAINFALL (mm)= 25.00
RUNOFF COEFFICIENT = .09

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

SAVE HYD (0001)	AREA (ha)=	5.35
ID= 2 PCYC= 56	QPEAK (cms)=	.02 (i)
DT= 5.0 min	TPEAK (hrs)=	1.75
	VOLUME (mm)=	2.26

Filename: EF607.TXT
Comments:

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

---

* Total to South

ADD HYD (0001)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	2.62	.04	1.58	7.48
	+ ID2= 2 (0001):	5.35	.02	1.75	2.26
	ID = 3 (0001):	7.97	.06	1.75	3.97

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

SAVE HYD (0001)	AREA (ha)=	7.97
ID= 3 PCYC= 56	QPEAK (cms)=	.06 (i)
DT= 5.0 min	TPEAK (hrs)=	1.75
	VOLUME (mm)=	3.97

Filename: EFSOUTH.TXT
Comments: Post-dev to South /z4

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

```
--------------------------------------------------------------------------------
*                   Pond Catchment
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  66.00   Dir. Conn.(%)=  58.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .50          .26
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      71.00        71.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       275.00
     Storage Coeff.  (min)=       2.24 (ii)  275.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00       280.00
     Unit Hyd. peak  (cms)=        .30          .01
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .08          .00           .08 (iii)
     TIME TO PEAK    (hrs)=       1.42          .08          1.42
     RUNOFF VOLUME    (mm)=      23.00          .00         13.33
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =        .92          .00           .53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*                   Pond inflow

--------------------
| ADD HYD   (0001) |
|   1 +  8 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):       .76      .08     1.42    13.33
        + ID2= 8 (0001):     14.79      .49     1.50     5.80
          ================================================
          ID = 2 (0001):     15.55      .53     1.50     6.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.55
| ID= 2   PCYC= 56 |   QPEAK     (cms)=    .53 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=   6.17
```

```
  Filename: EFSMWFIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
************************************************************
*                   Route through SWMF
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 8 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000       .000   |     .015       .109
                            .005       .026   |     .017       .139
                            .010       .053   |     .000       .000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)     15.55       .53      1.50       6.17
     OUTFLOW: ID= 8 (0001)     15.55       .01      4.17       6.08

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.40
                   TIME SHIFT OF PEAK FLOW         (min)=160.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .08

--------------------------------------------------------------------------------
************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.55
| ID= 8   PCYC=548 |   QPEAK     (cms)=    .01 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   4.17
--------------------   VOLUME      (mm)=   6.08
  Filename: EFSWMFQ.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Catchment 601
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   3.97   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .22

     Unit Hyd Qpeak  (cms)=    .69

     PEAK FLOW       (cms)=    .02 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=   2.26
     TOTAL RAINFALL   (mm)=  25.00
     RUNOFF COEFFICIENT   =    .09

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

--------------------------------------------------------------------------------
```

```
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.97
| ID= 1   PCYC= 53 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=   2.26
  Filename: EF601.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add 200maj, 608maj, 601

--------------------
| ADD HYD   (0001) |
|   1 +  9 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 9> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0002 = HYDROGRAPH 0001
          ID1= 1 (0001):     3.97      .02     1.67     2.26
        + ID2= 9 (0001):      .00      .00      .00      .00
          ================================================
          ID = 2 (0001):     3.97      .02     1.67     2.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 602
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   2.04   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .24

     Unit Hyd Qpeak  (cms)=    .32

     PEAK FLOW       (cms)=    .01 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=   2.51
     TOTAL RAINFALL   (mm)=  25.00
     RUNOFF COEFFICIENT   =    .10

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

--------------------------------------------------------------------------------
*                   Route 602
--------------------
| SHIFT HYD (0001) |
| IN= 1---> OUT= 3 |
| SHIFT=  5.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 1 (0001):    2.04      .01      1.67      2.51
    SHIFT ID= 3 (0001):    2.04      .01      1.75      2.51

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.04
```

```
| ID= 3   PCYC= 53 |   QPEAK     (cms)=    .01 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.75
--------------------   VOLUME     (mm)=   2.51
  Filename: EF602.TXT
  Comments:

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

```
--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     3.97      .02     1.67     2.26
        + ID2= 3 (0001):     2.04      .01     1.75     2.51
          ================================================
          ID = 1 (0001):     6.01      .03     1.67     2.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
*                   Catchment 302
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .90
|ID= 2 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  25.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .33          .57
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      77.00        77.00
     Mannings n             =     .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       290.00
     Storage Coeff.  (min)=       2.35 (ii)  289.03 (ii)
     Unit Hyd. Tpeak (min)=       5.00       290.00
     Unit Hyd. peak  (cms)=        .30          .01
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .04          .00          .04 (iii)
     TIME TO PEAK    (hrs)=       1.42          .08         1.42
     RUNOFF VOLUME    (mm)=      23.00          .00         5.74
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .23

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .90
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   5.74
  Filename: EF302.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.01      .03     1.67     2.34
        + ID2= 2 (0001):      .90      .04     1.42     5.74
          ================================================
          ID = 3 (0001):     6.91      .05     1.42     2.79

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 603
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.79   Curve Number   (CN)= 70.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .42

     Unit Hyd Qpeak  (cms)=    .53

     PEAK FLOW       (cms)=    .03 (i)
     TIME TO PEAK    (hrs)=   1.92
     RUNOFF VOLUME    (mm)=   3.09
     TOTAL RAINFALL   (mm)=  25.00
     RUNOFF COEFFICIENT   =    .12

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.79
| ID= 1   PCYC= 61 |   QPEAK     (cms)=    .03 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.92
--------------------   VOLUME     (mm)=   3.09
  Filename: EF603.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
```

```
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.79      .03     1.92     3.09
        + ID2= 3 (0001):     6.91      .05     1.42     2.79
          ================================================
          ID = 2 (0001):    12.70      .06     1.75     2.92

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 300
--------------------
| CALIB             |
| STANDHYD  (0001) |   Area    (ha)=    .66
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .20          .46
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      66.00        66.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       265.00
     Storage Coeff.  (min)=       2.14 (ii)  263.49 (ii)
     Unit Hyd. Tpeak (min)=       5.00       265.00
     Unit Hyd. peak  (cms)=        .31          .01
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .02 (iii)
     TIME TO PEAK    (hrs)=       1.42          .08         1.42
     RUNOFF VOLUME    (mm)=      23.00          .00         4.04
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .16

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .66
| ID= 1   PCYC= 34 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   4.04
  Filename: EF300.TXT
  Comments:

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

--------------------------------------------------------------------------------
```

```
--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .66      .02     1.42     4.04
        + ID2= 2 (0001):    12.70      .06     1.75     2.92
          ================================================
          ID = 3 (0001):    13.36      .08     1.42     2.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 301
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .18
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .05          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      35.00        35.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      49.38          .00
               over (min)        10.00       180.00
     Storage Coeff.  (min)=       1.47 (ii)  180.09 (ii)
     Unit Hyd. Tpeak (min)=       5.00       185.00
     Unit Hyd. peak  (cms)=        .33          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .01 (iii)
     TIME TO PEAK    (hrs)=       1.33          .00         1.33
     RUNOFF VOLUME    (mm)=      23.00          .00         2.99
     TOTAL RAINFALL   (mm)=      25.00        25.00        25.00
     RUNOFF COEFFICIENT   =        .92          .00          .12

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .18
| ID= 1   PCYC= 20 |   QPEAK     (cms)=    .01 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   2.99
  Filename: EF301.TXT
  Comments:
```

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

ADD HYD (0001)		AREA	QPEAK	TPEAK	R.V.
1 + 3 = 2		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	.18	.01	1.33	2.99
	+ ID2= 3 (0001):	13.36	.08	1.42	2.98
	ID = 2 (0001):	13.54	.09	1.42	2.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---

* Catchment 303

CALIB		
STANDHYD (0001)	Area (ha)=	.53
ID= 1 DT= 5.0 min	Total Imp(%)=	15.00 Dir. Conn.(%)= 10.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.08	.45	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	59.00	59.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	49.38	.00	
over	(min)	10.00	245.00	
Storage Coeff.	(min)=	2.01 (ii)	246.35 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	250.00	
Unit Hyd. peak	(cms)=	.31	.01	
				TOTALS
PEAK FLOW	(cms)=	.01	.00	.01 (iii)
TIME TO PEAK	(hrs)=	1.42	.08	1.42
RUNOFF VOLUME	(mm)=	23.00	.00	1.63
TOTAL RAINFALL	(mm)=	25.00	25.00	25.00
RUNOFF COEFFICIENT	=	.92	.00	.07

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.
***** WARNING: THE PERVIOUS AREA HAS NO FLOW .

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00
(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

SAVE HYD (0001)	AREA (ha)=	.53
ID= 1 PCYC= 23	QPEAK (cms)=	.01 (i)

```
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   1.63
  Filename: EF303.TXT
  Comments:

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

```
--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):       .53      .01     1.42     1.63
        + ID2= 2 (0001):     13.54      .09     1.42     2.98
          ================================================
          ID = 3 (0001):     14.07      .10     1.42     2.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
*                   Add flows from pond

--------------------
| ADD HYD   (0001) |
|   3 +  8 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0001):     14.07      .10     1.42     2.93
        + ID2= 8 (0001):     15.55      .01     4.17     6.08
          ================================================
          ID = 1 (0001):     29.62      .10     1.42     4.45

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
*                   Wetland Area
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   4.10   Curve Number   (CN)= 58.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=    .28

     PEAK FLOW       (cms)=    .01 (i)
     TIME TO PEAK    (hrs)=   2.17
     RUNOFF VOLUME    (mm)=   1.93
     TOTAL RAINFALL   (mm)=  25.00
     RUNOFF COEFFICIENT   =    .08

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

```
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   4.10
| ID= 2   PCYC= 61 |   QPEAK     (cms)=    .01 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.17
```

```
--------------------   VOLUME     (mm)=   1.93
  Filename: WLAREA.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    29.62      .10     1.42     4.45
        + ID2= 2 (0001):     4.10      .01     2.17     1.93
          ================================================
          ID = 3 (0001):    33.72      .10     1.42     4.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 606
--------------------
| CALIB             |
| NASHYD    (0001) |   Area    (ha)=   1.28   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

     Unit Hyd Qpeak  (cms)=    .26

     PEAK FLOW       (cms)=    .01 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=   2.22
     TOTAL RAINFALL   (mm)=  25.00
     RUNOFF COEFFICIENT   =    .09

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.28
| ID= 1   PCYC= 50 |   QPEAK     (cms)=    .01 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.58
--------------------   VOLUME     (mm)=   2.22
  Filename: EF606.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     1.28      .01     1.58     2.22
        + ID2= 3 (0001):    33.72      .10     1.42     4.15
          ================================================
```

```
          ID = 2 (0001):    35.00      .10     1.42     4.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  35.00
| ID= 2   PCYC=548 |   QPEAK     (cms)=    .10 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=   4.08
  Filename: EFNODEA.TXT
  Comments: Post-dev to Node A /z2

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

------------------------------------------------------------------------------

 FINISH
==============================================================================
```

APPENDIX F

OTTHYMO Outputs – 5Yr and 100Yr Chicago Events

```
================================================================================

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989a * * *
       O   O    T      T    HHHHH    Y    M M M  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO             01673

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.


  Input   filename: ef.dat
  Output  filename: ef.out
  Summary filename: ef.sum



DATE: 01-25-2023                      TIME: 10:10:41


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
*
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

*
*                   Eastfields Development
*
*                   5Yr Event
*                   January 30, 2023
*                   Andrew Rosenthal, EIT
*
*                   Updated catchments and logic based on detailed grading
*
*                   LGI, LGP from L=SQRT(A/1.5)
*
*******************************************************************************
*                   Pre-Development, 5Yr 4hr Chicago
*******************************************************************************
*                   IDF Values from MTO Lookup Tool
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 578.169
| Ptotal= 44.02 mm |                          B=   1.500
--------------------                          C=    .722
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33

                    The CORRELATION coefficient is =  .9997
```

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	160.80	149.67
10.	99.20	99.14
15.	74.80	76.39
30.	46.10	47.89
60.	28.50	29.55
120.	17.60	18.07
360.	8.20	8.22
720.	5.10	4.99
1440.	3.10	3.03

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	3.28	1.08	11.46	2.08	7.88	3.08	4.22
.17	3.46	1.17	16.33	2.17	7.29	3.17	4.07
.25	3.65	1.25	34.23	2.25	6.79	3.25	3.94
.33	3.88	1.33	149.67	2.33	6.37	3.33	3.82
.42	4.14	1.42	43.58	2.42	6.00	3.42	3.71
.50	4.45	1.50	24.93	2.50	5.68	3.50	3.61
.58	4.82	1.58	18.15	2.58	5.40	3.58	3.51
.67	5.27	1.67	14.54	2.67	5.15	3.67	3.42
.75	5.83	1.75	12.27	2.75	4.92	3.75	3.33
.83	6.57	1.83	10.68	2.83	4.72	3.83	3.25
.92	7.58	1.92	9.51	2.92	4.54	3.92	3.17
1.00	9.05	2.00	8.61	3.00	4.37	4.00	3.10

---

* 100

CALIB					
NASHYD (0001)	Area (ha)=	8.90	Curve Number (CN)=	65.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	.33		

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

Unit Hyd Qpeak (cms)= 1.03

PEAK FLOW (cms)= .15 (i)
TIME TO PEAK (hrs)= 1.75
RUNOFF VOLUME (mm)= 8.55
TOTAL RAINFALL (mm)= 44.02
RUNOFF COEFFICIENT = .19

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

SAVE HYD (0001)	AREA (ha)=	8.90
ID= 1 PCYC= 61	QPEAK (cms)=	.15 (i)
DT= 5.0 min	TPEAK (hrs)=	1.75
	VOLUME (mm)=	8.55

Filename: EHSouPre.TXT
Comments: Pre-Development to South /z3

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

--------------------------------------------------------------------------------
*                    101a
--------------------
| CALIB              |
| NASHYD    (0001) |   Area     (ha)=  12.80   Curve Number    (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .35

     Unit Hyd Qpeak  (cms)=   1.40

     PEAK FLOW       (cms)=    .19 (i)
     TIME TO PEAK    (hrs)=   1.75
     RUNOFF VOLUME    (mm)=   7.72
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .18

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

--------------------------------------------------------------------------------
*                    101b
--------------------
| CALIB              |
| NASHYD    (0001) |   Area     (ha)=  21.11   Curve Number    (CN)= 71.0
|ID= 2 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .85

     Unit Hyd Qpeak  (cms)=    .95

     PEAK FLOW       (cms)=    .25 (i)
     TIME TO PEAK    (hrs)=   2.50
     RUNOFF VOLUME    (mm)=  10.53
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .24

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    12.80      .19     1.75     7.72
        + ID2= 2 (0001):    21.11      .25     2.50    10.53
          ================================================
          ID = 3 (0001):    33.91      .36     2.08     9.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  33.91
| ID= 3   PCYC= 90 |   QPEAK     (cms)=    .36 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.08
```

```
--------------------   VOLUME     (mm)=   9.47
  Filename: EFNorPre.TXT
  Comments: 101, Pre-development to Node A /z1

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

--------------------------------------------------------------------------------
********************************************************************************
*                    Post-Development, 5Yr 4hr Chicago
********************************************************************************
*                    Catchment 600
--------------------
| CALIB              |
| NASHYD    (0001) |   Area     (ha)=   5.11   Curve Number    (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .31

     Unit Hyd Qpeak  (cms)=    .63

     PEAK FLOW       (cms)=    .08 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=   7.71
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .18

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.11
| ID= 1   PCYC= 58 |   QPEAK     (cms)=    .08 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=   7.71
  Filename: EF600.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                    Catchment 200
--------------------
| CALIB              |
| STANDHYD  (0001) |   Area     (ha)=    .46
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------

                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .18          .28
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      55.00        55.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         5.12
               over (min)        10.00        30.00
     Storage Coeff.  (min)=       1.47 (ii)   29.52 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=        .33          .04
```

```
                                                                  *TOTALS*
     PEAK FLOW       (cms)=        .06          .00            .06 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75           1.33
     RUNOFF VOLUME    (mm)=      41.76         2.19          14.05
     TOTAL RAINFALL   (mm)=      44.02        44.02          44.02
     RUNOFF COEFFICIENT   =        .95          .05            .32

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .46
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .06 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  14.05
  Filename: EF200.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .126 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .46       .06      1.33   14.05
     ================================================
     MAJOR SYS.(ID= 4):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):    .46       .06      1.33   14.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 4   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.11      .08     1.67     7.71
        + ID2= 3 (0001):      .46      .06     1.33    14.05
```

```
          ================================================
          ID = 2 (0001):     5.57      .09     1.67     8.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 608
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.38   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .17

     Unit Hyd Qpeak  (cms)=    .31

     PEAK FLOW       (cms)=    .03 (i)
     TIME TO PEAK    (hrs)=   1.50
     RUNOFF VOLUME    (mm)=   7.66
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .17

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .085 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   1.38       .03      1.50    7.66
     ======================================================
     MAJOR SYS.(ID= 5):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):   1.38       .03      1.50    7.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 5   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  9    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 4> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 5> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 9> IS ALSO DRY
--------------------------------------------------------------------------------

--------------------
```

```
| ADD HYD   (0001) |
|   2 +  3 =  1    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
          ID1= 2 (0001):      5.57       .09      1.67      8.23
        + ID2= 3 (0001):      1.38       .03      1.50      7.66
          ================================================
          ID = 1 (0001):      6.95       .11      1.67      8.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 201
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.10
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.24         1.86
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     144.00       144.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         2.05
               over (min)        10.00        75.00
     Storage Coeff.  (min)=       2.62 (ii)   74.72 (ii)
     Unit Hyd. Tpeak (min)=       5.00        75.00
     Unit Hyd. peak  (cms)=        .29          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .34          .01          .34 (iii)
     TIME TO PEAK    (hrs)=       1.42         2.58         1.42
     RUNOFF VOLUME    (mm)=      41.76         2.19        13.92
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .05          .32

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.10
| ID= 2   PCYC= 61 |   QPEAK     (cms)=    .34 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  13.92
  Filename: EF201.TXT
  Comments:

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

--------------------------------------------------------------------------------
```

```
*                   Add 201 to 200min, 608min, 600

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.95      .11     1.67     8.12
        + ID2= 2 (0001):     3.10      .34     1.42    13.92
          ================================================
          ID = 3 (0001):    10.05      .43     1.42     9.91

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 100
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  50.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.26         1.50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     158.00       158.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         3.44
               over (min)        10.00        65.00
     Storage Coeff.  (min)=       2.77 (ii)   64.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00        65.00
     Unit Hyd. peak  (cms)=        .28          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .68          .01          .68 (iii)
     TIME TO PEAK    (hrs)=       1.42         2.42         1.42
     RUNOFF VOLUME    (mm)=      41.76         2.98        22.27
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .07          .51

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*                   Add 100 to main

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     3.76      .68     1.42    22.27
        + ID2= 3 (0001):    10.05      .43     1.42     9.91
```

```
          ================================================
          ID = 2 (0001):    13.81     1.11     1.42    13.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 604
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .44
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .13          .31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      54.00        54.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         7.74
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       1.45 (ii)   24.97 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .33          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .00          .03 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67         1.33
     RUNOFF VOLUME    (mm)=      41.76         2.66         7.90
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .06          .18

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .44
| ID= 1   PCYC= 36 |   QPEAK     (cms)=    .03 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   7.90
  Filename: EF604.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
```

```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):       .44      .03     1.33     7.90
        + ID2= 2 (0001):     13.81     1.11     1.42    13.28
          ================================================
          ID = 3 (0001):     14.25     1.12     1.42    13.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 400
--------------------
| CALIB             |
| STANDHYD  (0001) |   Area    (ha)=    .35
|ID= 1 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .14          .21
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      48.00        48.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         6.14
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       1.35 (ii)   25.39 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=        .33          .04
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .04          .00          .04 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75         1.33
     RUNOFF VOLUME    (mm)=      41.76         2.19        13.81
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .05          .31

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .35
| ID= 1   PCYC= 45 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  13.81
  Filename: EF400.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
```

```
| DUHYD     (0001) |
| Inlet Cap.= .032 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)      (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):    .35       .04      1.33   13.81
     ====================================================
     MAJOR SYS.(ID= 4):    .02       .01      1.33   13.81
     MINOR SYS.(ID= 2):    .33       .03      1.33   13.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):      .33      .03     1.33    13.81
        + ID2= 3 (0001):    14.25     1.12     1.42    13.11
          ================================================
          ID = 1 (0001):    14.58     1.13     1.42    13.13

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 401
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .19
|ID= 2 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .06          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      36.00        36.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         6.68
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       1.14 (ii)   20.69 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .34          .05
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .02 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67         1.33
     RUNOFF VOLUME    (mm)=      41.76         1.95         8.15
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .04          .19

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
```

```
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .19
| ID= 2   PCYC= 27 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   8.15
  Filename: EF401.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .016 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .19       .02      1.33    8.15
     ================================================
     MAJOR SYS.(ID= 5):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):    .19       .02      1.33    8.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  8    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    14.58     1.13     1.42    13.13
        + ID2= 3 (0001):      .19      .02     1.33     8.15
          ================================================
          ID = 8 (0001):    14.77     1.14     1.42    13.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 5> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 = HYDROGRAPH 0004
          ID1= 4 (0001):      .02      .01     1.33    13.81
        + ID2= 5 (0001):      .00      .00      .00      .00
          ================================================
          ID = 1 (0001):      .02      .01     1.33    13.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
```

```
*                   Catchment 402
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   1.91
|ID= 2 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  40.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         .96          .95
     Dep. Storage     (mm)=        2.00         5.00
     Average Slope     (%)=        2.00         2.00
     Length            (m)=      113.00       113.00
     Mannings n           =        .013         .250

     Max.eff.Inten.(mm/hr)=       96.62         3.63
               over (min)         10.00        50.00
     Storage Coeff.  (min)=        2.26 (ii)   51.84 (ii)
     Unit Hyd. Tpeak (min)=        5.00        55.00
     Unit Hyd. peak  (cms)=         .30          .02
                                                          *TOTALS*
     PEAK FLOW       (cms)=         .29          .01          .29 (iii)
     TIME TO PEAK    (hrs)=        1.42         2.25         1.42
     RUNOFF VOLUME    (mm)=       41.76         2.52        18.10
     TOTAL RAINFALL   (mm)=       44.02        44.02        44.02
     RUNOFF COEFFICIENT   =         .95          .06          .41

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.91
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .29 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  18.10
  Filename: EF402.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add to 400, 401 major (flows to Street A)

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .02      .01     1.33    13.81
        + ID2= 2 (0001):     1.91      .29     1.42    18.10
          ================================================
          ID = 3 (0001):     1.93      .29     1.42    18.05
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---

* Catchment 605

CALIB	
STANDHYD (0001)	Area (ha)= .71
ID= 1 DT= 5.0 min	Total Imp(%)= 30.00 Dir. Conn.(%)= 15.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.21	.50	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	69.00	69.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	96.62	6.45	
over	(min)	10.00	30.00	
Storage Coeff.	(min)=	1.68 (ii)	30.99 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	35.00	
Unit Hyd. peak	(cms)=	.32	.04	
				TOTALS
PEAK FLOW	(cms)=	.04	.01	.04 (iii)
TIME TO PEAK	(hrs)=	1.33	1.83	1.33
RUNOFF VOLUME	(mm)=	41.76	2.66	8.50
TOTAL RAINFALL	(mm)=	44.02	44.02	44.02
RUNOFF COEFFICIENT	=	.95	.06	.19

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00
(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

SAVE HYD (0001)	AREA (ha)= .71
ID= 1 PCYC= 48	QPEAK (cms)= .04 (i)
DT= 5.0 min	TPEAK (hrs)= 1.33
	VOLUME (mm)= 8.50

Filename: EF605.TXT
Comments:

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

ADD HYD (0001)				
1 + 3 = 2	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	.71	.04	1.33	8.50

```
        + ID2= 3 (0001):     1.93      .29     1.42    18.05
          ================================================
          ID = 2 (0001):     2.64      .31     1.42    15.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.64
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .31 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  15.49
  Filename: EFSTIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| COMPUTE VOLUME   |
| ID= 2   (0001)   |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
           START CONTROLLING AT      .04        1.25
           INFLOW HYD. PEAKS AT      .31        1.42
           STOP  CONTROLLING AT      .17        1.48

           REQUIRED STORAGE VOLUME (ha.m.)=    .0063
           TOTAL HYDROGRAPH VOLUME (ha.m.)=    .0409
           % OF HYDROGRAPH TO STORE       =  15.3959

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .17  (cms).

--------------------------------------------------------------------------------
**************************************************************
*                    Route through EZStorm Units
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000       .000   |     .077       .024
                            .034       .004   |     .134       .032
                            .052       .012   |     .166       .040
                            .065       .021   |     .179       .043

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)        2.64       .31      1.42      15.49
     OUTFLOW: ID= 1 (0001)        2.64       .06      1.67      15.48

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.67
                    TIME SHIFT OF PEAK FLOW         (min)= 15.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=   .02

--------------------------------------------------------------------------------
**************************************************************
```

```
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.64
| ID= 1   PCYC= 59 |   QPEAK     (cms)=    .06 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  15.48
  Filename: EFSTOUT.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   South Undeveloped, 607
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.35   Curve Number   (CN)= 62.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .29

     Unit Hyd Qpeak  (cms)=    .70

     PEAK FLOW       (cms)=    .09 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=   7.71
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .18

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.35
| ID= 2   PCYC= 58 |   QPEAK     (cms)=    .09 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=   7.71
  Filename: EF607.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Total to South

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     2.64      .06     1.67    15.48
        + ID2= 2 (0001):     5.35      .09     1.67     7.71
          ================================================
          ID = 3 (0001):     7.99      .15     1.67    10.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   7.99
| ID= 3   PCYC= 59 |   QPEAK     (cms)=    .15 (i)
```

```
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  10.27
  Filename: EFSOUTH.TXT
  Comments: Post-dev to South /z4

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

--------------------------------------------------------------------------------
*                   Pond Catchment
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  66.00   Dir. Conn.(%)=  58.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .50          .26
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      71.00        71.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62        21.11
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       1.71 (ii)    9.87 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .32          .11
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .18          .01          .18 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.33
     RUNOFF VOLUME    (mm)=      41.76         2.85        25.41
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .06          .58

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*                   Pond inflow

--------------------
| ADD HYD   (0001) |
|   1 +  8 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .76      .18     1.33    25.41
        + ID2= 8 (0001):    14.77     1.14     1.42    13.06
          ================================================
          ID = 2 (0001):    15.53     1.21     1.42    13.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
```

```
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.53
| ID= 2   PCYC= 61 |   QPEAK     (cms)=   1.21 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  13.67
  Filename: EFSMWFIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
****************************************************************
*                   Route through SWMF
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 8 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000       .000   |     .051       .333
                            .005       .026   |     .163       .405
                            .010       .053   |     .367       .480
                            .015       .109   |     .526       .519
                            .017       .139   |    1.058       .600
                            .020       .200   |    1.394       .641
                            .023       .265   |    2.172       .727

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)     15.53      1.21      1.42      13.67
     OUTFLOW: ID= 8 (0001)     15.53       .02      4.17      13.58

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.62
                   TIME SHIFT OF PEAK FLOW         (min)=165.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .19

--------------------------------------------------------------------------------
****************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.53
| ID= 8   PCYC=769 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   4.17
--------------------   VOLUME     (mm)=  13.58
  Filename: EFSWMFQ.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Catchment 601
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   3.97   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .22

     Unit Hyd Qpeak  (cms)=    .69
```

```
     PEAK FLOW       (cms)=    .08 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=   7.70
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .17

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.97
| ID= 1   PCYC= 54 |   QPEAK     (cms)=    .08 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.58
--------------------   VOLUME     (mm)=   7.70
  Filename: EF601.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add 200maj, 608maj, 601

--------------------
| ADD HYD   (0001) |
|   1 +  9 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 9> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0002 = HYDROGRAPH 0001
          ID1= 1 (0001):     3.97      .08     1.58     7.70
        + ID2= 9 (0001):      .00      .00      .00      .00
          ================================================
          ID = 2 (0001):     3.97      .08     1.58     7.70

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 602
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   2.04   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .24

     Unit Hyd Qpeak  (cms)=    .32

     PEAK FLOW       (cms)=    .04 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=   8.52
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .19

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

--------------------------------------------------------------------------------
*                   Route 602
--------------------
| SHIFT HYD (0001) |
```

```
| IN= 1---> OUT= 3 |
| SHIFT=  5.0 min  |       AREA     QPEAK     TPEAK      R.V.
-------------------       (ha)     (cms)     (hrs)      (mm)
          ID= 1 (0001):    2.04      .04      1.58      8.52
    SHIFT ID= 3 (0001):    2.04      .04      1.67      8.52

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.04
| ID= 3   PCYC= 55 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=   8.52
  Filename: EF602.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     3.97      .08     1.58     7.70
        + ID2= 3 (0001):     2.04      .04     1.67     8.52
          ==========================================================
          ID = 1 (0001):     6.01      .12     1.58     7.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 302
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .90
|ID= 2 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .33          .57
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      77.00        77.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         4.96
               over (min)        10.00        35.00
     Storage Coeff.  (min)=       1.80 (ii)   36.57 (ii)
     Unit Hyd. Tpeak (min)=       5.00        40.00
     Unit Hyd. peak  (cms)=        .32          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .09          .00          .09 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.92         1.33
     RUNOFF VOLUME    (mm)=      41.76         2.43        12.22
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .06          .28

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

```
       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .90
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .09 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  12.22
  Filename: EF302.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.01      .12     1.58     7.98
        + ID2= 2 (0001):      .90      .09     1.33    12.22
          ================================================
          ID = 3 (0001):     6.91      .13     1.58     8.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 603
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.79   Curve Number   (CN)= 70.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .42

     Unit Hyd Qpeak  (cms)=    .53

     PEAK FLOW       (cms)=    .10 (i)
     TIME TO PEAK    (hrs)=   1.83
     RUNOFF VOLUME    (mm)=  10.16
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .23

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.79
| ID= 1   PCYC= 64 |   QPEAK     (cms)=    .10 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.83
--------------------   VOLUME     (mm)=  10.16
  Filename: EF603.TXT
```

Comments:

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

ADD HYD (0001)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 3 = 2	ID1= 1 (0001):	5.79	.10	1.83	10.16
	+ ID2= 3 (0001):	6.91	.13	1.58	8.53
	ID = 2 (0001):	12.70	.22	1.67	9.27

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---

* Catchment 300

CALIB STANDHYD (0001) ID= 1 DT= 5.0 min	Area (ha)= .66	Total Imp(%)= 30.00	Dir. Conn.(%)= 20.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.20	.46	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	66.00	66.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	96.62	3.34	
over	(min)	10.00	40.00	
Storage Coeff.	(min)=	1.64 (ii)	38.76 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	40.00	
Unit Hyd. peak	(cms)=	.32	.03	
				TOTALS
PEAK FLOW	(cms)=	.05	.00	.05 (iii)
TIME TO PEAK	(hrs)=	1.33	1.92	1.33
RUNOFF VOLUME	(mm)=	41.76	1.95	9.87
TOTAL RAINFALL	(mm)=	44.02	44.02	44.02
RUNOFF COEFFICIENT	=	.95	.04	.22

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

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00
(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

SAVE HYD (0001) ID= 1 PCYC= 48 DT= 5.0 min	AREA (ha)= .66	QPEAK (cms)= .05 (i)	TPEAK (hrs)= 1.33

```
--------------------   VOLUME     (mm)=   9.87
  Filename: EF300.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .66      .05     1.33     9.87
        + ID2= 2 (0001):    12.70      .22     1.67     9.27
          ================================================
          ID = 3 (0001):    13.36      .22     1.67     9.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 301
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .18
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .05          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      35.00        35.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         6.68
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       1.12 (ii)   20.35 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .34          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .02 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67         1.33
     RUNOFF VOLUME    (mm)=      41.76         1.95         8.15
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .04          .19

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .18
```

```
| ID= 1   PCYC= 27 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
-------------------   VOLUME     (mm)=   8.15
  Filename: EF301.TXT
  Comments:

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

```
--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .18      .02     1.33     8.15
        + ID2= 3 (0001):    13.36      .22     1.67     9.30
          ================================================
          ID = 2 (0001):    13.54      .23     1.67     9.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
*                   Catchment 303
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  15.00   Dir. Conn.(%)=  10.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .08          .45
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      59.00        59.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      96.62         1.15
               over (min)        10.00        55.00
     Storage Coeff.  (min)=       1.53 (ii)   54.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00        55.00
     Unit Hyd. peak  (cms)=        .33          .02
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .02 (iii)
     TIME TO PEAK    (hrs)=       1.33         2.17         1.33
     RUNOFF VOLUME    (mm)=      41.76          .99         4.52
     TOTAL RAINFALL   (mm)=      44.02        44.02        44.02
     RUNOFF COEFFICIENT   =        .95          .02          .10

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .53
| ID= 1   PCYC= 37 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   4.52
  Filename: EF303.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .53      .02     1.33     4.52
        + ID2= 2 (0001):    13.54      .23     1.67     9.29
          ================================================
          ID = 3 (0001):    14.07      .23     1.67     9.11

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Add flows from pond

--------------------
| ADD HYD   (0001) |
|   3 +  8 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0001):    14.07      .23     1.67     9.11
        + ID2= 8 (0001):    15.53      .02     4.17    13.58
          ================================================
          ID = 1 (0001):    29.60      .24     1.67    11.32

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Wetland Area
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   4.10   Curve Number   (CN)= 58.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=    .28

     PEAK FLOW       (cms)=    .04 (i)
     TIME TO PEAK    (hrs)=   2.08
     RUNOFF VOLUME    (mm)=   6.71
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .15

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

```
--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   4.10
| ID= 2   PCYC= 66 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.08
--------------------   VOLUME     (mm)=   6.71
  Filename: WLAREA.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    29.60      .24     1.67    11.32
        + ID2= 2 (0001):     4.10      .04     2.08     6.71
          ================================================
          ID = 3 (0001):    33.70      .27     1.75    10.76

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 606
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.28   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

     Unit Hyd Qpeak  (cms)=    .26

     PEAK FLOW       (cms)=    .03 (i)
     TIME TO PEAK    (hrs)=   1.50
     RUNOFF VOLUME    (mm)=   7.68
     TOTAL RAINFALL   (mm)=  44.02
     RUNOFF COEFFICIENT   =    .17

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.28
| ID= 1   PCYC= 52 |   QPEAK     (cms)=    .03 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=   7.68
  Filename: EF606.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
```

```
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     1.28      .03     1.50     7.68
        + ID2= 3 (0001):    33.70      .27     1.75    10.76
          ================================================
          ID = 2 (0001):    34.98      .29     1.67    10.65

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  34.98
| ID= 2   PCYC=769 |   QPEAK     (cms)=    .29 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  10.65
  Filename: EFNODEA.TXT
  Comments: Post-dev to Node A /z2

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

--------------------------------------------------------------------------------

 FINISH
================================================================================
```

```
==============================================================================

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989a * * *
       O   O    T      T    HHHHH    Y    M M M  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO             01673

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.


  Input   filename: ef.dat
  Output  filename: ef.out
  Summary filename: ef.sum



DATE: 01-25-2023                      TIME: 10:10:41


COMMENTS: _____________________________________________________________


------------------------------------------------------------------------------
*
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

*
*                   Eastfields Development
*
*                   100Yr Event
*                   January 30, 2023
*                   Andrew Rosenthal, EIT
*
*                   Updated catchments and logic based on detailed grading
*
*                   LGI, LGP from L=SQRT(A/1.5)
*
*******************************************************************************
*                   Pre-Development, 100Yr 4hr Chicago
*******************************************************************************
*                   IDF Values from MTO Lookup Tool
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 960.077
| Ptotal= 72.29 mm |                          B=   1.500
--------------------                          C=    .724
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33

                    The CORRELATION coefficient is =  .9997
```

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	265.90	247.60
10.	163.90	163.82
15.	123.50	126.14
30.	76.20	78.98
60.	47.00	48.66
120.	29.00	29.72
360.	13.50	13.50
720.	8.30	8.18
1440.	5.10	4.96

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	5.36	1.08	18.77	2.08	12.89	3.08	6.88
.17	5.64	1.17	26.78	2.17	11.92	3.17	6.65
.25	5.96	1.25	56.30	2.25	11.10	3.25	6.44
.33	6.33	1.33	247.60	2.33	10.41	3.33	6.24
.42	6.76	1.42	71.73	2.42	9.80	3.42	6.05
.50	7.26	1.50	40.93	2.50	9.28	3.50	5.88
.58	7.87	1.58	29.77	2.58	8.82	3.58	5.72
.67	8.60	1.67	23.83	2.67	8.41	3.67	5.57
.75	9.53	1.75	20.09	2.75	8.04	3.75	5.43
.83	10.74	1.83	17.49	2.83	7.71	3.83	5.30
.92	12.39	1.92	15.57	2.92	7.41	3.92	5.17
1.00	14.81	2.00	14.08	3.00	7.13	4.00	5.05

---

* 100

CALIB					
NASHYD (0001)	Area (ha)=	8.90	Curve Number (CN)=	65.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	.33		

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

Unit Hyd Qpeak (cms)= 1.03

PEAK FLOW (cms)= .41 (i)
TIME TO PEAK (hrs)= 1.67
RUNOFF VOLUME (mm)= 21.95
TOTAL RAINFALL (mm)= 72.29
RUNOFF COEFFICIENT = .30

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

SAVE HYD (0001)	AREA (ha)=	8.90
ID= 1 PCYC= 63	QPEAK (cms)=	.41 (i)
DT= 5.0 min	TPEAK (hrs)=	1.67
	VOLUME (mm)=	21.95

Filename: EHSouPre.TXT
Comments: Pre-Development to South /z3

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

--------------------------------------------------------------------------------
*                    101a
--------------------
| CALIB              |
| NASHYD    (0001)   |   Area     (ha)=  12.80   Curve Number    (CN)= 62.0
|ID= 1 DT= 5.0 min   |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .35

     Unit Hyd Qpeak  (cms)=   1.40

     PEAK FLOW       (cms)=    .52 (i)
     TIME TO PEAK    (hrs)=   1.75
     RUNOFF VOLUME    (mm)=  20.08
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .28

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

--------------------------------------------------------------------------------
*                    101b
--------------------
| CALIB              |
| NASHYD    (0001)   |   Area     (ha)=  21.11   Curve Number    (CN)= 71.0
|ID= 2 DT= 5.0 min   |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .85

     Unit Hyd Qpeak  (cms)=    .95

     PEAK FLOW       (cms)=    .63 (i)
     TIME TO PEAK    (hrs)=   2.42
     RUNOFF VOLUME    (mm)=  26.20
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .36

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    12.80      .52     1.75    20.08
        + ID2= 2 (0001):    21.11      .63     2.42    26.20
          ================================================
          ID = 3 (0001):    33.91      .97     2.00    23.89

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  33.91
| ID= 3   PCYC= 95 |   QPEAK     (cms)=    .97 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.00
```

```
--------------------   VOLUME     (mm)=  23.89
  Filename: EFNorPre.TXT
  Comments: 101, Pre-development to Node A /z1

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

--------------------------------------------------------------------------------
********************************************************************************
*                   Post-Development, 100Yr 4hr Chicago
********************************************************************************
*                   Catchment 600
--------------------
| CALIB             |
| NASHYD    (0001) |   Area    (ha)=   5.11   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .31

     Unit Hyd Qpeak  (cms)=    .63

     PEAK FLOW       (cms)=    .22 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=  20.07
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .28

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.11
| ID= 1   PCYC= 60 |   QPEAK     (cms)=    .22 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  20.07
  Filename: EF600.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Catchment 200
--------------------
| CALIB             |
| STANDHYD  (0001) |   Area    (ha)=    .46
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .18          .28
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      55.00        55.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        90.73
               over (min)       10.00        10.00
     Storage Coeff.  (min)=       1.20 (ii)   10.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .09
```

```
                                                                  *TOTALS*
     PEAK FLOW       (cms)=        .09          .04            .10 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      69.87        12.96          30.03
     TOTAL RAINFALL   (mm)=      72.29        72.29          72.29
     RUNOFF COEFFICIENT   =        .97          .18            .42

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .46
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .10 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  30.03
  Filename: EF200.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .126 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .46       .10      1.33   30.03
     ================================================
     MAJOR SYS.(ID= 4):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):    .46       .10      1.33   30.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 4   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.11      .22     1.67    20.07
        + ID2= 3 (0001):      .46      .10     1.33    30.03
```

```
          ================================================
          ID = 2 (0001):     5.57      .25     1.58    20.89

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*                   Catchment 608
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.38   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .17

     Unit Hyd Qpeak  (cms)=    .31

     PEAK FLOW       (cms)=    .09 (i)
     TIME TO PEAK    (hrs)=   1.50
     RUNOFF VOLUME    (mm)=  19.98
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .28

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

------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .085 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   1.38       .09      1.50   19.98
     ====================================================
     MAJOR SYS.(ID= 5):    .01       .00      1.50   19.98
     MINOR SYS.(ID= 3):   1.37       .09      1.50   19.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .01
| ID= 5   PCYC= 19 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=  19.98
  Filename: EF608maj.TXT
  Comments: 608 major

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

------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  9    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 4> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 = HYDROGRAPH 0001
          ID1= 4 (0001):      .00      .00      .00      .00
```

```
        + ID2= 5 (0001):      .01      .00     1.50    19.98
          ================================================
          ID = 9 (0001):      .01      .00     1.50    19.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     5.57      .25     1.58    20.89
        + ID2= 3 (0001):     1.37      .09     1.50    19.98
          ================================================
          ID = 1 (0001):     6.94      .33     1.58    20.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 201
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.10
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.24         1.86
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     144.00       144.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        36.29
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       2.14 (ii)   24.97 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .31          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .59          .12          .61 (iii)
     TIME TO PEAK    (hrs)=       1.42         1.75         1.42
     RUNOFF VOLUME    (mm)=      69.87        12.96        30.01
     TOTAL RAINFALL   (mm)=      72.29        72.29        72.29
     RUNOFF COEFFICIENT   =        .97          .18          .42

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.10
```

```
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .61 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  30.01
  Filename: EF201.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add 201 to 200min, 608min, 600

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.94      .33     1.58    20.71
        + ID2= 2 (0001):     3.10      .61     1.42    30.01
          ================================================
          ID = 3 (0001):    10.04      .87     1.42    23.58

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 100
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  50.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.26         1.50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     158.00       158.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        42.69
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       2.26 (ii)   24.88 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .30          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.18          .12          1.20 (iii)
     TIME TO PEAK    (hrs)=       1.42         1.75          1.42
     RUNOFF VOLUME    (mm)=      69.87        14.23         42.03
     TOTAL RAINFALL   (mm)=      72.29        72.29         72.29
     RUNOFF COEFFICIENT   =        .97          .20           .58

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
*                   Add 100 to main

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     3.76     1.20     1.42    42.03
        + ID2= 3 (0001):    10.04      .87     1.42    23.58
          ================================================
          ID = 2 (0001):    13.80     2.07     1.42    28.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 604
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .44
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .13          .31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      54.00        54.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        66.41
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       1.19 (ii)   11.14 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .09
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .04          .04          .06 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
     RUNOFF VOLUME    (mm)=      69.87        13.67        21.90
     TOTAL RAINFALL   (mm)=      72.29        72.29        72.29
     RUNOFF COEFFICIENT   =        .97          .19          .30

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .44
| ID= 1   PCYC= 45 |   QPEAK     (cms)=    .06 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  21.90
```

Filename: EF604.TXT
Comments:

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

ADD HYD (0001)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	.44	.06	1.33	21.90
	+ ID2= 2 (0001):	13.80	2.07	1.42	28.61
	ID = 3 (0001):	14.24	2.11	1.42	28.40

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---

* Catchment 400

CALIB STANDHYD (0001) ID= 1 DT= 5.0 min	Area (ha)= .35 Total Imp(%)= 40.00 Dir. Conn.(%)= 30.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.14	.21	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	48.00	48.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	159.67	90.73	
over	(min)	10.00	10.00	
Storage Coeff.	(min)=	1.11 (ii)	9.72 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	.34	.11	
				TOTALS
PEAK FLOW	(cms)=	.07	.03	.09 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	69.87	12.96	30.03
TOTAL RAINFALL	(mm)=	72.29	72.29	72.29
RUNOFF COEFFICIENT	=	.97	.18	.42

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

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00
(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

SAVE HYD (0001) ID= 1 PCYC= 48	AREA (ha)= .35 QPEAK (cms)= .09 (i)

```
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  30.03
  Filename: EF400.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .032 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):    .35       .09      1.33   30.03
     ==================================================
     MAJOR SYS.(ID= 4):    .08       .06      1.33   30.03
     MINOR SYS.(ID= 2):    .27       .03      1.33   30.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):      .27      .03     1.33    30.03
        + ID2= 3 (0001):    14.24     2.11     1.42    28.40
          ================================================
          ID = 1 (0001):    14.51     2.14     1.42    28.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 401
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .19
|ID= 2 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .06          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      36.00        36.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        86.29
               over (min)       10.00        10.00
     Storage Coeff.  (min)=        .93 (ii)   10.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .11
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .02          .04 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.33
     RUNOFF VOLUME    (mm)=      69.87        12.58        22.15
```

```
     TOTAL RAINFALL   (mm)=      72.29        72.29          72.29
     RUNOFF COEFFICIENT   =        .97          .17            .31

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .19
| ID= 2   PCYC= 31 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  22.15
  Filename: EF401.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .016 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .19       .04      1.33   22.15
     ====================================================
     MAJOR SYS.(ID= 5):    .04       .02      1.33   22.15
     MINOR SYS.(ID= 3):    .15       .02      1.33   22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  8    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    14.51     2.14     1.42    28.43
        + ID2= 3 (0001):      .15      .02     1.33    22.15
          ================================================
          ID = 8 (0001):    14.66     2.16     1.42    28.37

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 4 (0001):      .08      .06     1.33    30.03
```

```
        + ID2= 5 (0001):      .04      .02     1.33    22.15
          ================================================
          ID = 1 (0001):      .12      .07     1.33    27.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 402
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   1.91
|ID= 2 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .96          .95
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     113.00       113.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        48.47
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       1.85 (ii)   19.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .32          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .50          .08          .52 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58         1.33
     RUNOFF VOLUME    (mm)=      69.87        13.47        36.01
     TOTAL RAINFALL   (mm)=      72.29        72.29        72.29
     RUNOFF COEFFICIENT   =        .97          .19          .50

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.91
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .52 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  36.01
  Filename: EF402.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add to 400, 401 major (flows to Street A)

--------------------
| ADD HYD   (0001) |
```

```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .12      .07     1.33    27.24
        + ID2= 2 (0001):     1.91      .52     1.33    36.01
          ================================================
          ID = 3 (0001):     2.03      .59     1.33    35.47

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 605
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .71
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .21          .50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      69.00        69.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        66.41
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       1.38 (ii)   12.91 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .07          .06          .09 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
     RUNOFF VOLUME    (mm)=      69.87        13.67        22.10
     TOTAL RAINFALL   (mm)=      72.29        72.29        72.29
     RUNOFF COEFFICIENT   =        .97          .19          .31

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .71
| ID= 1   PCYC= 48 |   QPEAK     (cms)=    .09 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  22.10
  Filename: EF605.TXT
  Comments:

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

```
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .71      .09     1.33    22.10
        + ID2= 3 (0001):     2.03      .59     1.33    35.47
          ================================================
          ID = 2 (0001):     2.74      .68     1.33    32.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.74
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .68 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  32.01
  Filename: EFSTIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| COMPUTE VOLUME   |
| ID= 2   (0001)   |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
           START CONTROLLING AT      .00         .34
           INFLOW HYD. PEAKS AT      .68        1.33
           STOP  CONTROLLING AT      .17        1.66

           REQUIRED STORAGE VOLUME (ha.m.)=    .0269
           TOTAL HYDROGRAPH VOLUME (ha.m.)=    .0879
           % OF HYDROGRAPH TO STORE       =  30.5620

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .17  (cms).

--------------------------------------------------------------------------------
************************************************************
*                   Route through EZStorm Units
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          .000       .000     |     .077       .024
                          .034       .004     |     .134       .032
                          .052       .012     |     .166       .040
                          .065       .021     |     .179       .043

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)      2.74       .68      1.33      32.01
     OUTFLOW: ID= 1 (0001)      2.74       .15      1.67      32.01
```

```
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.56
                    TIME SHIFT OF PEAK FLOW         (min)= 20.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=   .04

--------------------------------------------------------------------------------
********************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.74
| ID= 1   PCYC= 63 |   QPEAK     (cms)=    .15 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  32.01
  Filename: EFSTOUT.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                    South Undeveloped, 607
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.35   Curve Number   (CN)= 62.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .29

     Unit Hyd Qpeak  (cms)=    .70

     PEAK FLOW       (cms)=    .25 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=  20.07
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .28

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.35
| ID= 2   PCYC= 60 |   QPEAK     (cms)=    .25 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  20.07
  Filename: EF607.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                    Total to South

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     2.74      .15     1.67    32.01
        + ID2= 2 (0001):     5.35      .25     1.67    20.07
          ================================================
          ID = 3 (0001):     8.09      .40     1.67    24.11
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
| SAVE HYD  (0001) |   AREA       (ha)=   8.09
| ID= 3   PCYC= 63 |   QPEAK     (cms)=    .40 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
                     VOLUME      (mm)=  24.11
```

Filename: EFSOUTH.TXT
Comments: Post-dev to South /z4

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

```
*                   Pond Catchment
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  66.00   Dir. Conn.(%)=  58.00
```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.50	.26	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	71.00	71.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	159.67	103.53	
over	(min)	10.00	10.00	
Storage Coeff.	(min)=	1.40 (ii)	8.07 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	.33	.13	
				TOTALS
PEAK FLOW	(cms)=	.30	.05	.32 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	69.87	13.97	46.39
TOTAL RAINFALL	(mm)=	72.29	72.29	72.29
RUNOFF COEFFICIENT	=	.97	.19	.64

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

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00
(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
*                   Pond inflow

| ADD HYD   (0001) |
|   1 +  8 =  2    |          AREA    QPEAK    TPEAK     R.V.
                             (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .76      .32     1.33    46.39
```

```
        + ID2= 8 (0001):    14.66     2.16     1.42    28.37
          ================================================
          ID = 2 (0001):    15.42     2.31     1.42    29.26

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.42
| ID= 2   PCYC= 60 |   QPEAK     (cms)=   2.31 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  29.26
  Filename: EFSMWFIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
************************************************************
*                    Route through SWMF
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 8 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000       .000    |     .051       .333
                           .005       .026    |     .163       .405
                           .010       .053    |     .367       .480
                           .015       .109    |     .526       .519
                           .017       .139    |    1.058       .600
                           .020       .200    |    1.394       .641
                           .023       .265    |    2.172       .727

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)     15.42      2.31      1.42      29.26
     OUTFLOW: ID= 8 (0001)     15.42       .11      3.67      28.99

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.94
                   TIME SHIFT OF PEAK FLOW         (min)=135.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .37

--------------------------------------------------------------------------------
************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.42
| ID= 8   PCYC=961 |   QPEAK     (cms)=    .11 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   3.67
--------------------   VOLUME     (mm)=  28.99
  Filename: EFSWMFQ.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                    Catchment 601
--------------------
```

```
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   3.97   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=    .22

     Unit Hyd Qpeak  (cms)=    .69

     PEAK FLOW       (cms)=    .22 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=  20.05
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .28

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

--------------------------------------------------------------------------------
-------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.97
| ID= 1   PCYC= 56 |   QPEAK     (cms)=    .22 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.58
-------------------   VOLUME     (mm)=  20.05
  Filename: EF601.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add 200maj, 608maj, 601

-------------------
| ADD HYD   (0001) |
|   1 +  9 =  2    |         AREA    QPEAK    TPEAK     R.V.
-------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     3.97      .22     1.58    20.05
        + ID2= 9 (0001):      .01      .00     1.50    19.98
          ================================================
          ID = 2 (0001):     3.98      .22     1.58    20.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 602
-------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   2.04   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=    .24

     Unit Hyd Qpeak  (cms)=    .32

     PEAK FLOW       (cms)=    .12 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=  21.92
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .30

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

```
--------------------------------------------------------------------------------
*                   Route 602
--------------------
| SHIFT HYD (0001) |
| IN= 1---> OUT= 3 |
| SHIFT=  5.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 1 (0001):    2.04      .12      1.58     21.92
    SHIFT ID= 3 (0001):    2.04      .12      1.67     21.92

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.04
| ID= 3   PCYC= 57 |   QPEAK     (cms)=    .12 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  21.92
  Filename: EF602.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     3.98      .22     1.58    20.05
        + ID2= 3 (0001):     2.04      .12     1.67    21.92
          ================================================
          ID = 1 (0001):     6.02      .33     1.58    20.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 302
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .90
|ID= 2 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .33          .57
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      77.00        77.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        63.45
               over (min)       10.00        15.00
     Storage Coeff.  (min)=       1.47 (ii)   14.01 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .15          .07          .17 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
```

```
     RUNOFF VOLUME    (mm)=      69.87        13.32          27.46
     TOTAL RAINFALL   (mm)=      72.29        72.29          72.29
     RUNOFF COEFFICIENT   =        .97          .18            .38

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .90
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .17 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  27.46
  Filename: EF302.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.02      .33     1.58    20.69
        + ID2= 2 (0001):      .90      .17     1.33    27.46
          ================================================
          ID = 3 (0001):     6.92      .40     1.58    21.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 603
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.79   Curve Number   (CN)= 70.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .42

     Unit Hyd Qpeak  (cms)=    .53

     PEAK FLOW       (cms)=    .27 (i)
     TIME TO PEAK    (hrs)=   1.83
     RUNOFF VOLUME    (mm)=  25.43
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .35

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

--------------------------------------------------------------------------------
--------------------
```

```
| SAVE HYD  (0001) |   AREA       (ha)=   5.79
| ID= 1   PCYC= 66 |   QPEAK     (cms)=    .27 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.83
--------------------   VOLUME     (mm)=  25.43
  Filename: EF603.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.79      .27     1.83    25.43
        + ID2= 3 (0001):     6.92      .40     1.58    21.57
          ================================================
          ID = 2 (0001):    12.71      .61     1.67    23.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 300
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .66
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .20          .46
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      66.00        66.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        57.53
               over (min)       10.00        15.00
     Storage Coeff.  (min)=       1.34 (ii)   13.23 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .09          .05          .10 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
     RUNOFF VOLUME    (mm)=      69.87        12.58        24.04
     TOTAL RAINFALL   (mm)=      72.29        72.29        72.29
     RUNOFF COEFFICIENT   =        .97          .17          .33

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .66
| ID= 1   PCYC= 48 |   QPEAK     (cms)=    .10 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  24.04
  Filename: EF300.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .66      .10     1.33    24.04
        + ID2= 2 (0001):    12.71      .61     1.67    23.33
          ================================================
          ID = 3 (0001):    13.37      .66     1.58    23.36

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 301
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .18
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .05          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      35.00        35.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        86.29
               over (min)       10.00        10.00
     Storage Coeff.  (min)=        .92 (ii)    9.83 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .11
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .02          .03 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.33
     RUNOFF VOLUME    (mm)=      69.87        12.58        21.99
     TOTAL RAINFALL   (mm)=      72.29        72.29        72.29
     RUNOFF COEFFICIENT   =        .97          .17          .30

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

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

```
--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .18
| ID= 1   PCYC= 30 |   QPEAK     (cms)=    .03 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  21.99
  Filename: EF301.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .18      .03     1.33    21.99
        + ID2= 3 (0001):    13.37      .66     1.58    23.36
          ================================================
          ID = 2 (0001):    13.55      .67     1.58    23.34

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 303
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  15.00   Dir. Conn.(%)=  10.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .08          .45
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      59.00        59.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     159.67        47.07
               over (min)       10.00        15.00
     Storage Coeff.  (min)=       1.25 (ii)   13.30 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .04          .04          .05 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
     RUNOFF VOLUME    (mm)=      69.87        11.11        16.55
     TOTAL RAINFALL   (mm)=      72.29        72.29        72.29
     RUNOFF COEFFICIENT   =        .97          .15          .23

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
```

```
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .53
| ID= 1   PCYC= 39 |   QPEAK     (cms)=    .05 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  16.55
  Filename: EF303.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .53      .05     1.33    16.55
        + ID2= 2 (0001):    13.55      .67     1.58    23.34
          ================================================
          ID = 3 (0001):    14.08      .70     1.58    23.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                  Add flows from pond

--------------------
| ADD HYD   (0001) |
|   3 +  8 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0001):    14.08      .70     1.58    23.09
        + ID2= 8 (0001):    15.42      .11     3.67    28.99
          ================================================
          ID = 1 (0001):    29.50      .72     1.58    26.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                  Wetland Area
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   4.10   Curve Number   (CN)= 58.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=    .28

     PEAK FLOW       (cms)=    .11 (i)
     TIME TO PEAK    (hrs)=   2.08
     RUNOFF VOLUME    (mm)=  17.80
```

```
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .25

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   4.10
| ID= 2   PCYC= 70 |   QPEAK     (cms)=    .11 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.08
--------------------   VOLUME     (mm)=  17.80
  Filename: WLAREA.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    29.50      .72     1.58    26.14
        + ID2= 2 (0001):     4.10      .11     2.08    17.80
          ================================================
          ID = 3 (0001):    33.60      .78     1.58    25.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 606
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.28   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

     Unit Hyd Qpeak  (cms)=    .26

     PEAK FLOW       (cms)=    .08 (i)
     TIME TO PEAK    (hrs)=   1.50
     RUNOFF VOLUME    (mm)=  20.01
     TOTAL RAINFALL   (mm)=  72.29
     RUNOFF COEFFICIENT   =    .28

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.28
| ID= 1   PCYC= 53 |   QPEAK     (cms)=    .08 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=  20.01
  Filename: EF606.TXT
  Comments:

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

```
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     1.28      .08     1.50    20.01
        + ID2= 3 (0001):    33.60      .78     1.58    25.12
          ================================================
          ID = 2 (0001):    34.88      .86     1.58    24.93

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  34.88
| ID= 2   PCYC=961 |   QPEAK     (cms)=    .86 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.58
--------------------   VOLUME     (mm)=  24.93
  Filename: EFNODEA.TXT
  Comments: Post-dev to Node A /z2

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

--------------------------------------------------------------------------------

 FINISH
================================================================================
```

APPENDIX G

OTTHYMO Outputs – Climate Change Events

```
================================================================================

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989a * * *
       O   O    T      T    HHHHH    Y    M M M  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO             01673

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.


  Input   filename: ef.dat
  Output  filename: ef.out
  Summary filename: ef.sum



DATE: 01-25-2023                      TIME: 10:10:41


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
*
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

*
*                   Eastfields Development
*
*                   5Yr Climate Change Event
*                   January 30, 2023
*                   Andrew Rosenthal, EIT
*
*                   Updated catchments and logic based on detailed grading
*
*                   LGI, LGP from L=SQRT(A/1.5)
*
*******************************************************************************
*                   Pre-Development, 5Yr 4hr CC Chicago
*******************************************************************************
*                   IDF Values from MTO Lookup Tool
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 580.949
| Ptotal= 46.98 mm |                          B=   1.500
--------------------                          C=    .711
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33

                    The CORRELATION coefficient is =  .9996
```

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	165.60	153.52
10.	102.60	102.33
15.	77.50	79.16
30.	48.10	49.98
60.	29.90	31.06
120.	18.60	19.14
360.	8.80	8.82
720.	5.50	5.39
1440.	3.40	3.30

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	3.64	1.08	12.43	2.08	8.60	3.08	4.65
.17	3.83	1.17	17.58	2.17	7.97	3.17	4.50
.25	4.04	1.25	36.25	2.25	7.43	3.25	4.36
.33	4.29	1.33	153.52	2.33	6.97	3.33	4.22
.42	4.57	1.42	45.94	2.42	6.58	3.42	4.10
.50	4.90	1.50	26.61	2.50	6.24	3.50	3.99
.58	5.30	1.58	19.50	2.58	5.93	3.58	3.88
.67	5.79	1.67	15.69	2.67	5.66	3.67	3.78
.75	6.40	1.75	13.28	2.75	5.42	3.75	3.69
.83	7.20	1.83	11.60	2.83	5.20	3.83	3.60
.92	8.28	1.92	10.35	2.92	5.00	3.92	3.51
1.00	9.86	2.00	9.38	3.00	4.82	4.00	3.43

---

* 100

CALIB					
NASHYD (0001)	Area (ha)=	8.90	Curve Number (CN)=	65.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	.33		

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

Unit Hyd Qpeak (cms)= 1.03

PEAK FLOW (cms)= .17 (i)
TIME TO PEAK (hrs)= 1.75
RUNOFF VOLUME (mm)= 9.73
TOTAL RAINFALL (mm)= 46.98
RUNOFF COEFFICIENT = .21

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

SAVE HYD (0001)	AREA (ha)=	8.90
ID= 1 PCYC= 61	QPEAK (cms)=	.17 (i)
DT= 5.0 min	TPEAK (hrs)=	1.75
	VOLUME (mm)=	9.73

Filename: EHSouPre.TXT
Comments: Pre-Development to South /z3

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

--------------------------------------------------------------------------------
*                    101a
--------------------
| CALIB              |
| NASHYD    (0001) |   Area     (ha)=  12.80   Curve Number    (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .35

     Unit Hyd Qpeak  (cms)=   1.40

     PEAK FLOW       (cms)=    .21 (i)
     TIME TO PEAK    (hrs)=   1.75
     RUNOFF VOLUME    (mm)=   8.80
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .19

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

--------------------------------------------------------------------------------
*                    101b
--------------------
| CALIB              |
| NASHYD    (0001) |   Area     (ha)=  21.11   Curve Number    (CN)= 71.0
|ID= 2 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .85

     Unit Hyd Qpeak  (cms)=    .95

     PEAK FLOW       (cms)=    .28 (i)
     TIME TO PEAK    (hrs)=   2.50
     RUNOFF VOLUME    (mm)=  11.94
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .25

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    12.80      .21     1.75     8.80
        + ID2= 2 (0001):    21.11      .28     2.50    11.94
          ================================================
          ID = 3 (0001):    33.91      .41     2.08    10.76

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  33.91
| ID= 3   PCYC= 91 |   QPEAK     (cms)=    .41 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.08
```

```
--------------------   VOLUME     (mm)=  10.76
  Filename: EFNorPre.TXT
  Comments: 101, Pre-development to Node A /z1

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

--------------------------------------------------------------------------------
********************************************************************************
*                   Post-Development, 5Yr 4hr CC Chicago
********************************************************************************
*                   Catchment 600
--------------------
| CALIB             |
| NASHYD    (0001) |   Area    (ha)=   5.11   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .31

     Unit Hyd Qpeak  (cms)=    .63

     PEAK FLOW       (cms)=    .09 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=   8.79
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .19

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.11
| ID= 1   PCYC= 59 |   QPEAK     (cms)=    .09 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=   8.79
  Filename: EF600.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Catchment 200
--------------------
| CALIB             |
| STANDHYD  (0001) |   Area    (ha)=    .46
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .18          .28
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      55.00        55.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         7.39
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       1.45 (ii)   25.67 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=        .33          .04
```

```
                                                                  *TOTALS*
     PEAK FLOW       (cms)=        .06          .00            .06 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75           1.33
     RUNOFF VOLUME    (mm)=      44.69         2.64          15.25
     TOTAL RAINFALL   (mm)=      46.98        46.98          46.98
     RUNOFF COEFFICIENT   =        .95          .06            .32

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .46
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .06 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  15.25
  Filename: EF200.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .126 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .46       .06      1.33   15.25
     ================================================
     MAJOR SYS.(ID= 4):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):    .46       .06      1.33   15.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 4   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.11      .09     1.67     8.79
        + ID2= 3 (0001):      .46      .06     1.33    15.25
```

```
          ================================================
          ID = 2 (0001):     5.57      .10     1.67     9.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 608
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.38   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .17

     Unit Hyd Qpeak  (cms)=    .31

     PEAK FLOW       (cms)=    .04 (i)
     TIME TO PEAK    (hrs)=   1.50
     RUNOFF VOLUME    (mm)=   8.73
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .19

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .085 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   1.38       .04      1.50    8.73
     ======================================================
     MAJOR SYS.(ID= 5):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):   1.38       .04      1.50    8.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 5   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  9    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 4> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 5> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 9> IS ALSO DRY
--------------------------------------------------------------------------------

--------------------
```

```
| ADD HYD   (0001) |
|   2 +  3 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     5.57      .10     1.67     9.33
        + ID2= 3 (0001):     1.38      .04     1.50     8.73
          ================================================
          ID = 1 (0001):     6.95      .13     1.67     9.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 201
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.10
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.24         1.86
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     144.00       144.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         2.84
               over (min)        10.00        65.00
     Storage Coeff.  (min)=       2.59 (ii)   65.82 (ii)
     Unit Hyd. Tpeak (min)=       5.00        70.00
     Unit Hyd. peak  (cms)=        .29          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .35          .01          .35 (iii)
     TIME TO PEAK    (hrs)=       1.42         2.50         1.42
     RUNOFF VOLUME    (mm)=      44.69         2.64        15.13
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .06          .32

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.10
| ID= 2   PCYC= 60 |   QPEAK     (cms)=    .35 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  15.13
  Filename: EF201.TXT
  Comments:

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

--------------------------------------------------------------------------------
```

```
*                   Add 201 to 200min, 608min, 600

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.95      .13     1.67     9.21
        + ID2= 2 (0001):     3.10      .35     1.42    15.13
          ================================================
          ID = 3 (0001):    10.05      .45     1.42    11.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 100
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  50.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.26         1.50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     158.00       158.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         4.67
               over (min)        10.00        55.00
     Storage Coeff.  (min)=       2.73 (ii)   57.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00        60.00
     Unit Hyd. peak  (cms)=        .29          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .70          .01          .70 (iii)
     TIME TO PEAK    (hrs)=       1.42         2.33         1.42
     RUNOFF VOLUME    (mm)=      44.69         3.42        23.97
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .07          .51

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*                   Add 100 to main

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     3.76      .70     1.42    23.97
        + ID2= 3 (0001):    10.05      .45     1.42    11.03
```

```
          ================================================
          ID = 2 (0001):    13.81     1.15     1.42    14.56

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 604
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .44
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .13          .31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      54.00        54.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         9.04
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       1.44 (ii)   23.54 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .33          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .01          .03 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67         1.33
     RUNOFF VOLUME    (mm)=      44.69         3.10         8.74
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .07          .19

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .44
| ID= 1   PCYC= 37 |   QPEAK     (cms)=    .03 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   8.74
  Filename: EF604.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
```

```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):       .44      .03     1.33     8.74
        + ID2= 2 (0001):     13.81     1.15     1.42    14.56
          ================================================
          ID = 3 (0001):     14.25     1.16     1.42    14.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 400
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .35
|ID= 1 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .14          .21
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      48.00        48.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         7.39
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       1.34 (ii)   23.66 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .33          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .04          .00          .04 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67         1.33
     RUNOFF VOLUME    (mm)=      44.69         2.64        15.25
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .06          .32

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .35
| ID= 1   PCYC= 48 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  15.25
  Filename: EF400.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
```

```
| DUHYD     (0001) |
| Inlet Cap.= .032 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)      (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):    .35       .04      1.33   15.25
     ==========================================================
     MAJOR SYS.(ID= 4):    .02       .01      1.33   15.25
     MINOR SYS.(ID= 2):    .33       .03      1.33   15.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):      .33      .03     1.33    15.25
        + ID2= 3 (0001):    14.25     1.16     1.42    14.38
          ================================================
          ID = 1 (0001):    14.58     1.18     1.42    14.40

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 401
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .19
|ID= 2 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .06          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      36.00        36.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         8.21
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       1.13 (ii)   19.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .34          .06
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .02 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58         1.33
     RUNOFF VOLUME    (mm)=      44.69         2.39         9.12
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .05          .19

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
```

```
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .19
| ID= 2   PCYC= 28 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   9.12
  Filename: EF401.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .016 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .19       .02      1.33    9.12
     ================================================
     MAJOR SYS.(ID= 5):    .00       .00      1.33    9.12
     MINOR SYS.(ID= 3):    .19       .02      1.33    9.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  8    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    14.58     1.18     1.42    14.40
        + ID2= 3 (0001):      .19      .02     1.33     9.12
          ================================================
          ID = 8 (0001):    14.76     1.18     1.42    14.33

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 4 (0001):      .02      .01     1.33    15.25
        + ID2= 5 (0001):      .00      .00     1.33     9.12
          ================================================
          ID = 1 (0001):      .03      .01     1.33    14.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 402
--------------------
```

```
| CALIB             |
| STANDHYD  (0001) |   Area    (ha)=   1.91
|ID= 2 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .96          .95
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     113.00       113.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         4.75
               over (min)        10.00        45.00
     Storage Coeff.  (min)=       2.24 (ii)   46.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00        50.00
     Unit Hyd. peak  (cms)=        .30          .02
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .30          .01          .30 (iii)
     TIME TO PEAK    (hrs)=       1.42         2.17         1.42
     RUNOFF VOLUME    (mm)=      44.69         2.97        19.56
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .06          .42

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.91
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .30 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  19.56
  Filename: EF402.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                  Add to 400, 401 major (flows to Street A)

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .03      .01     1.33    14.81
        + ID2= 2 (0001):     1.91      .30     1.42    19.56
          ================================================
          ID = 3 (0001):     1.94      .30     1.42    19.50

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------------------------------------------------------------------
*                   Catchment 605
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .71
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .21          .50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      69.00        69.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         7.53
               over (min)        10.00        30.00
     Storage Coeff.  (min)=       1.66 (ii)   29.20 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=        .32          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .04          .01          .04 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.75         1.33
     RUNOFF VOLUME    (mm)=      44.69         3.10         9.32
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .07          .20

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .71
| ID= 1   PCYC= 48 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   9.32
  Filename: EF605.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):       .71      .04     1.33     9.32
        + ID2= 3 (0001):     1.94      .30     1.42    19.50
          ================================================
```

```
          ID = 2 (0001):     2.65      .32     1.42    16.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.65
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .32 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  16.77
  Filename: EFSTIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| COMPUTE VOLUME   |
| ID= 2   (0001)   |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
           START CONTROLLING AT      .05        1.25
           INFLOW HYD. PEAKS AT      .32        1.42
           STOP  CONTROLLING AT      .17        1.48

           REQUIRED STORAGE VOLUME (ha.m.)=    .0068
           TOTAL HYDROGRAPH VOLUME (ha.m.)=    .0444
           % OF HYDROGRAPH TO STORE       =  15.3597

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .17  (cms).

--------------------------------------------------------------------------------
**************************************************************
*                   Route through EZStorm Units
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000       .000   |     .077       .024
                            .034       .004   |     .134       .032
                            .052       .012   |     .166       .040
                            .065       .021   |     .179       .043

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)      2.65       .32      1.42      16.77
     OUTFLOW: ID= 1 (0001)      2.65       .06      1.67      16.76

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.62
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .02

--------------------------------------------------------------------------------
**************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.65
```

```
| ID= 1   PCYC= 59 |   QPEAK     (cms)=    .06 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
-------------------   VOLUME     (mm)=  16.76
  Filename: EFSTOUT.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   South Undeveloped, 607
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.35   Curve Number   (CN)= 62.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .29

     Unit Hyd Qpeak  (cms)=    .70

     PEAK FLOW       (cms)=    .10 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=   8.79
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .19

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.35
| ID= 2   PCYC= 58 |   QPEAK     (cms)=    .10 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=   8.79
  Filename: EF607.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Total to South

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     2.65      .06     1.67    16.76
        + ID2= 2 (0001):     5.35      .10     1.67     8.79
          ================================================
          ID = 3 (0001):     8.00      .16     1.67    11.42

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   8.00
| ID= 3   PCYC= 59 |   QPEAK     (cms)=    .16 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  11.42
```

```
  Filename: EFSOUTH.TXT
  Comments: Post-dev to South /z4

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

--------------------------------------------------------------------------------
*                   Pond Catchment
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  66.00   Dir. Conn.(%)=  58.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .50          .26
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      71.00        71.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73        24.41
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       1.69 (ii)    9.74 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .32          .11
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .18          .01          .19 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.33
     RUNOFF VOLUME    (mm)=      44.69         3.29        27.30
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .07          .58

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*                   Pond inflow

--------------------
| ADD HYD   (0001) |
|   1 +  8 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .76      .19     1.33    27.30
        + ID2= 8 (0001):    14.76     1.18     1.42    14.33
          ==========================================
          ID = 2 (0001):    15.52     1.26     1.42    14.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.52
```

```
| ID= 2   PCYC= 60 |   QPEAK     (cms)=   1.26 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  14.96
  Filename: EFSMWFIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
****************************************************************
*                    Route through SWMF
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 8 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------        (cms)     (ha.m.)   |    (cms)     (ha.m.)
                              .000       .000   |      .051       .333
                              .005       .026   |      .163       .405
                              .010       .053   |      .367       .480
                              .015       .109   |      .526       .519
                              .017       .139   |    1.058       .600
                              .020       .200   |    1.394       .641
                              .023       .265   |    2.172       .727

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)      15.52      1.26      1.42      14.96
     OUTFLOW: ID= 8 (0001)      15.52       .02      4.17      14.86

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.63
                   TIME SHIFT OF PEAK FLOW         (min)=165.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .21

--------------------------------------------------------------------------------
****************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.52
| ID= 8   PCYC=801 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   4.17
--------------------   VOLUME     (mm)=  14.86
  Filename: EFSWMFQ.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                    Catchment 601
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   3.97   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .22

     Unit Hyd Qpeak  (cms)=    .69

     PEAK FLOW       (cms)=    .09 (i)
     TIME TO PEAK    (hrs)=   1.58
```

```
     RUNOFF VOLUME    (mm)=   8.78
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .19

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.97
| ID= 1   PCYC= 55 |   QPEAK     (cms)=    .09 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.58
--------------------   VOLUME     (mm)=   8.78
  Filename: EF601.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add 200maj, 608maj, 601

--------------------
| ADD HYD   (0001) |
|   1 +  9 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 9> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0002 = HYDROGRAPH 0001
          ID1= 1 (0001):     3.97      .09     1.58     8.78
        + ID2= 9 (0001):      .00      .00      .00      .00
          ================================================
          ID = 2 (0001):     3.97      .09     1.58     8.78

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 602
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   2.04   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .24

     Unit Hyd Qpeak  (cms)=    .32

     PEAK FLOW       (cms)=    .05 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=   9.70
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .21

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

--------------------------------------------------------------------------------
*                   Route 602
--------------------
| SHIFT HYD (0001) |
| IN= 1---> OUT= 3 |
| SHIFT=  5.0 min  |      AREA     QPEAK     TPEAK      R.V.
```

```
--------------------      (ha)      (cms)      (hrs)       (mm)
          ID= 1 (0001):    2.04       .05       1.58       9.70
    SHIFT ID= 3 (0001):    2.04       .05       1.67       9.70

------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.04
| ID= 3   PCYC= 55 |   QPEAK     (cms)=    .05 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=   9.70
  Filename: EF602.TXT
  Comments:

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

------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     3.97      .09     1.58     8.78
        + ID2= 3 (0001):     2.04      .05     1.67     9.70
          ================================================
          ID = 1 (0001):     6.01      .13     1.58     9.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*                   Catchment 302
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .90
|ID= 2 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .33          .57
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      77.00        77.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         5.87
               over (min)        10.00        35.00
     Storage Coeff.  (min)=       1.78 (ii)   34.28 (ii)
     Unit Hyd. Tpeak (min)=       5.00        35.00
     Unit Hyd. peak  (cms)=        .32          .03
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .09          .01          .09 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.83         1.33
     RUNOFF VOLUME    (mm)=      44.69         2.88        13.29
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .06          .28

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
```

```
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .90
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .09 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  13.29
  Filename: EF302.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.01      .13     1.58     9.09
        + ID2= 2 (0001):      .90      .09     1.33    13.29
          ================================================
          ID = 3 (0001):     6.91      .15     1.58     9.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 603
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.79   Curve Number   (CN)= 70.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .42

     Unit Hyd Qpeak  (cms)=    .53

     PEAK FLOW       (cms)=    .11 (i)
     TIME TO PEAK    (hrs)=   1.83
     RUNOFF VOLUME    (mm)=  11.53
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .25

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.79
| ID= 1   PCYC= 64 |   QPEAK     (cms)=    .11 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.83
--------------------   VOLUME     (mm)=  11.53
  Filename: EF603.TXT
  Comments:
```

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

ADD HYD (0001)		AREA	QPEAK	TPEAK	R.V.
1 + 3 = 2		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	5.79	.11	1.83	11.53
	+ ID2= 3 (0001):	6.91	.15	1.58	9.64
	ID = 2 (0001):	12.70	.24	1.67	10.50

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---

* Catchment 300

CALIB		
STANDHYD (0001)	Area (ha)=	.66
ID= 1 DT= 5.0 min	Total Imp(%)=	30.00 Dir. Conn.(%)= 20.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.20	.46	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	66.00	66.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	99.73	4.69	
over	(min)	10.00	35.00	
Storage Coeff.	(min)=	1.62 (ii)	34.03 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	35.00	
Unit Hyd. peak	(cms)=	.32	.03	
				TOTALS
PEAK FLOW	(cms)=	.05	.00	.05 (iii)
TIME TO PEAK	(hrs)=	1.33	1.83	1.33
RUNOFF VOLUME	(mm)=	44.69	2.39	10.82
TOTAL RAINFALL	(mm)=	46.98	46.98	46.98
RUNOFF COEFFICIENT	=	.95	.05	.23

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

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00
(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

SAVE HYD (0001)		AREA	(ha)=	.66
ID= 1 PCYC= 48		QPEAK	(cms)=	.05 (i)
DT= 5.0 min		TPEAK	(hrs)=	1.33
		VOLUME	(mm)=	10.82

Filename: EF300.TXT

Comments:

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

ADD HYD (0001)		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3	ID1= 1 (0001):	.66	.05	1.33	10.82
	+ ID2= 2 (0001):	12.70	.24	1.67	10.50
	ID = 3 (0001):	13.36	.25	1.67	10.52

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---

* Catchment 301

CALIB STANDHYD (0001) ID= 1 DT= 5.0 min	Area (ha)= .18 Total Imp(%)= 30.00 Dir. Conn.(%)= 20.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.05	.13	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	35.00	35.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	99.73	8.21	
over	(min)	10.00	20.00	
Storage Coeff.	(min)=	1.11 (ii)	18.81 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	20.00	
Unit Hyd. peak	(cms)=	.34	.06	
				TOTALS
PEAK FLOW	(cms)=	.02	.00	.02 (iii)
TIME TO PEAK	(hrs)=	1.33	1.58	1.33
RUNOFF VOLUME	(mm)=	44.69	2.39	8.96
TOTAL RAINFALL	(mm)=	46.98	46.98	46.98
RUNOFF COEFFICIENT	=	.95	.05	.19

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

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00

(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL THAN THE STORAGE COEFFICIENT.

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

SAVE HYD (0001) ID= 1 PCYC= 27 DT= 5.0 min		
	AREA (ha)=	.18
	QPEAK (cms)=	.02 (i)
	TPEAK (hrs)=	1.33

```
--------------------   VOLUME     (mm)=   8.96
  Filename: EF301.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .18      .02     1.33     8.96
        + ID2= 3 (0001):    13.36      .25     1.67    10.52
          ================================================
          ID = 2 (0001):    13.54      .26     1.67    10.50

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 303
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  15.00   Dir. Conn.(%)=  10.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .08          .45
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      59.00        59.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      99.73         2.03
               over (min)        10.00        45.00
     Storage Coeff.  (min)=       1.51 (ii)   43.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00        45.00
     Unit Hyd. peak  (cms)=        .33          .03
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .02 (iii)
     TIME TO PEAK    (hrs)=       1.33         2.00         1.33
     RUNOFF VOLUME    (mm)=      44.69         1.44         5.31
     TOTAL RAINFALL   (mm)=      46.98        46.98        46.98
     RUNOFF COEFFICIENT   =        .95          .03          .11

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
```

```
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .53
| ID= 1   PCYC= 39 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=   5.31
  Filename: EF303.TXT
  Comments:

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

```
--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):       .53      .02     1.33     5.31
        + ID2= 2 (0001):    13.54      .26     1.67    10.50
          ================================================
          ID = 3 (0001):    14.07      .26     1.67    10.30

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
*                   Add flows from pond

--------------------
| ADD HYD   (0001) |
|   3 +  8 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0001):    14.07      .26     1.67    10.30
        + ID2= 8 (0001):    15.52      .02     4.17    14.86
          ================================================
          ID = 1 (0001):    29.59      .27     1.67    12.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
*                   Wetland Area
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   4.10   Curve Number   (CN)= 58.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=    .28

     PEAK FLOW       (cms)=    .04 (i)
     TIME TO PEAK    (hrs)=   2.08
     RUNOFF VOLUME    (mm)=   7.67
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .16

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

```
--------------------
```

```
| SAVE HYD  (0001) |   AREA       (ha)=   4.10
| ID= 2   PCYC= 67 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.08
--------------------   VOLUME     (mm)=   7.67
  Filename: WLAREA.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    29.59      .27     1.67    12.57
        + ID2= 2 (0001):     4.10      .04     2.08     7.67
          ================================================
          ID = 3 (0001):    33.69      .31     1.75    11.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                    Catchment 606
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.28   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

     Unit Hyd Qpeak  (cms)=    .26

     PEAK FLOW       (cms)=    .03 (i)
     TIME TO PEAK    (hrs)=   1.50
     RUNOFF VOLUME    (mm)=   8.75
     TOTAL RAINFALL   (mm)=  46.98
     RUNOFF COEFFICIENT   =    .19

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.28
| ID= 1   PCYC= 52 |   QPEAK     (cms)=    .03 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=   8.75
  Filename: EF606.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (0001):     1.28      .03     1.50     8.75
        + ID2= 3 (0001):    33.69      .31     1.75    11.98
          ================================================
          ID = 2 (0001):    34.97      .33     1.67    11.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  34.97
| ID= 2   PCYC=801 |   QPEAK     (cms)=    .33 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  11.86
  Filename: EFNODEA.TXT
  Comments: Post-dev to Node A /z2

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

--------------------------------------------------------------------------------

 FINISH
================================================================================
```

```
================================================================================

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989a * * *
       O   O    T      T    HHHHH    Y    M M M  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO             01673

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.


  Input   filename: ef.dat
  Output  filename: ef.out
  Summary filename: ef.sum



DATE: 01-25-2023                      TIME: 10:10:41


COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
*
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

*
*                   Eastfields Development
*
*                   100Yr Climate Change Event
*                   January 30, 2023
*                   Andrew Rosenthal, EIT
*
*                   Updated catchments and logic based on detailed grading
*
*                   LGI, LGP from L=SQRT(A/1.5)
*
*******************************************************************************
*                   Pre-Development, 100Yr 4hr CC Chicago
*******************************************************************************
*                   IDF Values from MTO Lookup Tool
--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 963.129
| Ptotal= 75.36 mm |                          B=   1.500
--------------------                          C=    .717
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =   .33

                    The CORRELATION coefficient is =  .9996
```

TIME (min)	INPUT INT. (mm/hr)	TAB. INT. (mm/hr)
5.	270.70	251.67
10.	167.30	167.17
15.	126.30	129.05
30.	78.10	81.17
60.	48.40	50.24
120.	30.00	30.83
360.	14.00	14.11
720.	8.70	8.60
1440.	5.40	5.23

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
.08	5.72	1.08	19.77	2.08	13.64	3.08	7.33
.17	6.02	1.17	28.07	2.17	12.62	3.17	7.08
.25	6.36	1.25	58.41	2.25	11.76	3.25	6.86
.33	6.75	1.33	251.67	2.33	11.03	3.33	6.65
.42	7.20	1.42	74.20	2.42	10.40	3.42	6.46
.50	7.73	1.50	42.68	2.50	9.85	3.50	6.27
.58	8.37	1.58	31.17	2.58	9.37	3.58	6.11
.67	9.14	1.67	25.03	2.67	8.94	3.67	5.95
.75	10.12	1.75	21.14	2.75	8.55	3.75	5.80
.83	11.38	1.83	18.44	2.83	8.20	3.83	5.66
.92	13.11	1.92	16.43	2.92	7.88	3.92	5.52
1.00	15.64	2.00	14.88	3.00	7.59	4.00	5.40

---

* 100

CALIB					
NASHYD (0001)	Area (ha)=	8.90	Curve Number (CN)=	65.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	.33		

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

Unit Hyd Qpeak (cms)= 1.03

PEAK FLOW (cms)= .44 (i)
TIME TO PEAK (hrs)= 1.75
RUNOFF VOLUME (mm)= 23.63
TOTAL RAINFALL (mm)= 75.36
RUNOFF COEFFICIENT = .31

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

SAVE HYD (0001)	AREA (ha)=	8.90
ID= 1 PCYC= 63	QPEAK (cms)=	.44 (i)
DT= 5.0 min	TPEAK (hrs)=	1.75
	VOLUME (mm)=	23.63

Filename: EHSouPre.TXT
Comments: Pre-Development to South /z3

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

--------------------------------------------------------------------------------
*                    101a
--------------------
| CALIB              |
| NASHYD    (0001) |   Area     (ha)=  12.80   Curve Number    (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .35

     Unit Hyd Qpeak  (cms)=   1.40

     PEAK FLOW       (cms)=    .55 (i)
     TIME TO PEAK    (hrs)=   1.75
     RUNOFF VOLUME    (mm)=  21.66
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .29

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

--------------------------------------------------------------------------------
*                    101b
--------------------
| CALIB              |
| NASHYD    (0001) |   Area     (ha)=  21.11   Curve Number    (CN)= 71.0
|ID= 2 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .85

     Unit Hyd Qpeak  (cms)=    .95

     PEAK FLOW       (cms)=    .68 (i)
     TIME TO PEAK    (hrs)=   2.42
     RUNOFF VOLUME    (mm)=  28.14
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .37

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    12.80      .55     1.75    21.66
        + ID2= 2 (0001):    21.11      .68     2.42    28.14
          ================================================
          ID = 3 (0001):    33.91     1.03     2.00    25.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  33.91
| ID= 3   PCYC= 96 |   QPEAK     (cms)=   1.03 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.00
```

```
--------------------   VOLUME     (mm)=  25.69
  Filename: EFNorPre.TXT
  Comments: 101, Pre-development to Node A /z1

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

--------------------------------------------------------------------------------
********************************************************************************
*                   Post-Development, 100Yr 4hr CC Chicago
********************************************************************************
*                   Catchment 600
--------------------
| CALIB             |
| NASHYD    (0001) |   Area    (ha)=   5.11   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .31

     Unit Hyd Qpeak  (cms)=    .63

     PEAK FLOW       (cms)=    .24 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=  21.65
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .29

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.11
| ID= 1   PCYC= 61 |   QPEAK     (cms)=    .24 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  21.65
  Filename: EF600.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Catchment 200
--------------------
| CALIB             |
| STANDHYD  (0001) |   Area    (ha)=    .46
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .18          .28
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      55.00        55.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        96.19
               over (min)       10.00        10.00
     Storage Coeff.  (min)=       1.19 (ii)   10.47 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .09
```

```
                                                                  *TOTALS*
     PEAK FLOW       (cms)=        .10          .04            .11 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50           1.33
     RUNOFF VOLUME    (mm)=      72.91        13.74          31.49
     TOTAL RAINFALL   (mm)=      75.36        75.36          75.36
     RUNOFF COEFFICIENT   =        .97          .18            .42

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .46
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .11 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  31.49
  Filename: EF200.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .126 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .46       .11      1.33   31.49
     ================================================
     MAJOR SYS.(ID= 4):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):    .46       .11      1.33   31.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 4   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.11      .24     1.67    21.65
        + ID2= 3 (0001):      .46      .11     1.33    31.49
```

```
          ================================================
          ID = 2 (0001):     5.57      .27     1.58    22.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*                   Catchment 608
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.38   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .17

     Unit Hyd Qpeak  (cms)=    .31

     PEAK FLOW       (cms)=    .09 (i)
     TIME TO PEAK    (hrs)=   1.50
     RUNOFF VOLUME    (mm)=  21.57
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .29

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

------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .085 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   1.38       .09      1.50   21.57
     ================================================
     MAJOR SYS.(ID= 5):    .02       .01      1.50   21.57
     MINOR SYS.(ID= 3):   1.36       .09      1.42   21.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .02
| ID= 5   PCYC= 19 |   QPEAK     (cms)=    .01 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=  21.57
  Filename: EF608maj.TXT
  Comments: 608 major

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

------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  9    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 4> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 = HYDROGRAPH 0001
          ID1= 4 (0001):      .00      .00      .00      .00
```

```
        + ID2= 5 (0001):      .02      .01     1.50    21.57
          ================================================
          ID = 9 (0001):      .02      .01     1.50    21.57

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     5.57      .27     1.58    22.46
        + ID2= 3 (0001):     1.36      .09     1.42    21.57
          ================================================
          ID = 1 (0001):     6.93      .35     1.58    22.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 201
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.10
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.24         1.86
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     144.00       144.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        38.48
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       2.12 (ii)   24.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .31          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .60          .13          .62 (iii)
     TIME TO PEAK    (hrs)=       1.42         1.75         1.42
     RUNOFF VOLUME    (mm)=      72.91        13.74        31.47
     TOTAL RAINFALL   (mm)=      75.36        75.36        75.36
     RUNOFF COEFFICIENT   =        .97          .18          .42

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.10
```

```
| ID= 2   PCYC= 50 |   QPEAK     (cms)=    .62 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  31.47
  Filename: EF201.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add 201 to 200min, 608min, 600

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.93      .35     1.58    22.28
        + ID2= 2 (0001):     3.10      .62     1.42    31.47
          ================================================
          ID = 3 (0001):    10.03      .89     1.42    25.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 100
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  50.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.26         1.50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     158.00       158.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        45.74
               over (min)       10.00        25.00
     Storage Coeff.  (min)=       2.25 (ii)   24.25 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .30          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=       1.20          .12        1.22 (iii)
     TIME TO PEAK    (hrs)=       1.42         1.75        1.42
     RUNOFF VOLUME    (mm)=      72.91        15.96       44.40
     TOTAL RAINFALL   (mm)=      75.36        75.36       75.36
     RUNOFF COEFFICIENT   =        .97          .21         .59

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
*                   Add 100 to main

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     3.76     1.22     1.42    44.40
        + ID2= 3 (0001):    10.03      .89     1.42    25.12
          ================================================
          ID = 2 (0001):    13.79     2.12     1.42    30.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 604
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .44
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .13          .31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      54.00        54.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        70.92
               over (min)       10.00        10.00
     Storage Coeff.  (min)=       1.18 (ii)   10.87 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .09
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .05          .05          .06 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
     RUNOFF VOLUME    (mm)=      72.91        14.60        23.35
     TOTAL RAINFALL   (mm)=      75.36        75.36        75.36
     RUNOFF COEFFICIENT   =        .97          .19          .31

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .44
| ID= 1   PCYC= 48 |   QPEAK     (cms)=    .06 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  23.35
```

Filename: EF604.TXT
Comments:

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

ADD HYD (0001)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	.44	.06	1.33	23.35
	+ ID2= 2 (0001):	13.79	2.12	1.42	30.38
	ID = 3 (0001):	14.23	2.16	1.42	30.16

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---

* Catchment 400

CALIB STANDHYD (0001) ID= 1 DT= 5.0 min	Area (ha)= .35 Total Imp(%)= 40.00 Dir. Conn.(%)= 30.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.14	.21	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	48.00	48.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	162.93	96.19	
over	(min)	10.00	10.00	
Storage Coeff.	(min)=	1.10 (ii)	9.65 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	.34	.11	
				TOTALS
PEAK FLOW	(cms)=	.07	.04	.09 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	72.91	13.74	31.49
TOTAL RAINFALL	(mm)=	75.36	75.36	75.36
RUNOFF COEFFICIENT	=	.97	.18	.42

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

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00
(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

SAVE HYD (0001) ID= 1 PCYC= 48	AREA (ha)= .35 QPEAK (cms)= .09 (i)

```
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  31.49
  Filename: EF400.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .032 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):    .35       .09      1.33   31.49
     ==================================================
     MAJOR SYS.(ID= 4):    .08       .06      1.33   31.49
     MINOR SYS.(ID= 2):    .27       .03      1.33   31.49

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):      .27      .03     1.33    31.49
        + ID2= 3 (0001):    14.23     2.16     1.42    30.16
          ================================================
          ID = 1 (0001):    14.50     2.20     1.42    30.19

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 401
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .19
|ID= 2 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .06          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      36.00        36.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        91.64
               over (min)       10.00        10.00
     Storage Coeff.  (min)=        .92 (ii)    9.92 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .11
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .02          .04 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.33
     RUNOFF VOLUME    (mm)=      72.91        13.36        23.42
```

```
     TOTAL RAINFALL   (mm)=      75.36        75.36          75.36
     RUNOFF COEFFICIENT   =        .97          .18            .31

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .19
| ID= 2   PCYC= 32 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  23.42
  Filename: EF401.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .016 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .19       .04      1.33   23.42
     ====================================================
     MAJOR SYS.(ID= 5):    .05       .02      1.33   23.42
     MINOR SYS.(ID= 3):    .14       .02      1.33   23.42

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  8    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    14.50     2.20     1.42    30.19
        + ID2= 3 (0001):      .14      .02     1.33    23.42
          ================================================
          ID = 8 (0001):    14.64     2.21     1.42    30.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 4 (0001):      .08      .06     1.33    31.49
```

```
        + ID2= 5 (0001):      .05      .02     1.33    23.42
          ================================================
          ID = 1 (0001):      .13      .08     1.33    28.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 402
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   1.91
|ID= 2 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .96          .95
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     113.00       113.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        51.59
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       1.84 (ii)   18.99 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .32          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .51          .09          .53 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58         1.33
     RUNOFF VOLUME    (mm)=      72.91        14.33        37.75
     TOTAL RAINFALL   (mm)=      75.36        75.36        75.36
     RUNOFF COEFFICIENT   =        .97          .19          .50

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.91
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .53 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  37.75
  Filename: EF402.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add to 400, 401 major (flows to Street A)

--------------------
| ADD HYD   (0001) |
```

```
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .13      .08     1.33    28.61
        + ID2= 2 (0001):     1.91      .53     1.33    37.75
          ================================================
          ID = 3 (0001):     2.04      .60     1.33    37.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 605
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .71
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .21          .50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      69.00        69.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        70.92
               over (min)       10.00        15.00
     Storage Coeff.  (min)=       1.37 (ii)   12.60 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .07          .07          .09 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
     RUNOFF VOLUME    (mm)=      72.91        14.60        23.35
     TOTAL RAINFALL   (mm)=      75.36        75.36        75.36
     RUNOFF COEFFICIENT   =        .97          .19          .31

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .71
| ID= 1   PCYC= 48 |   QPEAK     (cms)=    .09 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  23.35
  Filename: EF605.TXT
  Comments:

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

```
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .71      .09     1.33    23.35
        + ID2= 3 (0001):     2.04      .60     1.33    37.17
          ================================================
          ID = 2 (0001):     2.75      .70     1.33    33.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.75
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .70 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  33.60
  Filename: EFSTIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| COMPUTE VOLUME   |
| ID= 2   (0001)   |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
           START CONTROLLING AT      .00         .35
           INFLOW HYD. PEAKS AT      .70        1.33
           STOP  CONTROLLING AT      .17        1.68

           REQUIRED STORAGE VOLUME (ha.m.)=    .0294
           TOTAL HYDROGRAPH VOLUME (ha.m.)=    .0924
           % OF HYDROGRAPH TO STORE       =  31.7812

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .17  (cms).

--------------------------------------------------------------------------------
**************************************************************
*                   Route through EZStorm Units
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000       .000    |     .077       .024
                           .034       .004    |     .134       .032
                           .052       .012    |     .166       .040
                           .065       .021    |     .179       .043

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)       2.75       .70      1.33      33.60
     OUTFLOW: ID= 1 (0001)       2.75       .16      1.67      33.59
```

```
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.08
                    TIME SHIFT OF PEAK FLOW         (min)= 20.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=   .04

--------------------------------------------------------------------------------
****************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.75
| ID= 1   PCYC= 63 |   QPEAK     (cms)=    .16 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  33.59
  Filename: EFSTOUT.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                    South Undeveloped, 607
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.35   Curve Number   (CN)= 62.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .29

     Unit Hyd Qpeak  (cms)=    .70

     PEAK FLOW       (cms)=    .26 (i)
     TIME TO PEAK    (hrs)=   1.67
     RUNOFF VOLUME    (mm)=  21.65
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .29

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.35
| ID= 2   PCYC= 60 |   QPEAK     (cms)=    .26 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  21.65
  Filename: EF607.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                    Total to South

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     2.75      .16     1.67    33.59
        + ID2= 2 (0001):     5.35      .26     1.67    21.65
          ================================================
          ID = 3 (0001):     8.10      .42     1.67    25.69
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
| SAVE HYD  (0001) |   AREA       (ha)=   8.10
| ID= 3   PCYC= 63 |   QPEAK     (cms)=    .42 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
                     VOLUME      (mm)=  25.69
```

Filename: EFSOUTH.TXT
Comments: Post-dev to South /z4

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

* Pond Catchment

```
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  66.00   Dir. Conn.(%)=  58.00
```

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	.50	.26	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	2.00	2.00	
Length	(m)=	71.00	71.00	
Mannings n	=	.013	.250	
Max.eff.Inten.	(mm/hr)=	162.93	109.31	
over	(min)	10.00	10.00	
Storage Coeff.	(min)=	1.39 (ii)	8.01 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	.33	.13	
				TOTALS
PEAK FLOW	(cms)=	.30	.05	.33 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	72.91	15.28	48.64
TOTAL RAINFALL	(mm)=	75.36	75.36	75.36
RUNOFF COEFFICIENT	=	.97	.20	.65

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

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
Fo (mm/hr)=125.00 K (1/hr)= 2.00
Fc (mm/hr)= 5.00 Cum.Inf. (mm)= 5.00
(ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

* Pond inflow

```
| ADD HYD   (0001) |
|   1 +  8 =  2    |
```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	.76	.33	1.33	48.64

```
        + ID2= 8 (0001):    14.64     2.21     1.42    30.12
          ================================================
          ID = 2 (0001):    15.40     2.36     1.42    31.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.40
| ID= 2   PCYC= 61 |   QPEAK     (cms)=   2.36 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.42
--------------------   VOLUME     (mm)=  31.03
  Filename: EFSMWFIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
************************************************************
*                   Route through SWMF
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 8 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000       .000    |     .051       .333
                           .005       .026    |     .163       .405
                           .010       .053    |     .367       .480
                           .015       .109    |     .526       .519
                           .017       .139    |    1.058       .600
                           .020       .200    |    1.394       .641
                           .023       .265    |    2.172       .727

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)     15.40      2.36      1.42      31.03
     OUTFLOW: ID= 8 (0001)     15.40       .13      3.50      30.76

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.60
                   TIME SHIFT OF PEAK FLOW         (min)=125.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .38

--------------------------------------------------------------------------------
************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.40
| ID= 8   PCYC=964 |   QPEAK     (cms)=    .13 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   3.50
--------------------   VOLUME     (mm)=  30.76
  Filename: EFSWMFQ.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Catchment 601
--------------------
```

```
| CALIB             |
| NASHYD    (0001) |   Area    (ha)=   3.97   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .22

     Unit Hyd Qpeak  (cms)=    .69

     PEAK FLOW       (cms)=    .23 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=  21.62
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .29

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.97
| ID= 1   PCYC= 56 |   QPEAK     (cms)=    .23 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.58
--------------------   VOLUME     (mm)=  21.62
  Filename: EF601.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Add 200maj, 608maj, 601

--------------------
| ADD HYD   (0001) |
|   1 +  9 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     3.97      .23     1.58    21.62
        + ID2= 9 (0001):      .02      .01     1.50    21.57
          ================================================
          ID = 2 (0001):     3.99      .23     1.50    21.62

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 602
--------------------
| CALIB             |
| NASHYD    (0001) |   Area    (ha)=   2.04   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .24

     Unit Hyd Qpeak  (cms)=    .32

     PEAK FLOW       (cms)=    .12 (i)
     TIME TO PEAK    (hrs)=   1.58
     RUNOFF VOLUME    (mm)=  23.60
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .31

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

```
--------------------------------------------------------------------------------
*                   Route 602
--------------------
| SHIFT HYD (0001) |
| IN= 1---> OUT= 3 |
| SHIFT=  5.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 1 (0001):    2.04      .12      1.58     23.60
    SHIFT ID= 3 (0001):    2.04      .12      1.67     23.60

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.04
| ID= 3   PCYC= 57 |   QPEAK     (cms)=    .12 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.67
--------------------   VOLUME     (mm)=  23.60
  Filename: EF602.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     3.99      .23     1.50    21.62
        + ID2= 3 (0001):     2.04      .12     1.67    23.60
          ==========================================================
          ID = 1 (0001):     6.03      .35     1.58    22.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 302
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .90
|ID= 2 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  25.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .33          .57
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      77.00        77.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        67.37
               over (min)       10.00        15.00
     Storage Coeff.  (min)=       1.46 (ii)   13.70 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .15          .07          .17 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
```

```
     RUNOFF VOLUME    (mm)=      72.91        14.15          28.84
     TOTAL RAINFALL   (mm)=      75.36        75.36          75.36
     RUNOFF COEFFICIENT   =        .97          .19            .38

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .90
| ID= 2   PCYC= 48 |   QPEAK     (cms)=    .17 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  28.84
  Filename: EF302.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.03      .35     1.58    22.29
        + ID2= 2 (0001):      .90      .17     1.33    28.84
          ================================================
          ID = 3 (0001):     6.93      .42     1.58    23.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 603
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.79   Curve Number   (CN)= 70.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .42

     Unit Hyd Qpeak  (cms)=    .53

     PEAK FLOW       (cms)=    .29 (i)
     TIME TO PEAK    (hrs)=   1.83
     RUNOFF VOLUME    (mm)=  27.32
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .36

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

--------------------------------------------------------------------------------
--------------------
```

```
| SAVE HYD  (0001) |   AREA       (ha)=   5.79
| ID= 1   PCYC= 67 |   QPEAK     (cms)=    .29 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.83
--------------------   VOLUME     (mm)=  27.32
  Filename: EF603.TXT
  Comments:

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

```
--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.79      .29     1.83    27.32
        + ID2= 3 (0001):     6.93      .42     1.58    23.14
          ================================================
          ID = 2 (0001):    12.72      .65     1.67    25.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
*                   Catchment 300
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .66
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .20          .46
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      66.00        66.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        61.09
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       1.33 (ii)   12.94 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .09          .05          .11 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.33
     RUNOFF VOLUME    (mm)=      72.91        13.36        25.27
     TOTAL RAINFALL   (mm)=      75.36        75.36        75.36
     RUNOFF COEFFICIENT   =        .97          .18          .34

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .66
| ID= 1   PCYC= 48 |   QPEAK     (cms)=    .11 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.33
--------------------   VOLUME     (mm)=  25.27
  Filename: EF300.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .66      .11     1.33    25.27
        + ID2= 2 (0001):    12.72      .65     1.67    25.05
          ================================================
          ID = 3 (0001):    13.38      .70     1.58    25.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 301
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .18
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .05          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      35.00        35.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     162.93        91.64
               over (min)       10.00        10.00
     Storage Coeff.  (min)=        .91 (ii)    9.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .11
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .03          .02          .03 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.33
     RUNOFF VOLUME    (mm)=      72.91        13.36        23.26
     TOTAL RAINFALL   (mm)=      75.36        75.36        75.36
     RUNOFF COEFFICIENT   =        .97          .18          .31

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00           K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

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

SAVE HYD (0001)	AREA (ha)= .18
ID= 1 PCYC= 31	QPEAK (cms)= .03 (i)
DT= 5.0 min	TPEAK (hrs)= 1.33
	VOLUME (mm)= 23.26

Filename: EF301.TXT
Comments:

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

ADD HYD (0001)		AREA	QPEAK	TPEAK	R.V.
1 + 3 = 2		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	.18	.03	1.33	23.26
	+ ID2= 3 (0001):	13.38	.70	1.58	25.06
	ID = 2 (0001):	13.56	.71	1.58	25.03

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---

* Catchment 303

CALIB			
STANDHYD (0001)	Area (ha)= .53		
ID= 1 DT= 5.0 min	Total Imp(%)= 15.00	Dir. Conn.(%)= 10.00	
	IMPERVIOUS	PERVIOUS (i)	
Surface Area (ha)=	.08	.45	
Dep. Storage (mm)=	2.00	5.00	
Average Slope (%)=	2.00	2.00	
Length (m)=	59.00	59.00	
Mannings n =	.013	.250	
Max.eff.Inten.(mm/hr)=	162.93	50.38	
over (min)	10.00	15.00	
Storage Coeff. (min)=	1.24 (ii)	12.97 (ii)	
Unit Hyd. Tpeak (min)=	5.00	15.00	
Unit Hyd. peak (cms)=	.33	.08	
			TOTALS
PEAK FLOW (cms)=	.04	.04	.05 (iii)
TIME TO PEAK (hrs)=	1.33	1.50	1.50
RUNOFF VOLUME (mm)=	72.91	11.89	17.59
TOTAL RAINFALL (mm)=	75.36	75.36	75.36
RUNOFF COEFFICIENT =	.97	.16	.23

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:

```
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .53
| ID= 1   PCYC= 40 |   QPEAK     (cms)=    .05 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=  17.59
  Filename: EF303.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .53      .05     1.50    17.59
        + ID2= 2 (0001):    13.56      .71     1.58    25.03
          ================================================
          ID = 3 (0001):    14.09      .75     1.58    24.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                  Add flows from pond

--------------------
| ADD HYD   (0001) |
|   3 +  8 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0001):    14.09      .75     1.58    24.75
        + ID2= 8 (0001):    15.40      .13     3.50    30.76
          ================================================
          ID = 1 (0001):    29.49      .77     1.58    27.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                  Wetland Area
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   4.10   Curve Number   (CN)= 58.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=    .28

     PEAK FLOW       (cms)=    .12 (i)
     TIME TO PEAK    (hrs)=   2.08
     RUNOFF VOLUME    (mm)=  19.22
```

```
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .26

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   4.10
| ID= 2   PCYC= 70 |   QPEAK     (cms)=    .12 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   2.08
--------------------   VOLUME     (mm)=  19.22
  Filename: WLAREA.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    29.49      .77     1.58    27.86
        + ID2= 2 (0001):     4.10      .12     2.08    19.22
          ================================================
          ID = 3 (0001):    33.59      .84     1.58    26.80

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 606
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.28   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

     Unit Hyd Qpeak  (cms)=    .26

     PEAK FLOW       (cms)=    .08 (i)
     TIME TO PEAK    (hrs)=   1.50
     RUNOFF VOLUME    (mm)=  21.58
     TOTAL RAINFALL   (mm)=  75.36
     RUNOFF COEFFICIENT   =    .29

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.28
| ID= 1   PCYC= 53 |   QPEAK     (cms)=    .08 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.50
--------------------   VOLUME     (mm)=  21.58
  Filename: EF606.TXT
  Comments:

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

```
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     1.28      .08     1.50    21.58
        + ID2= 3 (0001):    33.59      .84     1.58    26.80
          ================================================
          ID = 2 (0001):    34.87      .91     1.58    26.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  34.87
| ID= 2   PCYC=964 |   QPEAK     (cms)=    .91 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   1.58
--------------------   VOLUME     (mm)=  26.61
  Filename: EFNODEA.TXT
  Comments: Post-dev to Node A /z2

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

--------------------------------------------------------------------------------

 FINISH
================================================================================
```

APPENDIX H

OTTHYMO Outputs – Timmins Event

```
================================================================================

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
       O   O    T      T    H   H   Y Y   MM MM  O   O   * * * 1989a * * *
       O   O    T      T    HHHHH    Y    M M M  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO             01673

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.


  Input   filename: ef.dat
  Output  filename: ef.out
  Summary filename: ef.sum



DATE: 01-25-2023                       TIME: 10:10:41


COMMENTS: _____________________________________________________________

--------------------------------------------------------------------------------
*
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

*
*                    Eastfields Development
*
*                    Timmins Event
*                    January 30, 2023
*                    Andrew Rosenthal, EIT
*
*                    Updated catchments and logic based on detailed grading
*
*                    LGI, LGP from L=SQRT(A/1.5)
*
*******************************************************************************
*                    Post-Development, Timmins Event
*******************************************************************************

--------------------
|    READ STORM    |    Filename: TIMMINS.STM
| Ptotal=193.00 mm |    Comments: *12 HOUR - Timmins STORM
--------------------
                TIME    RAIN |  TIME    RAIN |  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
                1.00   15.00 |  4.00    3.00 |  7.00   43.00 | 10.00   13.00
                2.00   20.00 |  5.00    5.00 |  8.00   20.00 | 11.00   13.00
                3.00   10.00 |  6.00   20.00 |  9.00   23.00 | 12.00    8.00

--------------------------------------------------------------------------------
```

```
*                   Catchment 600
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.11   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .31

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

     Unit Hyd Qpeak  (cms)=    .63

     PEAK FLOW       (cms)=    .36 (i)
     TIME TO PEAK    (hrs)=   7.00
     RUNOFF VOLUME    (mm)= 102.26
     TOTAL RAINFALL   (mm)= 193.00
     RUNOFF COEFFICIENT   =    .53

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.11
| ID= 1   PCYC=158 |   QPEAK     (cms)=    .36 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
--------------------   VOLUME     (mm)= 102.26
  Filename: EF600.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Catchment 200
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .46
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .18          .28
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      55.00        55.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        45.10
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       2.03 (ii)   13.78 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .31          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .03          .05 (iii)
     TIME TO PEAK    (hrs)=       6.58         7.08         7.08
     RUNOFF VOLUME    (mm)=     190.33       104.14       129.81
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .54          .67

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

```
       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .46
| ID= 2   PCYC=149 |   QPEAK     (cms)=    .05 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 129.81
  Filename: EF200.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .126 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .46       .05      7.08  129.81
     ================================================
     MAJOR SYS.(ID= 4):    .00       .00       .00     .00
     MINOR SYS.(ID= 3):    .46       .05      7.08  129.81

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .00
| ID= 4   PCYC=  0 |   QPEAK     (cms)=    .00 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=    .00
--------------------

***** WARNING:  THIS HYDROGRAPH IS DRY.
--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.11      .36     7.00   102.26
        + ID2= 3 (0001):      .46      .05     7.08   129.81
          ================================================
          ID = 2 (0001):     5.57      .41     7.00   104.54

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 608
--------------------
```

```
| CALIB             |
| NASHYD    (0001) |   Area    (ha)=   1.38   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .17

     Unit Hyd Qpeak  (cms)=    .31

     PEAK FLOW       (cms)=    .10 (i)
     TIME TO PEAK    (hrs)=   7.00
     RUNOFF VOLUME    (mm)= 101.92
     TOTAL RAINFALL   (mm)= 193.00
     RUNOFF COEFFICIENT   =    .53

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

------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .085 |
| #of Inlets=    1 |
| Total(cms)=   .1 |      AREA     QPEAK     TPEAK    R.V.
--------------------       (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):   1.38       .10      7.00  101.92
     ================================================
     MAJOR SYS.(ID= 5):    .03       .02      7.00  101.92
     MINOR SYS.(ID= 3):   1.35       .09      6.42  101.92

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .03
| ID= 5   PCYC= 86 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
--------------------   VOLUME     (mm)= 101.92
  Filename: EF608maj.TXT
  Comments: 608 major

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

------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  9    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH 0001 <ID= 4> IS DRY.
*** W A R N I N G :  HYDROGRAPH 0001 = HYDROGRAPH 0001
          ID1= 4 (0001):      .00      .00      .00      .00
        + ID2= 5 (0001):      .03      .02     7.00   101.92
          ================================================
          ID = 9 (0001):      .03      .02     7.00   101.92

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
```

```
--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     5.57      .41     7.00   104.54
        + ID2= 3 (0001):     1.35      .09     6.42   101.92
          ================================================
          ID = 1 (0001):     6.92      .50     7.00   104.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 201
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.10
|ID= 2 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.24         1.86
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     144.00       144.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        45.08
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       3.62 (ii)   24.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .25          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .11          .21          .32 (iii)
     TIME TO PEAK    (hrs)=       7.00         7.25         7.17
     RUNOFF VOLUME    (mm)=     190.33       104.14       129.95
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .54          .67

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.10
| ID= 2   PCYC=164 |   QPEAK     (cms)=    .32 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.17
--------------------   VOLUME     (mm)= 129.95
  Filename: EF201.TXT
  Comments:

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

```
--------------------------------------------------------------------------------
*                   Add 201 to 200min, 608min, 600

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.92      .50     7.00   104.03
        + ID2= 2 (0001):     3.10      .32     7.17   129.95
          ================================================
          ID = 3 (0001):    10.02      .81     7.08   112.05

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 100
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   3.76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  60.00   Dir. Conn.(%)=  50.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.26         1.50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     158.00       158.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        48.73
               over (min)        10.00        25.00
     Storage Coeff.  (min)=       3.83 (ii)   25.28 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=        .25          .04
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .22          .18          .40 (iii)
     TIME TO PEAK    (hrs)=       7.08         7.25         7.17
     RUNOFF VOLUME    (mm)=     190.33       107.39       148.83
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .56          .77

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*                   Add 100 to main

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     3.76      .40     7.17   148.83
```

```
        + ID2= 3 (0001):    10.02      .81     7.08   112.05
          ================================================
          ID = 2 (0001):    13.78     1.21     7.08   122.09

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*                   Catchment 604
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .44
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .13          .31
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      54.00        54.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        47.18
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       2.01 (ii)   13.42 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .31          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .04          .05 (iii)
     TIME TO PEAK    (hrs)=       6.50         7.08         7.08
     RUNOFF VOLUME    (mm)=     190.33       106.14       118.61
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .55          .61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .44
| ID= 1   PCYC=150 |   QPEAK     (cms)=    .05 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 118.61
  Filename: EF604.TXT
  Comments:

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

------------------------------------------------------------------------------

--------------------
```

```
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):       .44      .05     7.08   118.61
        + ID2= 2 (0001):     13.78     1.21     7.08   122.09
          ================================================
          ID = 3 (0001):     14.22     1.26     7.08   121.98

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 400
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .35
|ID= 1 DT= 5.0 min |   Total Imp(%)=  40.00   Dir. Conn.(%)=  30.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .14          .21
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      48.00        48.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        45.10
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       1.87 (ii)   12.70 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .32          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .03          .04 (iii)
     TIME TO PEAK    (hrs)=       6.42         7.00         7.00
     RUNOFF VOLUME    (mm)=     190.33       104.14       129.77
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .54          .67

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .35
| ID= 1   PCYC=147 |   QPEAK     (cms)=    .04 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
--------------------   VOLUME     (mm)= 129.77
  Filename: EF400.TXT
  Comments:

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

--------------------------------------------------------------------------------
```

```
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .032 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 1):    .35       .04      7.00  129.77
     ==================================================
     MAJOR SYS.(ID= 4):    .01       .01      7.00  129.77
     MINOR SYS.(ID= 2):    .34       .03      6.33  129.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):      .34      .03     6.33   129.77
        + ID2= 3 (0001):    14.22     1.26     7.08   121.98
          ================================================
          ID = 1 (0001):    14.56     1.29     7.08   122.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 401
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .19
|ID= 2 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .06          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      36.00        36.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        44.05
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       1.58 (ii)   10.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .09
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .00          .02          .02 (iii)
     TIME TO PEAK    (hrs)=       6.33         7.00         7.00
     RUNOFF VOLUME    (mm)=     190.33       102.96       120.13
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .53          .62

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
```

```
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .19
| ID= 2   PCYC=146 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
--------------------   VOLUME     (mm)= 120.13
  Filename: EF401.TXT
  Comments:

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

--------------------------------------------------------------------------------
--------------------
| DUHYD     (0001) |
| Inlet Cap.= .016 |
| #of Inlets=    1 |
| Total(cms)=   .0 |      AREA     QPEAK     TPEAK    R.V.
--------------------      (ha)     (cms)     (hrs)    (mm)
     TOTAL HYD.(ID= 2):    .19       .02      7.00  120.13
     ================================================
     MAJOR SYS.(ID= 5):    .01       .00      7.00  120.13
     MINOR SYS.(ID= 3):    .18       .02      6.25  120.13

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  8    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    14.56     1.29     7.08   122.16
        + ID2= 3 (0001):      .18      .02     6.25   120.13
          ================================================
          ID = 8 (0001):    14.74     1.31     7.08   122.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   4 +  5 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 4 (0001):      .01      .01     7.00   129.77
        + ID2= 5 (0001):      .01      .00     7.00   120.13
          ================================================
          ID = 1 (0001):      .02      .01     7.00   125.21

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 402
```

```
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=   1.91
|ID= 2 DT= 5.0 min |   Total Imp(%)=  50.00   Dir. Conn.(%)=  40.00
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .96          .95
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=     113.00       113.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        46.55
               over (min)        10.00        20.00
     Storage Coeff.  (min)=       3.13 (ii)   21.00 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .27          .05
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .09          .11          .21 (iii)
     TIME TO PEAK    (hrs)=       6.92         7.17         7.17
     RUNOFF VOLUME    (mm)=     190.33       105.59       139.42
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .55          .72

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.91
| ID= 2   PCYC=159 |   QPEAK     (cms)=    .21 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.17
--------------------   VOLUME     (mm)= 139.42
  Filename: EF402.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                  Add to 400, 401 major (flows to Street A)

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .02      .01     7.00   125.21
        + ID2= 2 (0001):     1.91      .21     7.17   139.42
          ================================================
          ID = 3 (0001):     1.93      .21     7.00   139.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------------------------------------------------------------------
*                   Catchment 605
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .71
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  15.00
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .21          .50
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      69.00        69.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        47.18
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       2.33 (ii)   15.55 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .30          .07
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01          .06           .08 (iii)
     TIME TO PEAK    (hrs)=       6.58         7.08          7.08
     RUNOFF VOLUME    (mm)=     190.33       106.14        118.62
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.00
     RUNOFF COEFFICIENT   =        .99          .55           .61

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .71
| ID= 1   PCYC=152 |   QPEAK     (cms)=    .08 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 118.62
  Filename: EF605.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .71      .08     7.08   118.62
        + ID2= 3 (0001):     1.93      .21     7.00   139.28
```

```
          ====================================================
          ID = 2 (0001):     2.64      .29     7.00   133.72

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.64
| ID= 2   PCYC=159 |   QPEAK     (cms)=    .29 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
--------------------   VOLUME     (mm)= 133.72
  Filename: EFSTIN.TXT
  Comments:

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

-------------------------------------------------------------------------------
--------------------
| COMPUTE VOLUME   |
| ID= 2   (0001)   |             DISCHARGE      TIME
--------------------               (cms)       (hrs)
           START CONTROLLING AT      .00         .26
           INFLOW HYD. PEAKS AT      .29        7.00
           STOP  CONTROLLING AT      .17        7.64

           REQUIRED STORAGE VOLUME (ha.m.)=    .0550
           TOTAL HYDROGRAPH VOLUME (ha.m.)=    .3530
           % OF HYDROGRAPH TO STORE       =  15.5798

           NOTE:  Storage was computed to reduce the Inflow
                  peak to     .17  (cms).

-------------------------------------------------------------------------------
***************************************************************
*                  Route through EZStorm Units
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000       .000    |     .077       .024
                           .034       .004    |     .134       .032
                           .052       .012    |     .166       .040
                           .065       .021    |     .179       .043
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
```

```
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.
     **** WARNING : STORAGE-DISCHARGE TABLE WAS EXCEEDED.

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)     2.64       .29      7.00     133.72
     OUTFLOW: ID= 1 (0001)     2.64       .21      7.33     133.71

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 74.50
                   TIME SHIFT OF PEAK FLOW         (min)= 20.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .06

--------------------------------------------------------------------------------
****************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.64
| ID= 1   PCYC=172 |   QPEAK     (cms)=    .21 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.33
--------------------   VOLUME     (mm)= 133.71
  Filename: EFSTOUT.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   South Undeveloped, 607
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.35   Curve Number   (CN)= 62.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .29

     Unit Hyd Qpeak  (cms)=    .70

     PEAK FLOW       (cms)=    .39 (i)
     TIME TO PEAK    (hrs)=   7.00
     RUNOFF VOLUME    (mm)= 102.25
     TOTAL RAINFALL   (mm)= 193.00
     RUNOFF COEFFICIENT   =    .53

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.35
| ID= 2   PCYC=157 |   QPEAK     (cms)=    .39 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
--------------------   VOLUME     (mm)= 102.25
  Filename: EF607.TXT
  Comments:

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

--------------------------------------------------------------------------------
*                   Total to South

--------------------
```

```
| ADD HYD   (0001) |
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     2.64      .21     7.33   133.71
        + ID2= 2 (0001):     5.35      .39     7.00   102.25
          ================================================
          ID = 3 (0001):     7.99      .58     7.08   112.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   7.99
| ID= 3   PCYC=172 |   QPEAK     (cms)=    .58 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 112.63
  Filename: EFSOUTH.TXT
  Comments: Post-dev to South /z4

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

--------------------------------------------------------------------------------
*                   Pond Catchment
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  66.00   Dir. Conn.(%)=  58.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .50          .26
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      71.00        71.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        48.09
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       2.37 (ii)   15.71 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .30          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .05          .03          .09 (iii)
     TIME TO PEAK    (hrs)=       6.67         7.08         7.08
     RUNOFF VOLUME    (mm)=     190.33       106.88       155.14
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .55          .80

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
```

```
*                    Pond inflow

--------------------
| ADD HYD   (0001) |
|   1 +  8 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .76      .09     7.08   155.14
        + ID2= 8 (0001):    14.74     1.31     7.08   122.14
          ================================================
          ID = 2 (0001):    15.50     1.39     7.08   123.76

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.50
| ID= 2   PCYC=165 |   QPEAK     (cms)=   1.39 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 123.76
  Filename: EFSMWFIN.TXT
  Comments:

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

--------------------------------------------------------------------------------
****************************************************************
*                    Route through SWMF
--------------------
| RESERVOIR (0001) |
| IN= 2---> OUT= 8 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000        .000   |     .051       .333
                           .005        .026   |     .163       .405
                           .010        .053   |     .367       .480
                           .015        .109   |     .526       .519
                           .017        .139   |    1.058       .600
                           .020        .200   |    1.394       .641
                           .023        .265   |    2.172       .727

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
     INFLOW : ID= 2 (0001)     15.50      1.39      7.08     123.76
     OUTFLOW: ID= 8 (0001)     15.50      1.11      7.33     123.23

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 79.28
                    TIME SHIFT OF PEAK FLOW         (min)= 15.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=   .61

--------------------------------------------------------------------------------
****************************************************************
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  15.50
| ID= 8   PCYC=*** |   QPEAK     (cms)=   1.11 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.33
--------------------   VOLUME     (mm)= 123.23
  Filename: EFSWMFQ.TXT
```

```
  Comments:

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

------------------------------------------------------------------------------
*                   Catchment 601
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   3.97   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .22

     Unit Hyd Qpeak  (cms)=    .69

     PEAK FLOW       (cms)=    .29 (i)
     TIME TO PEAK    (hrs)=   7.00
     RUNOFF VOLUME    (mm)= 102.16
     TOTAL RAINFALL   (mm)= 193.00
     RUNOFF COEFFICIENT   =    .53

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

------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   3.97
| ID= 1   PCYC=153 |   QPEAK     (cms)=    .29 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
--------------------   VOLUME     (mm)= 102.16
  Filename: EF601.TXT
  Comments:

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

------------------------------------------------------------------------------
*                   Add 200maj, 608maj, 601

--------------------
| ADD HYD   (0001) |
|   1 +  9 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     3.97      .29     7.00   102.16
        + ID2= 9 (0001):      .03      .02     7.00   101.92
          ================================================
          ID = 2 (0001):     4.00      .31     7.00   102.16

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
*                   Catchment 602
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   2.04   Curve Number   (CN)= 65.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .24

     Unit Hyd Qpeak  (cms)=    .32
```

```
     PEAK FLOW       (cms)=    .16 (i)
     TIME TO PEAK    (hrs)=   7.00
     RUNOFF VOLUME    (mm)= 108.15
     TOTAL RAINFALL   (mm)= 193.00
     RUNOFF COEFFICIENT   =    .56

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

--------------------------------------------------------------------------------
*                   Route 602
--------------------
| SHIFT HYD (0001) |
| IN= 1---> OUT= 3 |
| SHIFT=  5.0 min  |      AREA     QPEAK     TPEAK      R.V.
--------------------      (ha)     (cms)     (hrs)      (mm)
          ID= 1 (0001):    2.04      .16      7.00    108.15
    SHIFT ID= 3 (0001):    2.04      .16      7.08    108.15

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   2.04
| ID= 3   PCYC=154 |   QPEAK     (cms)=    .16 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 108.15
  Filename: EF602.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   2 +  3 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 2 (0001):     4.00      .31     7.00   102.16
        + ID2= 3 (0001):     2.04      .16     7.08   108.15
          ==========================================
          ID = 1 (0001):     6.04      .47     7.00   104.18

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 302
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .90
|ID= 2 DT= 5.0 min |   Total Imp(%)=  37.00   Dir. Conn.(%)=  25.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .33          .57
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      77.00        77.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        46.14
```

```
               over (min)       10.00        15.00
     Storage Coeff.  (min)=       2.49 (ii)   16.73 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .29          .06
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .03          .07          .10 (iii)
     TIME TO PEAK    (hrs)=       6.67         7.08         7.08
     RUNOFF VOLUME    (mm)=     190.33       105.20       126.37
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .55          .65

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .90
| ID= 2   PCYC=153 |   QPEAK     (cms)=    .10 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 126.37
  Filename: EF302.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     6.04      .47     7.00   104.18
        + ID2= 2 (0001):      .90      .10     7.08   126.37
          ================================================
          ID = 3 (0001):     6.94      .57     7.00   107.06

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 603
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   5.79   Curve Number   (CN)= 70.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .42

     Unit Hyd Qpeak  (cms)=    .53

     PEAK FLOW       (cms)=    .45 (i)
     TIME TO PEAK    (hrs)=   7.08
     RUNOFF VOLUME    (mm)= 118.46
```

```
     TOTAL RAINFALL   (mm)= 193.00
     RUNOFF COEFFICIENT   =    .61

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   5.79
| ID= 1   PCYC=165 |   QPEAK     (cms)=    .45 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 118.46
  Filename: EF603.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     5.79      .45     7.08   118.46
        + ID2= 3 (0001):     6.94      .57     7.00   107.06
          ================================================
          ID = 2 (0001):    12.73     1.01     7.00   112.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 300
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .66
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .20          .46
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      66.00        66.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        44.05
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       2.27 (ii)   15.50 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .30          .07
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .02          .06          .07 (iii)
     TIME TO PEAK    (hrs)=       6.58         7.08         7.08
     RUNOFF VOLUME    (mm)=     190.33       102.96       120.31
     TOTAL RAINFALL   (mm)=     193.00       193.00       193.00
     RUNOFF COEFFICIENT   =        .99          .53          .62

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

```
       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .66
| ID= 1   PCYC=152 |   QPEAK     (cms)=    .07 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 120.31
  Filename: EF300.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .66      .07     7.08   120.31
        + ID2= 2 (0001):    12.73     1.01     7.00   112.24
          ================================================
          ID = 3 (0001):    13.39     1.08     7.00   112.64

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 301
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .18
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .05          .13
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      35.00        35.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        44.05
               over (min)        10.00        10.00
     Storage Coeff.  (min)=       1.55 (ii)   10.59 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .09
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .00          .02          .02 (iii)
     TIME TO PEAK    (hrs)=       6.33         7.00         7.00
     RUNOFF VOLUME    (mm)=     190.33       102.96        120.14
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.00
     RUNOFF COEFFICIENT   =        .99          .53           .62
```

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

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .18
| ID= 1   PCYC=146 |   QPEAK     (cms)=    .02 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
--------------------   VOLUME     (mm)= 120.14
  Filename: EF301.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .18      .02     7.00   120.14
        + ID2= 3 (0001):    13.39     1.08     7.00   112.64
          ================================================
          ID = 2 (0001):    13.57     1.10     7.00   112.74

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 303
--------------------
| CALIB            |
| STANDHYD  (0001) |   Area    (ha)=    .53
|ID= 1 DT= 5.0 min |   Total Imp(%)=  15.00   Dir. Conn.(%)=  10.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .08          .45
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      59.00        59.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      43.00        40.32
               over (min)        10.00        15.00
     Storage Coeff.  (min)=       2.12 (ii)   14.93 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .31          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .05          .06 (iii)
     TIME TO PEAK    (hrs)=       6.50         7.08         7.08
     RUNOFF VOLUME    (mm)=     190.33        97.76        106.84
     TOTAL RAINFALL   (mm)=     193.00       193.00        193.00
```

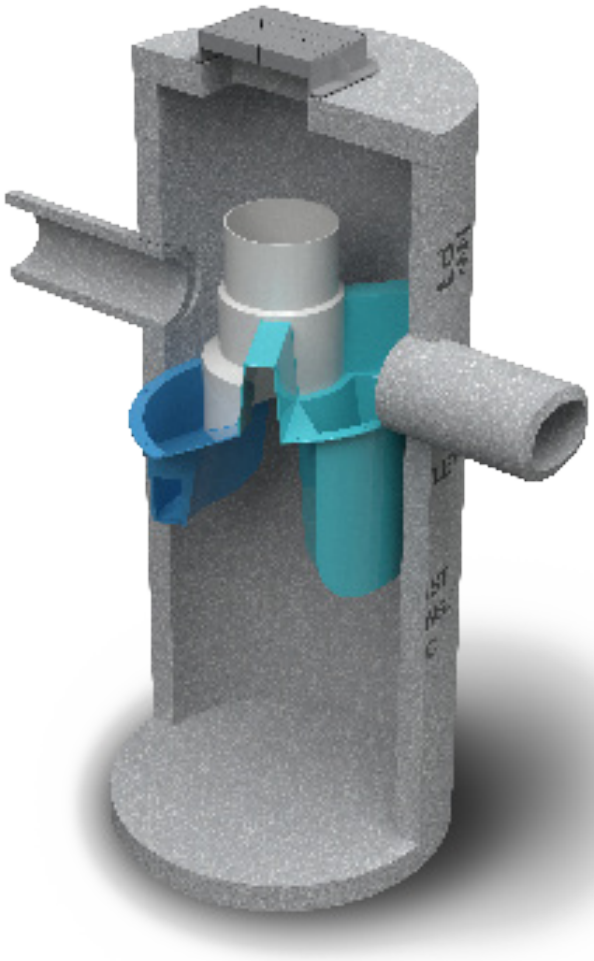
```
     RUNOFF COEFFICIENT   =        .99          .51           .55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING: FOR AREAS WITH IMPERVIOUS LESS THAN 20%
               YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) HORTONS EQUATION SELECTED FOR RAINFALL LOSSES:
            Fo   (mm/hr)=125.00          K  (1/hr)=  2.00
            Fc   (mm/hr)=  5.00     Cum.Inf.   (mm)=  5.00
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=    .53
| ID= 1   PCYC=150 |   QPEAK     (cms)=    .06 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
--------------------   VOLUME     (mm)= 106.84
  Filename: EF303.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):      .53      .06     7.08   106.84
        + ID2= 2 (0001):    13.57     1.10     7.00   112.74
          ================================================
          ID = 3 (0001):    14.10     1.16     7.00   112.52

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Add flows from pond

--------------------
| ADD HYD   (0001) |
|   3 +  8 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 3 (0001):    14.10     1.16     7.00   112.52
        + ID2= 8 (0001):    15.50     1.11     7.33   123.23
          ================================================
          ID = 1 (0001):    29.60     2.14     7.08   118.13

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Wetland Area
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   4.10   Curve Number   (CN)= 58.0
|ID= 2 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
```

```
--------------------   U.H. Tp(hrs)=    .56

     Unit Hyd Qpeak  (cms)=    .28

     PEAK FLOW       (cms)=    .23 (i)
     TIME TO PEAK    (hrs)=   7.25
     RUNOFF VOLUME    (mm)=  94.49
     TOTAL RAINFALL   (mm)= 193.00
     RUNOFF COEFFICIENT   =    .49

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   4.10
| ID= 2   PCYC=170 |   QPEAK     (cms)=    .23 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.25
--------------------   VOLUME     (mm)=  94.49
  Filename: WLAREA.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):    29.60     2.14     7.08   118.13
        + ID2= 2 (0001):     4.10      .23     7.25    94.49
          ================================================
          ID = 3 (0001):    33.70     2.37     7.08   115.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*                   Catchment 606
--------------------
| CALIB            |
| NASHYD    (0001) |   Area    (ha)=   1.28   Curve Number   (CN)= 62.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=    .19

     Unit Hyd Qpeak  (cms)=    .26

     PEAK FLOW       (cms)=    .10 (i)
     TIME TO PEAK    (hrs)=   7.00
     RUNOFF VOLUME    (mm)= 102.03
     TOTAL RAINFALL   (mm)= 193.00
     RUNOFF COEFFICIENT   =    .53

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

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=   1.28
```

```
| ID= 1   PCYC=150 |   QPEAK     (cms)=    .10 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.00
-------------------   VOLUME     (mm)= 102.03
  Filename: EF606.TXT
  Comments:

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

--------------------------------------------------------------------------------

--------------------
| ADD HYD   (0001) |
|   1 +  3 =  2    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
          ID1= 1 (0001):     1.28      .10     7.00   102.03
        + ID2= 3 (0001):    33.70     2.37     7.08   115.25
          ================================================
          ID = 2 (0001):    34.98     2.46     7.08   114.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
--------------------
| SAVE HYD  (0001) |   AREA       (ha)=  34.98
| ID= 2   PCYC=*** |   QPEAK     (cms)=   2.46 (i)
| DT= 5.0 min      |   TPEAK     (hrs)=   7.08
-------------------   VOLUME     (mm)= 114.77
  Filename: EFNODEA.TXT
  Comments: Post-dev to Node A /z2

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

--------------------------------------------------------------------------------

 FINISH
================================================================================
```

APPENDIX I

O+M Information – OGS Units



Operation and Maintenance Manual

First Defense® High Capacity and First Defense®Optimum

Vortex Separator for Stormwater Treatment

Table of Contents

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints.

The two product models described in this guide are the First Defense® High Capacity and the First Defense® Optimum; they are inspected and maintained identically.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for “offline” arrangements using separate junction manholes
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

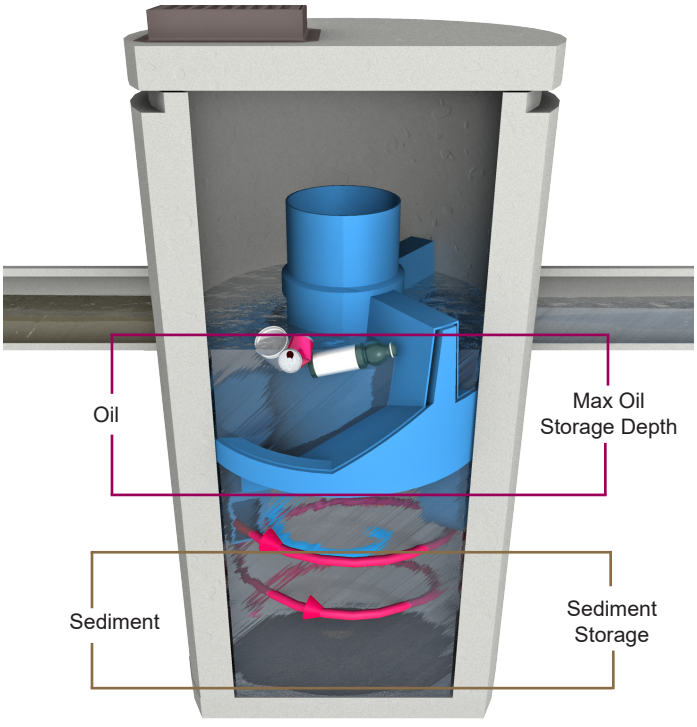


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components have modified geometries allowing greater design flexibility to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2). First Defense® model sizes (diameter) are shown in Table 1.

III. Maintenance

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

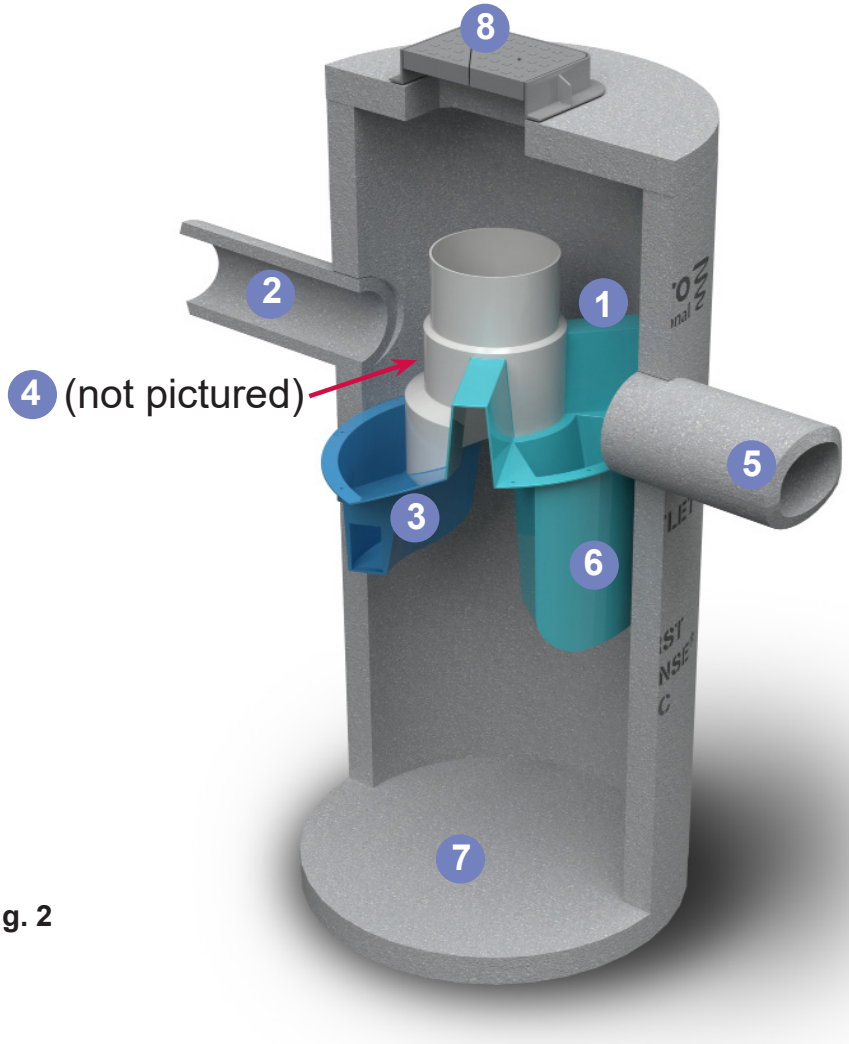


Fig. 2

Table 1

First Defense® Model Sizes
(ft / m) diameter
3 / 0.9
4 / 1.2
5 / 1.5
6 / 1.8
7 / 2.1
8 / 2.4
10 / 3.0

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense® have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

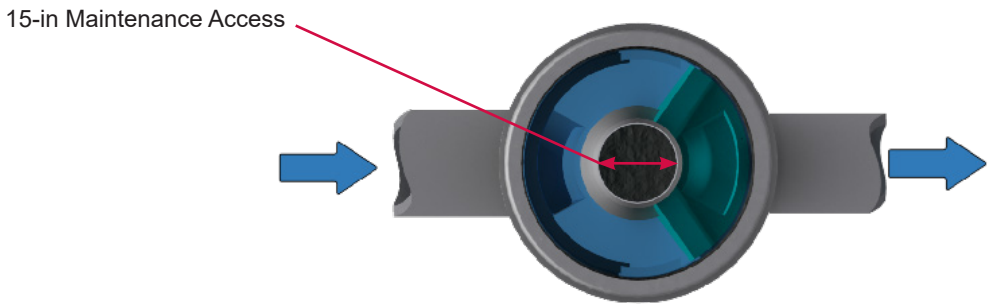


Fig.3 The central opening to the sump of the First Defense®is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.4).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.

- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Fig.4 Floatables are removed with a vactor hose

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and Sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose or with the skimmer or net

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): [3-FT] [4-FT] [5-FT] [6-FT] [7-FT] [8-FT] [10-FT]

INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

First Defense® Inspection and Maintenance Log

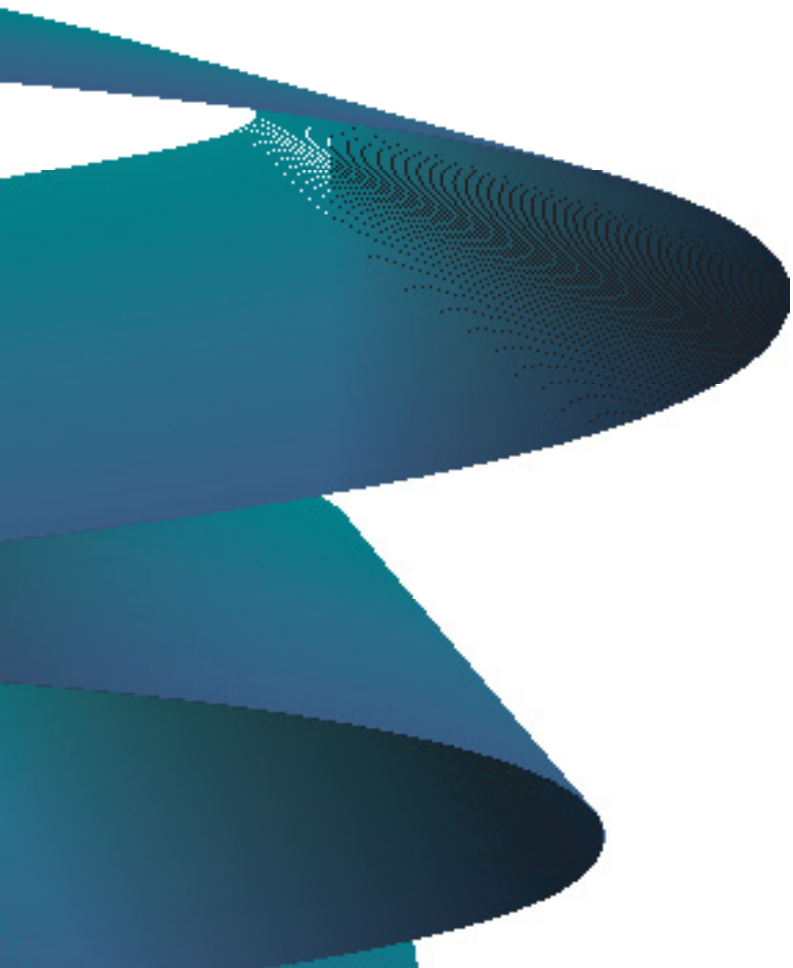
Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Notes

Hydro International



Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

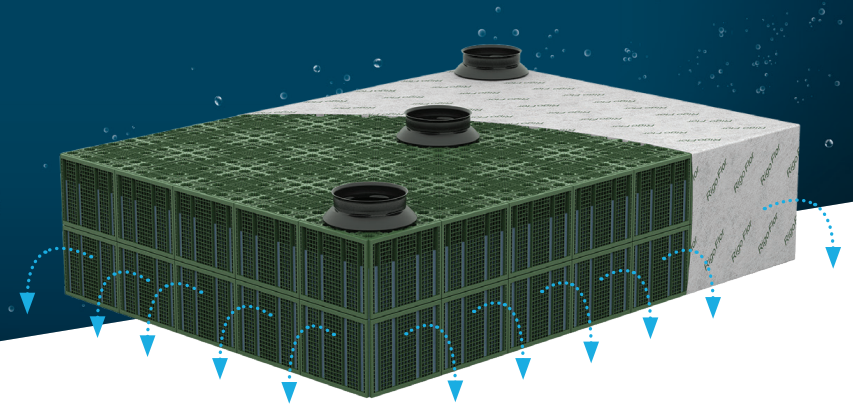
Turning Water Around...®

APPENDIX J

O+M Information – EZStorm Units

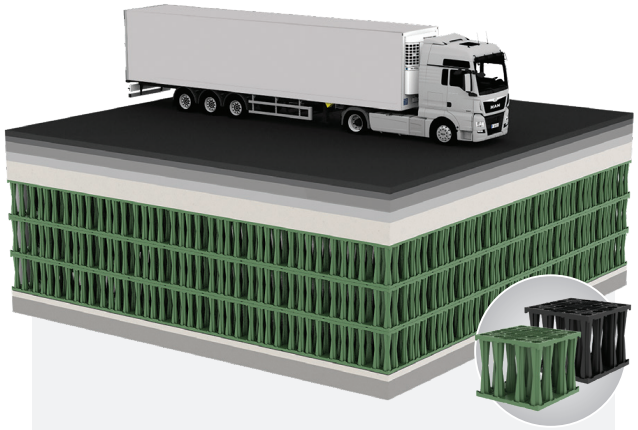
EZStorm

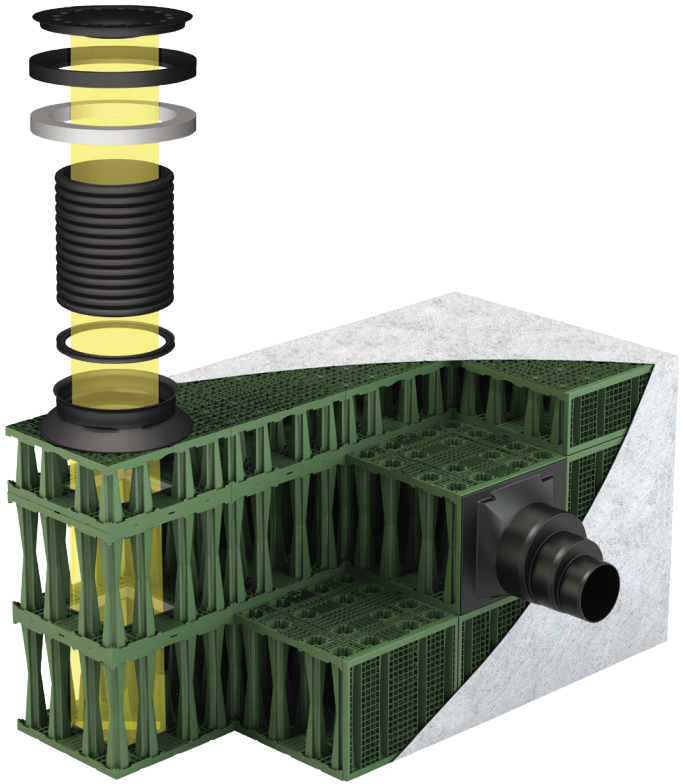
Underground retention and detention



STORMWATER MANAGEMENT

Protection of the receiving environment





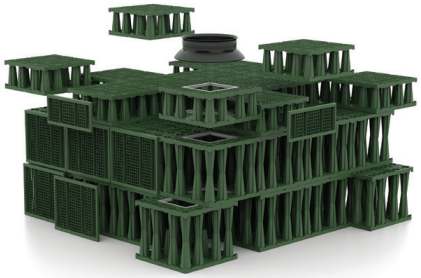
EZStorm is a simple and innovative solution to retain or infiltrate stormwater.

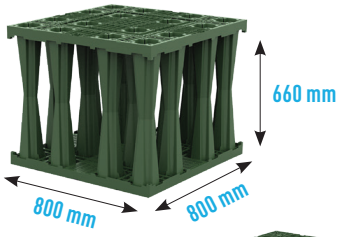
The **EZStorm** is a modular block system with many design options. Each block is composed of two half-elements that are assembled on-site before installation.

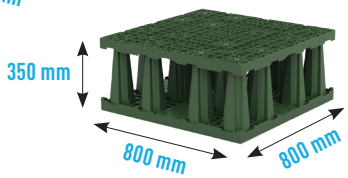
Thanks to its superior mechanical strength, **EZStorm** can be installed under heavy or light roadways, offering multiple applications such as roads, parking lots, bike paths, pedestrian walkways, gardens, and parks.

nextstorm.ca

Phone. : 450 373-8262 Toll-free : 1 877 565-6260
TeleFax : 450 373-0042 Email : info@nextstorm.ca





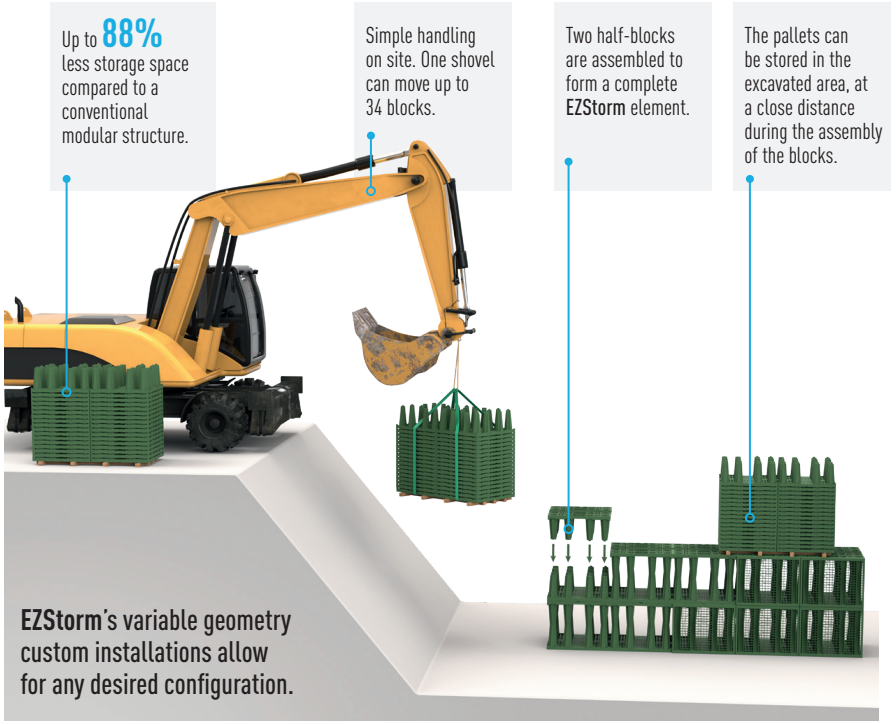


Excavation volume reduced by **10%** to **35%** compared to gravel solutions.

ADVANTAGES

- Ultra Lightweight Geocellular Structure (ULGS) offers **96% void ratio**, which minimizes the footprint and excavation volumes.
- With custom-made installations with variable geometry, all configurations are possible using **EZStorm** modules.
- The polypropylene structure can support a CL-625, H-25, or HS-20 load (up to 20 tons per axle under conditions).
- Due to its superior structural capacity, **EZStorm** can be installed to a depth of 6 m with a maximum backfill of 4 m under conditions.
- Quick and easy assembly and installation require less labor. The EZStorm system can be connected to pipes of various diameters.
- EZStorm half-blocks offer a solution for low coverage and allow the height of a structure to be modulated in combination with full blocks.
- 100% inspectable in all directions and easy to maintain.
- Few accessories required

IMPLEMENTATION OF THE BASIN



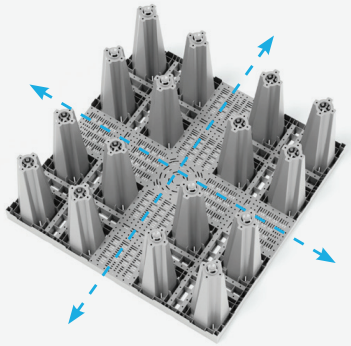
INSPECTION AND MAINTENANCE

The **EZStorm** system was developed to facilitate inspection and cleaning operations directly from the ground surface. It is 100% inspectable and offers complete visibility in all directions.

INSPECTION

EZStorm blocks are designed with cross tunnels for easy checking of the basin.

Camera inspection and hydrocuring are therefore possible in 2 directions and 4 dimensions.



CLEANING

The **EZStorm** tanks can be clean and flushed using a high-pressure sewer cleaning device. The entire cleaning process can be performed from the ground surface and does not require any intervention inside the basin.

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

April 3, 2023

2852243 Ontario Inc.
Fidelity Engineering & Construction
512 Purdy Road
Colborne, ON K0K 1S0

Attn: Jim Pillsworth
Sent by email to: jpillsworth@fidelityeng.com

Re: Environmental Impact Study Review for Eastfields Residential Development, Colborne, Ontario
Cambium Reference 6697-003

Dear Jim Pillsworth,

Cambium Inc. (Cambium) is pleased to provide 2852243 Ontario Inc. (the Client) the following Environmental Impact Study (EIS) Review for the Eastfields Residential Development in Colborne, Ontario (the Site). The Site is legally described as Part of Lot 182, Reid Plan and Part of Lot 29, Concession 2, Township of Cramahe, Ontario. The Site fronts on Durham Street North, approximately 38 m north of Scott Street. The Client is pursuing Draft Plan Approval for a Plan of Subdivision including 212 new residential lots, per the enclosed Redline Draft Plan (RFA, April 3, 2023). The Site is located in the Colborne settlement area in Ecoregion 6E.

An EIS was prepared for the proposed subdivision by Lakeside Green Environmental Consulting (LGEC), dated June 2017. The EIS (LGEC 2017) provided mention of a drainage feature on the Site, but did not assess the hydrologic or thermal regime, aquatic habitat, or fish community associated with this feature. Furthermore, no mitigation measures were recommended to protect the ecological or hydrologic characteristics of this feature.

A review of the EIS was conducted by Lower Trent Conservation (LTC), and comments were provided in a letter dated July 28, 2017. The letter indicated that the EIS report addressed LTC's concerns, with one outstanding comment:

> *Drainage ditch should be recognized as a watercourse; therefore a surface water feature is present on site.*

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

April 3, 2023

Supplemental work to address the drainage feature was subsequently conducted by Cambium and detailed in a letter dated November 24, 2022. Additional comments received from LTC, dated February 14, indicated the need to address two additional branches that feed into the main drainage feature on the Site.

This letter provides Cambium's assessment of the drainage features on the Site and an evaluation of reasonably anticipated ecological impacts to the feature, positive or negative, that may arise as a result of the proposed development, to guide the planning decision-making process and address approval authority requirements.

POLICY CONTEXT

Provincial Policy Statement

Section 2.1 of the Provincial Policy Statement (PPS) (Ministry of Municipal Affairs and Housing, 2020) protects the form and function of natural heritage features as defined by the PPS, which includes fish habitat. Development in fish habitat shall only be permitted in accordance with provincial and federal requirements.

Section 2.2 of the PPS protects the quality and quantity of water, including the form and hydrologic function of sensitive surface water features and sensitive ground water features. Focus is given to maintaining hydrologic linkages and functions at the watershed scale to minimize potential negative impacts, including cross-jurisdictional and cross-watershed impacts of development. Mitigative measures and/or alternative development approaches should be considered for development near water features.

Conservation Authority Regulation

"Conservation Authorities are local watershed management agencies that deliver services and programs to protect and manage impacts on water and other natural resources in partnership with all levels of government, landowners and many other organizations" (Conservation Ontario, 2021). Conservation Authorities each have their own Ontario Regulation under the *Conservation Authorities Act, 1990*. In general, they regulate development within and adjacent

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

to river or stream valleys, Great Lakes and inland lakes shorelines, watercourses, hazardous lands (flood, erosion, unstable soils) and wetlands.

Lower Trent Conservation (LTC) regulates these features under Ontario Regulation 167/06: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.

The LTC Regulation 163/06 Policy Document defines 'watercourse' as "an identifiable depression in the ground in which a flow of water regularly or continuously occurs".

Fisheries Act

Works within and adjacent to lakes, watercourses, and other bodies of water containing fish have the potential to impact fish and/or fish habitat. As a result of amendments to the federal Fisheries Act in 2019, projects near water that could potentially impact fish or fish habitat may require Fisheries and Oceans Canada (DFO) review. The primary purpose of the review is to determine whether harmful alteration, disruption, or destruction (HADD) of fish habitat, as defined by the Act, can be avoided. The DFO Fisheries Protection Program provides a Decision Framework and guidance material applicable to these reviews (available on-line at www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html). If it is determined that "HADD" may be unavoidable, the project should be submitted to DFO for review and determination of project approach and conditions of approval.

CHARACTERIZATION OF NATURAL FEATURES AND FUNCTIONS

Data acquired through a background information review and field investigations are summarized in the following sections. Field investigations, carried out by Cambium staff to assess the drainage feature on the Site, are summarized in Table 1.

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

Table 1 Summary of Field Investigations

Date	Time On Site	Weather	Observer	Activities
2021-12-03	12:00-14:00	1°C, sunny	K. Domsic	Surface Water and Drainage Feature Mapping Aquatic Habitat Assessment
2023-02-21	10:15-11:30	-1°C, cloudy	K. Domsic	Surface Water and Drainage Feature Mapping Aquatic Habitat Assessment

Feature Mapping

No provincially mapped watercourses are present on the Site (see Figure 1, enclosed). A watercourse is mapped as originating on adjacent lands, approximately 45 m west of the Site. The watercourse conveys flows in a southwesterly direction and outlets to Colborne Creek, downstream of King Street East and Kensington Avenue, approximately 375 m southwest of the Site.

Historical aerial imagery from the National Air Photo Library, dated August 12, 1962, shows no visible watercourse on the Site (see Photo A17791-053, enclosed); it appears that the upper reach of the mapped watercourse, west (downstream) of the Site, is consistent with the natural condition of this system. As such, we understand that the feature on the Site is of man-made origin.

Six distinct watercourse reaches (i.e., segments) were identified on the Site, as detailed in Table 2, and depicted on Figure 1. Representative photos of each reach are enclosed. Overall, the watercourse channel on the Site is highly uniform in terms of its morphological structure (i.e., characterized by an excavated drainage course).

Reach 1 originates as a roadside ditch, south of the driveway at 89 Durham Street North, just north of the Site (Reach 1; Photos 1-2) and flows in a southerly direction along the west side of the road. This feature also receives some flow from the equalization culvert under Durham Street North at the downstream end of Reach 1. The downstream end of the culvert was perched 4 cm at the time of the field investigations. These observations are consistent with the catchment mapping provided in Appendix A of the Stormwater Management Report for the Site (Jewell Engineering, 2022).

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

Reach 2 begins at the eastern property boundary, immediately north of the existing residences on Durham Street North and flows in a southwesterly direction through the agricultural fields that comprise the majority of the Site (see Photos 3-6). Flow is somewhat constricted by a partially buried culvert under at an existing farm crossing at the conjunction of Reaches 2 and 3. The culvert could not be fully measured, but appeared to be approximately 0.3 m in diameter. Downstream of the crossing, the watercourse continues in a southwesterly direction to the western boundary of the Site.

Along Reach 3 (Photos 7-9), a berm separates the watercourse from the wetland and pond to the north. Reach 3A is a drainage branch that flows south, entering the upstream portion of Reach 3, near the east edge of the wetland (Photos 10-11). Reach 3B is a drainage branch that flows northward, entering the downstream portion of Reach 3 near the east edge of a cedar forest (Photos 12-13).

Reach 4 (Photo 14-15) is located along the southern edge of a cedar forest. Viewed from the property boundary, the dug feature appears to connect to the mapped watercourse downstream via an unmapped channel dominated by wetland vegetation, on adjacent lands to the west (Photo 16).

Surface Water and Aquatic Habitat

A summary of channel dimensions and characteristics for each reach are provided in Table 2. Surface water was present and flowing in a southwesterly direction throughout the feature on the Site, at the time of the field investigations. It should be noted that there had been snow accumulation, followed by warm rainy weather, facilitating a snow melt event in the 24 hours preceding the field investigations in 2021. No signs of groundwater inputs (e.g., iron floc, watercress) were observed. The results of the geotechnical studies undertaken by Cambium further indicate that the local water table does not influence this feature (Cambium 2022, submitted under separate cover). Given the limited sources of flow on the Site (primarily roadside drainage), Reaches 1-4 are unlikely to exhibit a permanent flow regime; however, field data to support an 'intermittent flow' classification on the Site is not available at this time. Reaches

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

April 3, 2023

3A and 3B exhibit 'intermittent flow' characteristics (surface water limited to occasional pockets at the time of the field investigations; no discernable flow observed).

Downstream of the Site (as viewed from the west boundary of the Site), the watercourse transitions into a natural, meandering channel through a grass-dominated wetland. The flow path was visible but fully choked / densely vegetated with grasses (Photo 16).

Further downstream of the Site, the channel as viewed from the intersection of King Street East and Kensington Avenue exhibited a more defined structure with a wetted width of approximately 0.5 m to 1.0 m and maximum depth of approximately 5 cm to 15 cm. Substrates in this area included a mix of sand, gravel, and cobble (Photos 17-18).

Colborne Creek was observed upstream and downstream of Kensington Avenue. Flow volumes were substantially greater in this reach, which had a wetted width of several metres, and maximum depth of approximately 1 m (unmeasured due to access limitations) (Photos 19-20).

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

Table 2 Surface Water and Aquatic Habitat

Reach	Wetted Width (m)	Max. Depth (cm)	Substrate Type	Vegetative Cover and other Notes (Photos enclosed)
1: Durham St. N. Roadside Ditch	0.4 – 0.5	3 - 4	No sorting	Swale. 100% instream cover (grasses, clover, queen Anne's lace, Phragmites) (Photos 1 – 2).
2: On Site through Agricultural Field	0.6 – 1.0	7 - 10	Muck and detritus	Dug channel. Adjacent residential lots fronting on Durham St. N.: no instream cover, 80% overhanging cover (Photo 3). Adjacent fields only: 100% in-stream cover (grasses, Phragmites, meadow species) (Photo 4 - 5).
3: On Site through Meadow / Wetland	1.0	10	Muck and detritus	Dug channel. 80% in-stream cover (shrub willows, Phragmites, meadow species) (Photos 6 – 7).
3A: NE Branch	Mainly dry with wet pockets: 0.5 – 1.6	Mainly dry with wet pockets: 4 – 10	Muck and detritus	Dug channel. 100% instream cover (grasses, Phragmites; Photos 8 – 9)
3B: SW Branch	Mainly dry with wet pockets: 1.1	Mainly dry with wet pockets: 11	Muck and detritus	Dug channel. 100% instream cover (grasses; Photos 10 – 11)
4: On Site along Woodland edge	2.0	15	Muck and detritus	Dug channel. 50% in-stream cover (grasses); 80% overhanging cover (cedar) (Photo 12 – 13).

Fish Community

Fish community records are not available for the unnamed watercourse on the Site or downstream. Fish ON-Line records for Colborne Creek approximately 500 m downstream of the confluence with the unnamed watercourse (immediately downstream of Victoria Street) include: Brook Trout, Coho Salmon, Pumpkinseed, Rainbow Smelt, Rainbow Trout, Rock Bass, Smallmouth Bass, White Sucker. This community assemblage indicates that Colborne Creek exhibits a cool to coldwater thermal regime.

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

No physical barriers to fish movement were observed between Colborne Creek and the Site, though barriers may exist in areas on private property that were not directly observable. Upstream of King Street, based on the location of trees along the banks, it is likely that maximum depth within the watercourse is 0.5 m or less (Photo 17). Immediately upstream of the confluence with Colborne Creek, the unnamed watercourse is a roadside ditch along Kensington Avenue. Along this reach, there is no in-stream or overhanging cover, and limited coarse substrates (Photo 18). These conditions likely limit upstream habitat suitability for fish migrating upstream from Colborne Creek.

The watercourse on the Site (Photos 1-15) and immediately downstream of the Site (Photo 16) provides substantially different habitat than Colborne Creek. In the vicinity of the Site, Colborne Creek is approximately 4-5 m wide, and over 0.5 m deep (Photos 19-20). The watercourse on the Site and immediately downstream of the Site is almost entirely choked with in-channel vegetation, has no signs of groundwater inputs (to support coldwater thermal regime), and has no coarse substrates (substrates are limited to detritus and muck). As such, it is highly unlikely that the watercourse on the Site could support the majority of fish species documented downstream in Colborne Creek.

IMPACT ASSESSMENT AND RECOMMENDATIONS

The Stormwater Management Report (Jewell Engineering, 2022) details how enhanced quality treatment and required quantity control will be achieved across the Site, ensuring maintenance of pre- vs post- development flows to downstream receivers. According to the current Redline Draft Plan of Subdivision and Watercourse Relocation Plan (enclosed):

- Reach 1 is to remain in its existing condition, with exception of additional driveway culverts for the new lots to front on Durham Street. Some deepening of the channel is required to accommodate the driveway culverts from lots 71-60;
- Reach 2 is to remain as an open channel along the south property boundary, with no alterations except for regrading (i.e., raising) of the north bank, to

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

match height of south bank. Conversely, the western portion of the reach is to be piped under Street B and realigned as an open ditch through the park block to the west of Street B;

- Reach 3 is to remain in its existing condition; no alteration to Reach 3 is proposed;
- Reach 3A is to be removed and surface water conveyance will be replicated through stormwater management (SWM) system design. The proposed SWM system has been designed to maximize the retention of external undeveloped catchment area, in order to maintain the pre-development surface water patterns to the extent possible. Additionally, the proposed system allows for post-development flows to match pre-development flows as closely as possible at the outlet of the SWM facility;
- Reach 3B is to remain in its existing condition – no alteration to Reach 3B is proposed, as this feature is located within the wetland buffer;
- Reach 4 is to remain in its existing condition - no alteration to Reach 4 is proposed; and,
- The current draft stormwater management pond design drains west through the wetland for additional filtration and thermal mitigation prior to reaching the watercourse.

Based on the relatively low sensitivity of the watercourse on the Site, as detailed above (man-made origin to serve agricultural purposes, channelized, limited substrates and habitat features, choked with in-channel vegetation), the proposed alterations are not anticipated to have a negative effect on the ecological or hydrologic function of the watercourse downstream, provided the following recommendations are adhered to:

- All required approvals and permits should be obtained prior to the commencement of any Site alteration or construction activities.
- The final design for the Reach 2 realignment and stormwater management pond outlet should be reviewed by a qualified ecologist, to assess compliance

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

with fish and fish habitat protection provisions under the federal Fisheries Act. A request for review will be submitted to Fisheries and Oceans Canda (DFO) for review, to determine if the project poses a risk of 'serious harm' to fish or fish habitat.

- An Erosion and Sediment Control (ESC) Plan should be developed as part of the detailed design process, to prevent sedimentation into Reaches 3 and 4, and downstream receivers. This Plan should have specific design considerations towards the preservation of riparian habitats.
- In-water works should occur outside of spring spawning period which extends from March 15 to July 15, per Ministry guidance (MNR, 2013).
- Prior to site alteration and dewatering, fish community presence should be confirmed and/or Reaches 1 and 2 should be isolated and a fish and wildlife salvage should be conducted by qualified ecologists. A License to Collect Fish for Scientific Purposes (LCFSP) and Wildlife Scientific Collectors Authorization (WSCA) issued by the local MNRF District office will be required. Any fish or wildlife taken from these reaches should be carefully relocated to suitable habitat downstream.
- The proposed culvert under Street B should be appropriately sized and partially embedded, as to not create a barrier to fish movement under flowing conditions.
- Portions of the watercourse can be removed, piped, or realigned, given that pre-development flows are maintained in the post-development condition. If necessary, clean drainage from rear yards, roofs, or other clean sources should be conveyed directly to the watercourse to help maintain pre-development flows.
- The design for the proposed realigned portion of Reach 2 should reflect and serve to replicate the existing channel morphology, cover features, and substrates (refer to Table 2 for details).
- Native, non-invasive tree and shrub species should be used in Landscape Plans for riparian areas along the realigned portion of Reach 2, as well as

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

Reaches 3 and 4, and around the SWM facility. Preliminary recommendations are provided in Table 3. Cambium is available to provide more detailed recommendations during detailed design.

- Cambium also recommends applying suitable seed mixtures in areas adjacent to riparian areas along the realigned portion of Reach 2, as well as Reaches 3 and 4, and around the SWM facility, including all disturbed and sloped areas within the development envelope. The Ontario Seed Company (OSC) based out of Waterloo, Ontario carries a variety of native seed mixtures that contain native wildflowers and grass species, which provide rapid vegetation cover. Suitable seed mixes for the conditions documented are detailed in Table 3.

Table 3 Planting Plan Recommendations

Planting Location	Species	Size	Instructions
Top of Slope	Trees: White Oak (*Quercus alba*) Pin Cherry (*Prunus pensylvanica*) Sugar Maple (*Acer saccharum*) Canada Plum (*Prunus nigra*) Downy Serviceberry (*Amelanchier arborea*) Trembling Aspen (*Populus tremuloides*) Eastern Red Cedar (*Juniperus virginiana*) Eastern White Cedar (*Thuja occidentalis*)	2 m height	Species selection should include a mix of deciduous and coniferous species; a minimum of 4 species should be used. Trees should be randomly spaced to replicate natural conditions.
Top of Slope	Shrubs: Alternate-leaved Dogwood (*Cornus alternifolia*) Fragrant Sumac (*Rhus aromatica*) Nannyberry (*Vibernum lentago*) Red Elderberry (*Sambucus racemosa*) Red Raspberry (*Rubus ideaus*)	8-10" container stock	A minimum of 3 species should be used. Shrubs should be planted in clusters with plants in random assemblages, spaced 2-5 m apart, offset by 1 m or less from the top of bank.

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

Planting Location	Species	Size	Instructions
Top of Slope	Groundcover: Native grass and wildflower seed mixture (i.e., OSC Rural Ontario Roadside Mixture 8145)	N/A	Application rates as per manufacturers instructions. All exposed soils at top of bank up to the edge of the development footprint should be seeded.
Slope	Any of the above listed shrub species plus: Chokeberry (*Aronia melanocarpa*) Common Elderberry (*Sambucus canadensis*) Highbush Cranberry (*Viburnum trilobum*) Red-osier Dogwood (*Cornus sericea*) Silky Dogwood (*Cornus amomum*) Balsam Fir (*Abies balsamea*)	8-10" container stock	Clusters of 2-3 shrubs spaced at 8-12 m intervals along the feature embankment. Random spacing of clusters.
Slope	Groundcover: OSC8215 Creek Bank Mixture, or OSC8240 Seasonally Flooded Native Seed Mixture	N/A	Application rates as per manufacturers instructions. All exposed soils on the slope, extending 0.5 m upgradient of the top of slope position should be seeded.
Additional Notes:			
Timing:	Planting should occur in the autumn, ideally between October 15 – November 15		
Stock:	Container stock is preferred, but bare root stock can be used if planting occurs within 24 hours of collecting materials from the source.		
Species Selection:	Listed species have been selected based on growth characteristics, soil and topography conditions of the Site, and restoration objectives. Other species may be considered, provided that the selected species are native to the local area.		

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

Planting Location	Species	Size	Instructions
Wildlife Value:	Clusters of trees and shrubs provide diverse sheltering habitat for a variety of wildlife and are preferred over individual plantings. Planting a variety of species increases the ecological value for wildlife.		
Compost / Mulch	If compost or mulch is applied at the Site, these media should be obtained from a reputable source and be heat treated to prevent spread of invasive species.		

Further measures that could be implemented to improve the ecological and hydrologic function of the watercourse downstream of the Site post-development include:

- Creation of an Invasive Species Management Plan with a focus on removal of Common Reed (*Phragmites*) from Reaches 3 and 4 as well as the dug pond north of Reach 3, to mitigate downstream seed dispersion.
- Consideration of channel naturalization practices in Reaches 3 and 4, in conjunction with the removal of invasive Phragmites.

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Monitoring

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325
194 Sophia Street
Peterborough, ON
K9H 1E5

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

April 3, 2023

CLOSING

In closing, potential negative impacts associated with the proposed development and Site alteration can be appropriately minimized, provided that the recommendations outlined above are adhered to. The information presented herein demonstrates that the proposed development can be carried out in a way that will not adversely impact natural heritage and hydrologic features and functions identified on or adjacent to the subject Site.

Respectfully submitted,

Cambium Inc.

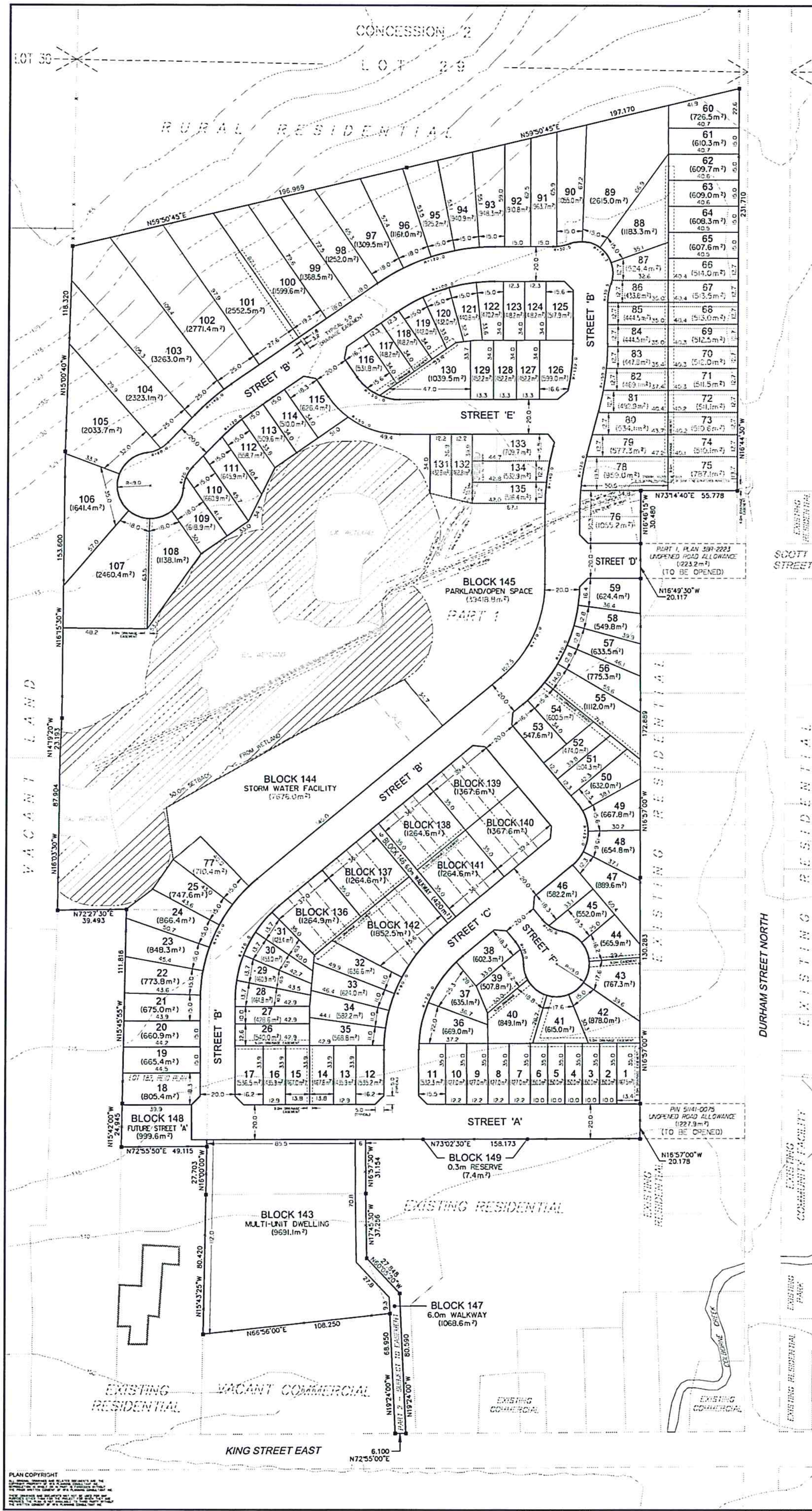
Kristina Domsic, B.E.S.
Ecologist / Project Coordinator

Jeremy Prahl, B.Sc., EP, Can-CISEC
Senior Ecologist / Group Manager

KD/jp

Encl. *Redline Draft Plan of Subdivision (RFA, April 3, 2023)*
Figure 1 Site Drainage Features
Historical Air Photo A17791-053
Representative Photos
Watercourse Relocation Plan

P:\6600 to 6699\6697-003 Fidelity Engineering & Construction - EIS Review - Eastfields Colborne Res Dev\Deliverables\REPORT - EIS Review\2023-03 Update\2023-04-03 LTR - EIS Review Eastfields, Colborne.docx



REDLINE
AMENDED - APPROVED PLAN
OF SUBDIVISION D12-CR1702

DRAFT PLAN OF SUBDIVISION

EASTFIELDS SUBDIVISION - REDLINE PLAN

PARTS 1 AND 2, PLAN 39R-14479
PART OF LOT 182, REID PLAN AND
PART OF LOT 29, CONCESSION 2
(FORMER VILLAGE OF COLBORNE)
TOWNSHIP OF CRAMAHE
COUNTY OF NORTHUMBERLAND

METRIC NOTE:
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

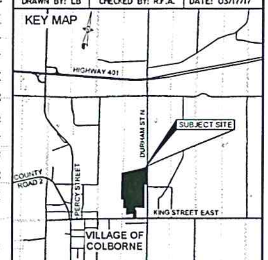
CONTOURS NOTE:
CONTOURS PREPARED USING DATA OBTAINED BY OTHERS. CONTOURS DRAWN AT INTERVALS OF 5.0m.
SCALE 1:1000

0 5 10 25 50 75 100m

No.	REVISION	DATE	APP'D
3	REDLINE - DRAINAGE CHANNEL AND LOT ADJUSTMENTS	MARCH 30/23	R.F.A.
2	EXISTING DRAFT PLAN REVISED TO INCLUDE NEW ABSOLUTE TITLES, BOUNDARY SURVEY, SLOPE STABILIZATION REQUIREMENTS AND STORM WATER FOR EASTFIELDS DRAFT PLAN OF SUBDIVISION	NOV. 25, 2022	R.F.A.
1	DRAFT PLAN APPROVED BY NORTHUMBERLAND COUNTY (APRIL 2020)	MARCH 17/17	R.F.A.

DRAWN BY: LB | CHECKED BY: R.F.A. | DATE: 03/17/17

KEY MAP



ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17)OF THE PLANNING ACT.

(a) SEE SURVEYORS CERTIFICATE.
(b) AS SHOWN ON DRAFT PLAN.
(c) AS SHOWN ON DRAFT PLAN.
(d) SEE LAND USE SUMMARY
(e) SEE DRAFT PLAN
(f) AS SHOWN ON DRAFT PLAN.
(g) AS SHOWN ON DRAFT PLAN.
(h) MUNICIPAL WATER AND SANITARY SEWER
(i) SANDY LOAM
(j) AS SHOWN ON DRAFT PLAN.
(k) GARBAGE COLLECTION, FIRE PROTECTION, ROAD MAINTENANCE, SCHOOL BUSES, ETC.
(l) AS SHOWN ON DRAFT PLAN.

LAND USE SCHEDULE

LAND USE	AREA(m²)	AREA%	UNITS
LOTS 7-17, 47, 50-59, [illegible], 116-129 & [illegible] -12.2m MIN. SINGLE DETACHED LOTS (418.2m²)	31829.3	15.7	60
LOTS 18-25, 36-46, 48, 49, 60-65, [illegible]-95, 110-115 & 130 -15.0m MIN. SINGLE DETACHED LOTS (507.8m²)	33667.2	16.6	45
LOTS 96-109 -18.0m MIN. SINGLE DETACHED LOTS (618.9m²)	25493.1	12.6	14
LOTS 1-6 & 26-35 -10.0m MIN. SEMI-DETACHED LOTS (350.0m²)	7339.9	3.6	16
BLOCKS 136-142 - ROW DWELLINGS 36.0m MIN. FRONTAGE PER BLOCK (230.0m² PER UNIT)	9646.4	4.8	29
BLOCK 143 - MULTI-UNIT DWELLING (50 UNITS/ha)	9691.5	4.8	48
BLOCK 144 - STORM WATER FACILITY	7676.0	3.8	
BLOCK 145 - PARKLAND/OPEN SPACE EXCLUDING EIS AREA - 11000.3 WETLAND & BUFFER (EIS) AREA - 28438.2	39418.5	19.4 (5.4) (14.0)	
BLOCK 146 & 147 - WALKWAYS AND SERVICE EASEMENT	1488.6	0.7	
BLOCKS 148 - FUTURE STREET 'A'	999.6	0.5	
BLOCK 149 - 0.3m RESERVE	7.4	0.0	
20.0m MUNICIPAL ROAD ALLOWANCE - 1720.3m (STREETS 'A', 'B', 'C', 'D', 'E' & 'F')	34239.0	16.9	
SUB TOTAL	202588.0m²	100.0%	212

LEGEND

EXISTING WETLAND

30.0m SETBACK AND BUFFER FROM EXISTING WETLAND

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ARE CORRECTLY SHOWN.

STEVEN GIFFORD
ONTARIO LAND SURVEYOR.

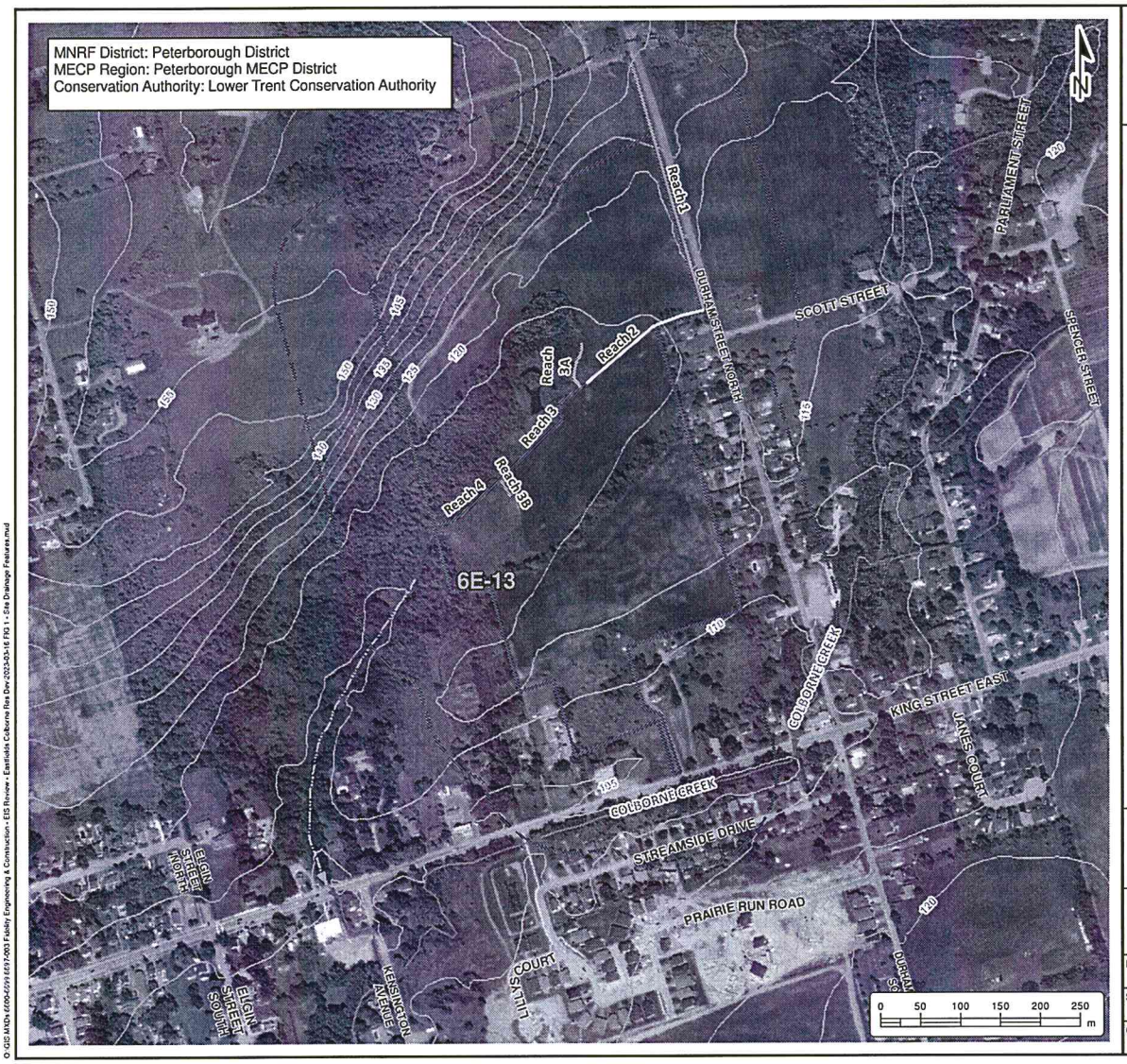
DATE: [illegible] 15, 2022

GIFFORD, HARRIS SURVEYING LTD.
ONTARIO LAND SURVEYORS
255 Glen Miller Road, Unit 1, Trenton, Ontario K8V 5P9
613-392-2177 • 1-877-394-6646

RUTH FERGUSON AULTHOUSE
REGISTERED PROFESSIONAL PLANNER
R.P.P.

RFA PLANNING CONSULTANT INC
211 Dundas Street East, Suite 202, Belleville, Ontario, K8N 1E2

JOB No. 818-DP



ENVIRONMENTAL IMPACT STUDY

2852243 ONTARIO INC., FIDELITY ENGINEERING & CONSTRUCTION
Part of Lot 182, Reid Plan and
Part of Lot 29, Concession 2,
Township of Cramahe, Ontario

LEGEND

- Watercourse, Intermittent
- Watercourse, Permanent
- Contour 5m Interval (Major)
- Contour 5m Interval (Minor)
- Unevaluated Wetlands
- Ecodistrict
- Adjacent Lands (120m)
- Site

Drainage Feature:

- Reach 1
- Reach 2
- Reach 3
- Reach 3A
- Reach 3B
- Reach 4

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources and Forestry or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

CAMBIUM
194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

SITE DRAINAGE FEATURES

Project No.:	Date:
6697-003	February 2023
Scale:	Rev.:
1:6,500	Projection: NAD 1983 UTM Zone 18N
Created by: DBB	Checked by: KD
Figure: 1	

O:\GIS MXDs\6696-6699\6697-003 Fidelity Engineering & Construction - EIS Review - Eastfields Colborne Rise Dev 2023-03-16 FIG 1 - Site Drainage Features.mxd


AIR PHOTO DIVISION
ENERGY, MINES & RESOURCES - CANADIAN GOVT. COPYI

Photo 1 Downstream view of Reach 1: roadside ditch (south towards Site), December 3, 2021.

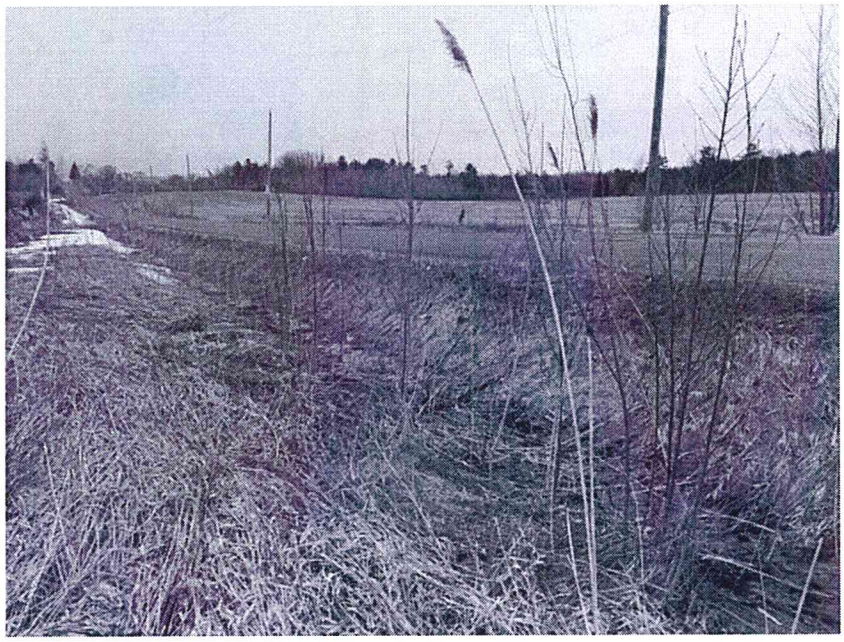


Photo 2 Upstream view of Reach 1: roadside ditch (north from culvert at southeast corner of Site), February 21, 2023.

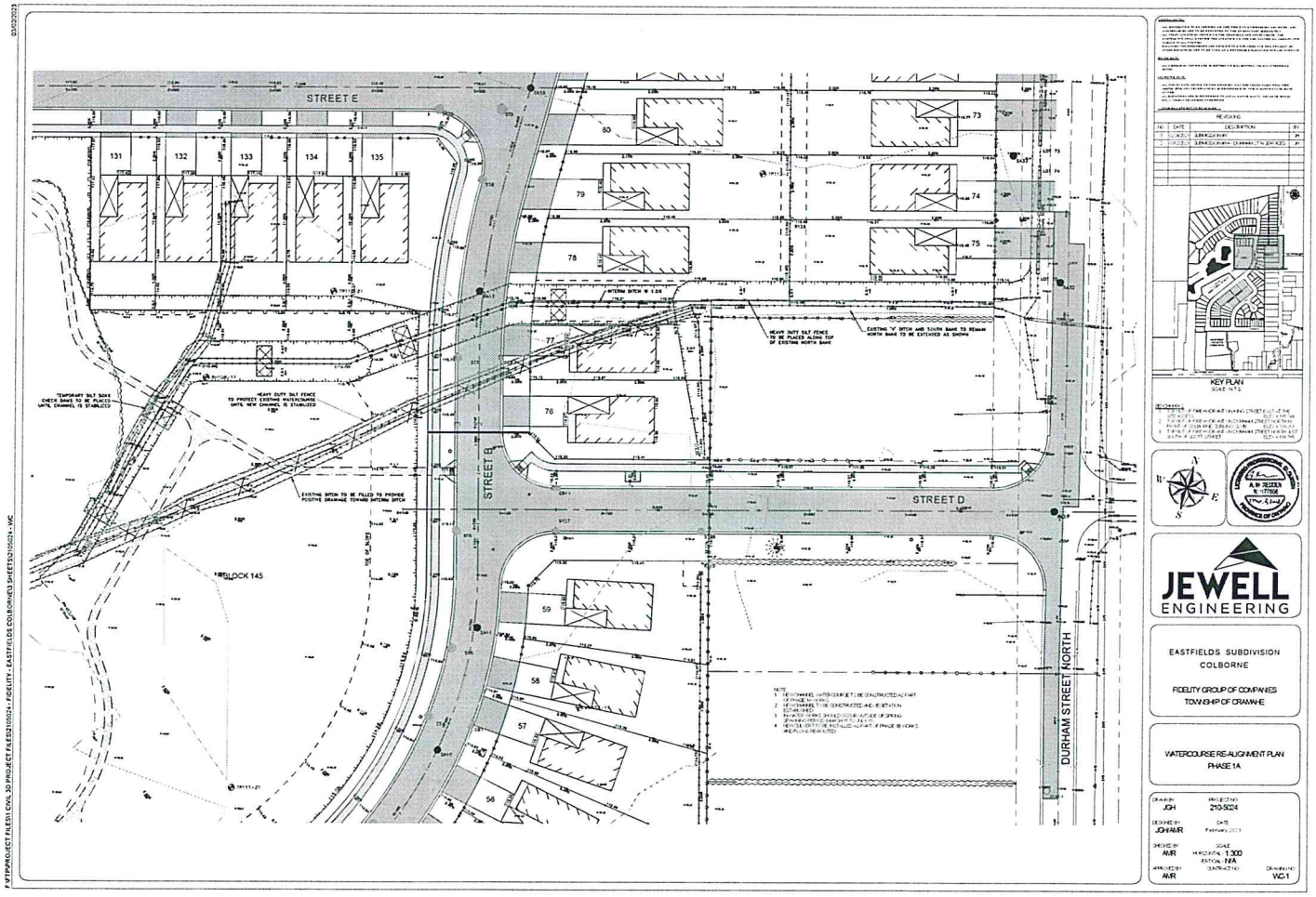

STREET E
STREET B
STREET D
DURHAM STREET NORTH
BLOCK 145
131
132
133
134
135
73
74
75
76
77
78
79
60
59
58
57
56
KEY PLAN
JEWELL ENGINEERING
EASTFIELDS SUBDIVISION
COLBORNE
FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE
WATERCOURSE RE-ALIGNMENT PLAN
PHASE 1A
JGH
210-5024
JGH/AVR
AVR
AVR
WC-1

Photo 3 Downstream view of Reach 2: channelized watercourse (from culvert at southeast corner of Site), December 3, 2021.

Photo 4 Downstream view of Reach 2: channelized watercourse (from culvert at southeast corner of Site), February 21, 2023.

Photo 5 Downstream view of Reach 2 through agricultural fields, December 3, 2021.

Photo 6 Downstream view of Reach 2 through agricultural fields, February 21, 2023.

Photo 7 Channel structure of Reach 3 (along wetland edge), December 3, 2021.

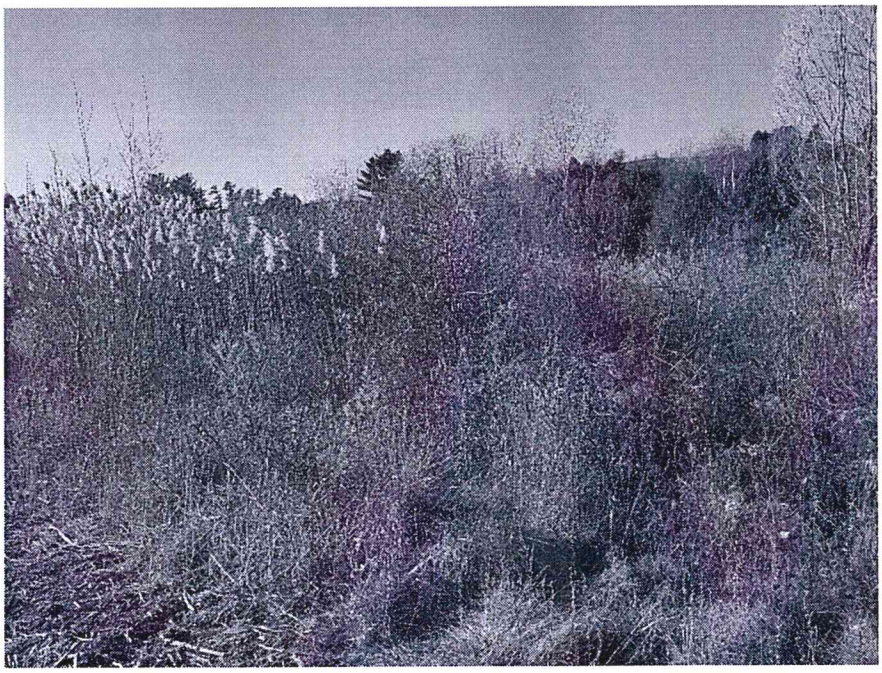


Photo 8 Downstream view of Reach 3 (along wetland edge), December 3, 2021.

Photo 9 Downstream view of Reach 3 (along wetland edge), February 21, 2023.

Photo 10 Upstream view of Reach 3A, February 21, 2023.

Photo 11 Downstream view of Reach 3A, February 21, 2023.

Photo 12 Upstream view of Reach 3B, February 21, 2023.

Photo 13 Downstream view of Reach 3B, February 21, 2023.

Photo 14 Upstream view of Reach 4, December 3, 2021.

Photo 15 Downstream view of Reach 4, February 21, 2023.

Photo 16 Downstream view of watercourse off-Site from west edge of Site, December 3, 2021.

Photo 17 Upstream view of watercourse off-Site from King Street E, December 3, 2021.

Photo 18 Downstream view of watercourse off-Site along Kensington Ave, December 3, 2021.

Photo 19 Upstream view of Colborne Creek from Kensington Ave, December 3, 2021.

Photo 20 Downstream view of Colborne Creek from Kensington Ave (at confluence with watercourse from Site), December 3, 2021.

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Quality Verification

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325,
Peterborough, Ontario
Canada, K9J 6Z3

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

March 20, 2023

2852243 Ontario Inc.
512 Purdy Road
Colborne, ON. K0K 1S0

Attn: Jim Pilsworth

Re: Eastfields Drainage Feature Slope Stability Letter Report
Cambium Reference: 6697-006

Dear, Mr. Pilsworth,

Cambium was asked to provide a slope stability assessment of the drainage features present at the Eastfields Residential Development in Colborne, Ontario (Site). Cambium has observed the drainage features in question on site and reviewed the updated site grading plan and associated watercourse drawing supplied by Jewell Engineering. It is apparent that there is a drainage feature that cuts across the northern portion of the Site from northeast to southwest. The main drainage feature initiates on the west side of Durham Street North, just north of the intersection with Scott Street, and extends to the southwest with slight offset immediately southeast of the pond on Site. The main drainage feature is fed by a ditch that runs south along the west side of Durham Street North and a culvert that drains water from the east side of Durham Street North. A secondary drainage feature extends approximately 120 m north from the main feature, along the east side of the pond on Site.

It is understood that a portion of the drainage feature, from the intersection with the secondary drainage feature to the northwest corner of the lot at 94 Durham Street North, is to be realigned to be more conducive to development.

The existing drainage feature is linear in nature, ranging from 2 m to 8 m in width, with no signs of meandering from the confines of the existing ditch. The slopes of the drainage feature range from 0.5 m to 1.5 m in height and have inclinations that range from less steep than 3 Horizontal to 1 Vertical (3H:1V) to steeper than 1H:1V. The slopes of the drainage features are vegetated mainly with grasses and weeds, and small bushes in some areas. There are no significant signs of slope failure, slide features or toe erosion along the length of the drainage

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Quality Verification

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325,
Peterborough, Ontario
Canada, K9J 6Z3

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

features. Previous geotechnical investigations provide evidence that the soils within the slopes are known to be silt and sand or gravelly silty sand till.

Based on the MNRF Technical Guide for River and Stream Systems: Erosion Hazard Limit (2002), despite the shallow depth and lack of failure observed within the drainage features, the slopes are considered to have low to slight potential for instability with a slope rating ranging from 15 in areas of gentle inclination to 31 in areas of steep inclination.

Erosion Hazard Limit

The erosion hazard limit for the drainage features is the sum of the toe erosion allowance, the stable slope allowance, and the erosion access allowance.

Based on the conditions observed on site, the lack of slope failure features, the linear trend of the drainage features, and the confinement of the system, negligible toe erosion has been observed and is anticipated within the drainage features over a 100 year development period.

Generally, a 3H:1V slope would be considered a stable slope in the absence of geotechnical studies, but a recent 2022 slope stability study of the large slope to the north, was completed on the same site, providing evidence that the soils were considered stable at inclinations of 2H:1V, meeting a Factor of Safety of 1.3. As such, a stable slope allowance equivalent to two times the height of the slope should be applied from the base of each side of the drainage feature.

Conservation policy states that a 6 m erosion access allowance is to be applied to all slopes that prove to be unstable, to provide emergency access and access to repair the slope, should it be required. It is understood that this value has been fashioned to apply to all slopes, regardless of size, and are considered an over-estimate of what is required for shorter slopes, such as this. Based on Cambium's experience with slopes of short height in various conservation authorities, an erosion access allowance of 3 m is considered sufficient in this scenario, providing adequate space for emergency vehicles and/or a mini excavator, which would offer sufficient reach.

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Quality Verification

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325,
Peterborough, Ontario
Canada, K9J 6Z3

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

March 20, 2023

Ultimately, the erosion hazard limit, as measured from the base of the drainage feature slope, is equivalent to 2H+3 (m), where H is the height of the slope in meters. Alternately, in areas where the drainage feature is at or designed to have an inclination of 2H:1V, resulting in a low potential for instability, development may occur no closer than a distance equivalent to the height of the slope, away from the crest of the slope, as per the MNRF technical guide.

Erosion Control

During construction, care should be taken to retain as much of the vegetation on the slope as possible and erosion control measures should be put in place to maintain the stable slope, including revegetation of the slope if any bushes and trees are removed, or in areas where vegetation is presently sparse. Care should also be taken to ensure that there is no concentration of runoff down the slope from downspouts or regrading of the site.

Closing

We trust the information in this report is sufficient for your current needs. If you have questions or comments regarding this document, please do not hesitate to contact Mr. Peterkin at (705) 761-1426.

Best regards,

Cambium Inc.

Stuart Baird, M.Eng., P.Eng.
General Manager - Geotechnical

Brian Peterkin, M.Eng., P. Eng., P.Geo.
Senior Project Manager

SEB/bjp

C:\Users\joanne_kendrick\Desktop\2022-03-20 - LRT RPT Eastfields Drainage Feature Slope Letter Report.docx

CAMBIUM

Environmental

Geotechnical

Building Sciences

Construction Quality Verification

Telephone
(866) 217.7900
(705) 742.7900

Facsimile
(705) 742.7907

Website
cambium-inc.com

Mailing Address
P.O. Box 325,
Peterborough, Ontario
Canada, K9J 6Z3

Locations
Peterborough
Kingston
Barrie
Oshawa

Laboratory
Peterborough

Professional Engineers Ontario

APGO

March 20, 2023

CAMBIUM QUALIFICATIONS AND LIMITATIONS

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

Reliance on Materials and Information

The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work or reports.

Facts, conditions, information and circumstances may vary with time and locations and Cambium's work is based on a review of such matters as they existed at the particular time and location indicated in its reports. No assurance is made by Cambium that the facts, conditions, information, circumstances or any underlying assumptions made by Cambium in connection with the work performed will not change after the work is completed and a report is submitted. If any such changes occur or additional information is obtained, Cambium should be advised and requested to consider if the changes or additional information affect its findings or results.

When preparing reports, Cambium considers applicable legislation, regulations, governmental guidelines and policies to the extent they are within its knowledge, but Cambium is not qualified to advise with respect to legal matters. The presentation of information regarding applicable legislation, regulations, governmental guidelines and policies is for information only and is not intended to and should not be interpreted as constituting a legal opinion concerning the work completed or conditions outlined in a report. All legal matters should be reviewed and considered by an appropriately qualified legal practitioner.

Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

Reliance

Cambium's services, work and reports may be relied on by the client and its corporate directors and officers, employees, and professional advisors. Cambium is not responsible for the use of its work or reports by any other party, or for the reliance on, or for any decision which is made by any party using the services or work performed by or a report prepared by Cambium without Cambium's express written consent. Any party that relies on services or work performed by Cambium or a report prepared by Cambium without Cambium's express written consent, does so at its own risk. No report of Cambium may be disclosed or referred to in any public document without Cambium's express prior written consent. Cambium specifically disclaims any liability or responsibility to any such party for any loss, damage, expense, fine, penalty or other such thing which may arise or result from the use of any information, recommendation or other matter arising from the services, work or reports provided by Cambium.

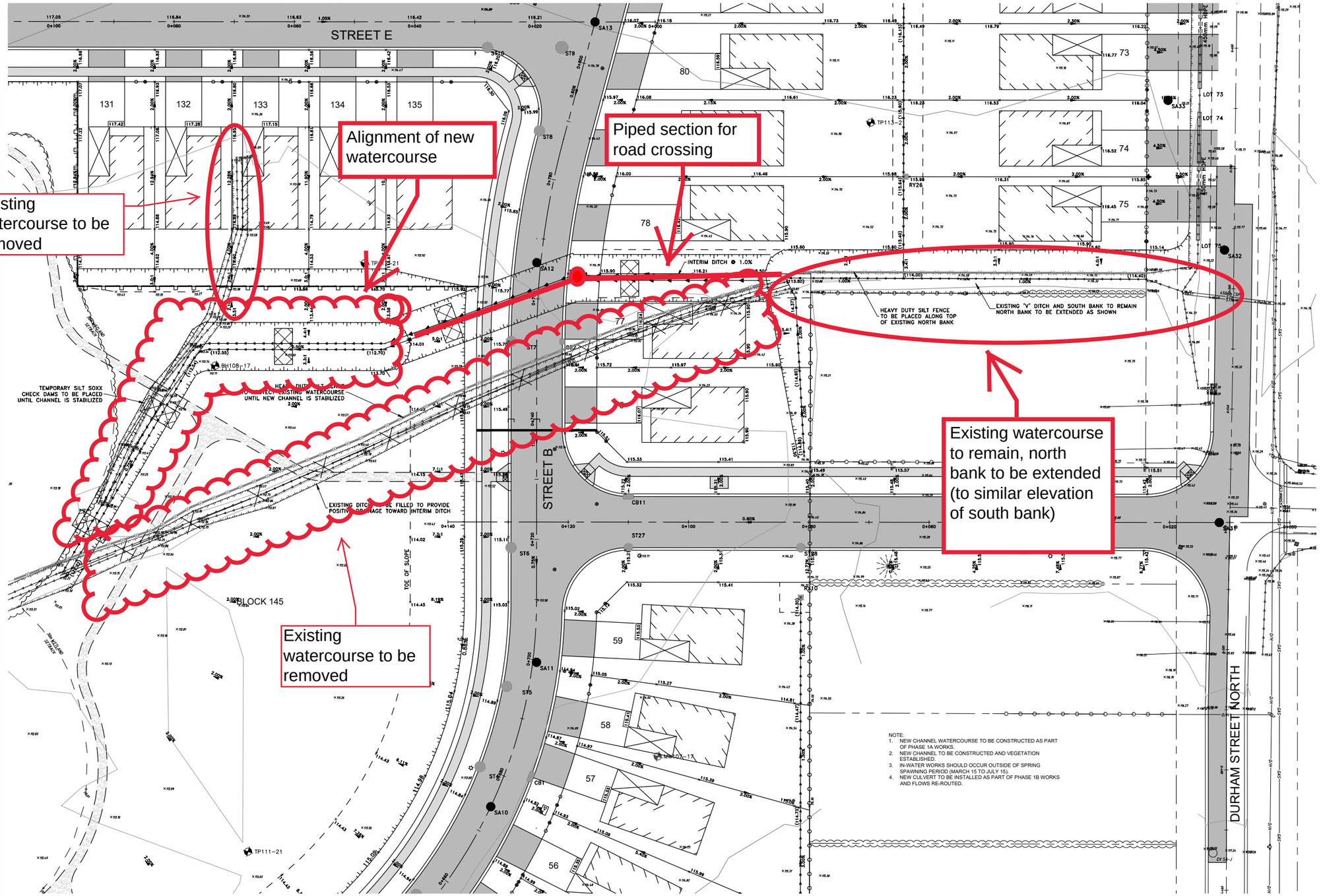
Limitation of Liability

Potential liability to the client arising out of the report is limited to the amount of Cambium's professional liability insurance coverage. Cambium shall only be liable for direct damages to the extent caused by Cambium's negligence and/or breach of contract. Cambium shall not be liable for consequential damages.

Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.

03/02/2023



GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES.
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

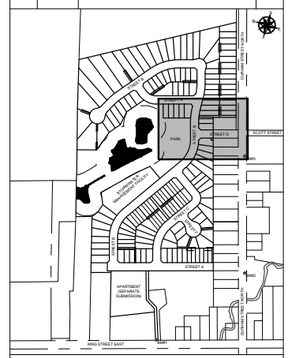
GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

** DRAWINGS ARE NOT TO BE SCALED **

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	02/24/2023	SUBMISSION #1	JH
2	03/02/2023	SUBMISSION #1A - DURHAM ST N SERVICES	JH



KEY PLAN
SCALE - N.T.S.

BENCHMARKS
1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765

LICENSED PROFESSIONAL ENGINEER
A.M. REDDEN
100177606
Mar. 3, 2023
PROVINCE OF ONTARIO

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

WATERCOURSE RE-ALIGNMENT PLAN
PHASE 1A

DRAWN BY: JGH	PROJECT NO: 210-5024
DESIGNED BY: JGH/AMR	DATE: February 2023
CHECKED BY: AMR	SCALE: HORIZONTAL - 1:300 VERTICAL - N/A
APPROVED BY: AMR	CONTRACT NO:
	DRAWING NO: WC-1

F:\FTPPROJECT FILES\11 CIVIL 3D PROJECT FILES\2105024 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - WC

Fisheries and Oceans Canada
Pêches et Océans Canada

Ontario and Prairie Region
Fish and Fish Habitat Protection Program
867 Lakeshore Rd.
Burlington, ON
L7S 1A1

Région de l'Ontario et des Prairies
Programme de protection du poisson et de son habitat
867 chemin Lakeshore
Burlington, ON
L7S 1A1

Your file *Votre référence*

April 17, 2023

Our file *Notre référence*
23-HCAA-00632

Jim Pillsworth
512 Purdy Rd, Colborne, ON, K0K 1S0

Subject: Channel Realignment, Colborne Creek, Cramahe (23-HCAA-00632) – Implementation of Measures to Avoid and Mitigate the Potential for Prohibited Effects to Fish and Fish Habitat

Dear Jim Pillsworth:

The Fish and Fish Habitat Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on March 29, 2023. We understand that you propose to:

- Relocate a tributary of Colborne Creek to facilitate future development in the area;
- Create a channel with approximate dimensions of: 0.55m deep, 1m wide, and a 3:1 slope on the banks;
- Install a new 750mm concrete culvert to facilitate a new road on the future;
- Create a vegetated buffer on both sides of the new channel;
- Fill in the existing channel.

Our review considered the following information:

- Request for Review form and associated documents submitted on March 29, 2023

Your proposal has been reviewed to determine whether it is likely to result in:

- the death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*
- effects to listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*

The aforementioned impacts are prohibited unless authorized under their respective legislation and regulations.

To avoid and mitigate the potential for prohibited effects to fish and fish habitat (as listed above), we recommend implementing the measures listed below:

- Plan in-water works, undertakings and activities to respect timing windows, or as stipulated by the Ministry of Natural Resources and Forestry (MNRF), to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed and migrate
    - No in-water work between March 15 – July 15.
- Capture, relocate and monitor for fish trapped within isolated, enclosed, or dewatered areas
    - Dewater gradually to reduce the potential for stranding fish
- Screen intake pipes to prevent entrainment or impingement of fish
    - Use the code of practice for water intake screens
- Apply the interim code of practice for temporary cofferdams and diversion channels
- Limit impacts on riparian vegetation to those approved for the work, undertaking or activity
    - Limit access to banks or areas adjacent to waterbodies
    - Construct access points and approaches perpendicular to the watercourse or waterbody
    - Re-vegetate the disturbed area with native species suitable for the site
- Replace/restore any other disturbed habitat features and remediate any areas impacted by the work, undertaking or activity
- Conduct in-water undertakings and activities during periods of low flow
- Limit the duration of in-water works, undertakings and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (spawning, rearing, feeding, migrating)
- Develop and implement an Sediment Control Plan to minimize sedimentation of the waterbody during all phases of the work, undertaking or activity
    - Conduct all in-water works, undertakings or activities in isolation of open or flowing water to reduce the introduction of sediment into the watercourse
    - Schedule work to avoid wet, windy and rainy periods (and heed weather advisories)
    - Inspect and maintain regularly the erosion and sediment control measures and structures during all phases of the project
    - Remove all exposed non-biodegradable sediment control materials once site has been stabilized
    - Operate machinery on land, or from barges or on ice
    - Monitor the watercourse to observe signs of sedimentation during all phases of the work, undertaking or activity and take corrective action
    - Dispose and stabilize all dredged material above the high water mark of nearby waterbodies to prevent entry in the water

.../3

- Avoid changing flow or water level
- Maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish and fish habitat
- Do not deposit any deleterious substances in the water course
- Develop and implement a response plan to avoid a spill of deleterious substances
    - Keep an emergency spill kit on site during the work, undertaking or activity
    - Report any spills of sewage, oil, fuel or other deleterious material, whether near or directly into a water body
    - Ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse
    - Maintain all machinery on site in a clean condition and free of fluid leaks
    - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water

Provided that you incorporate these measures into your plans, the Program is of the view that your proposal is not likely to result in the contravention of the above mentioned prohibitions and requirements.

Should your plans change or if you have omitted some information in your proposal, further review by the Program may be required. Consult our website (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or consult with a qualified environmental consultant to determine if further review may be necessary. It remains your responsibility to remain in compliance with the *Fisheries Act*, and the *Species at Risk Act*.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to (http://www.dfo-mpo.gc.ca/pnw-ppe/CONTACT-eng.html).

We recommend that you notify this office at least 10 days before starting your project and that a copy of this letter be kept on site while the work is in progress. It remains your responsibility to meet all other federal, territorial, provincial and municipal requirements that apply to your proposal (DFO.OP.10DayNotification-Notification10Jours.OP.MPO@dfo-mpo.gc.ca).

If you have any questions with the content of this letter, please contact Carter Bryant by email at Carter.Bryant@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

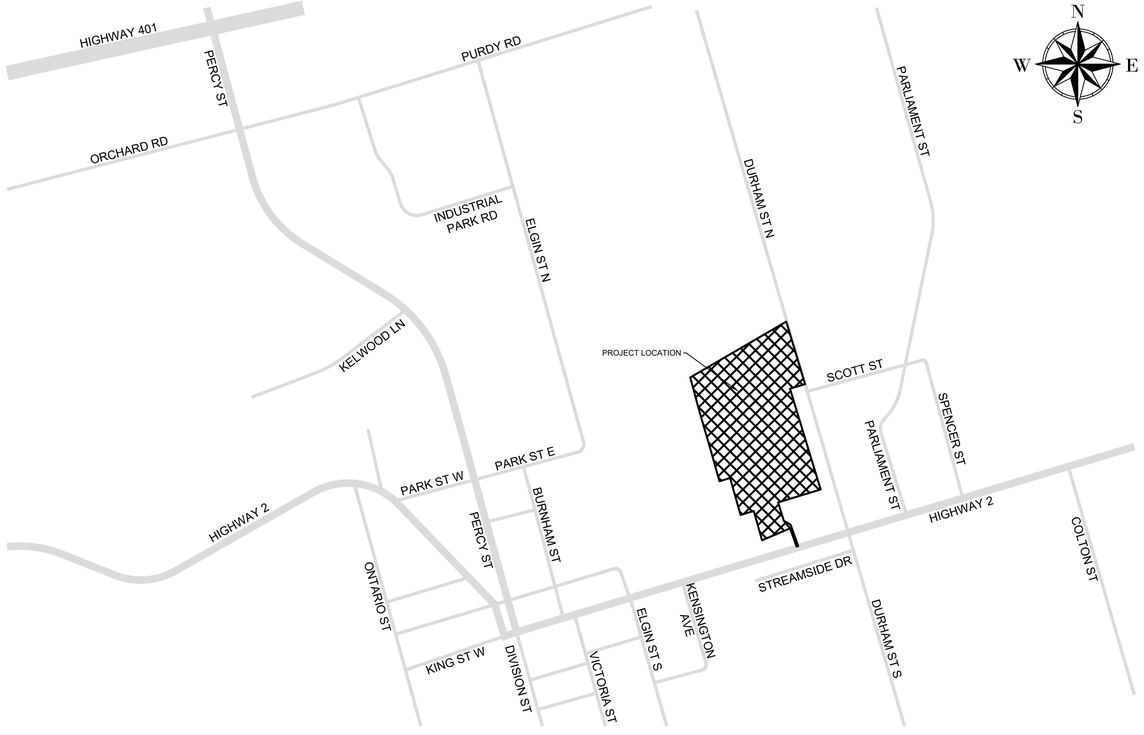
Carter Bryant
Biologist, Triage and Planning

EASTFIELDS DEVELOPMENT
FIDELITY GROUP OF COMPANIES

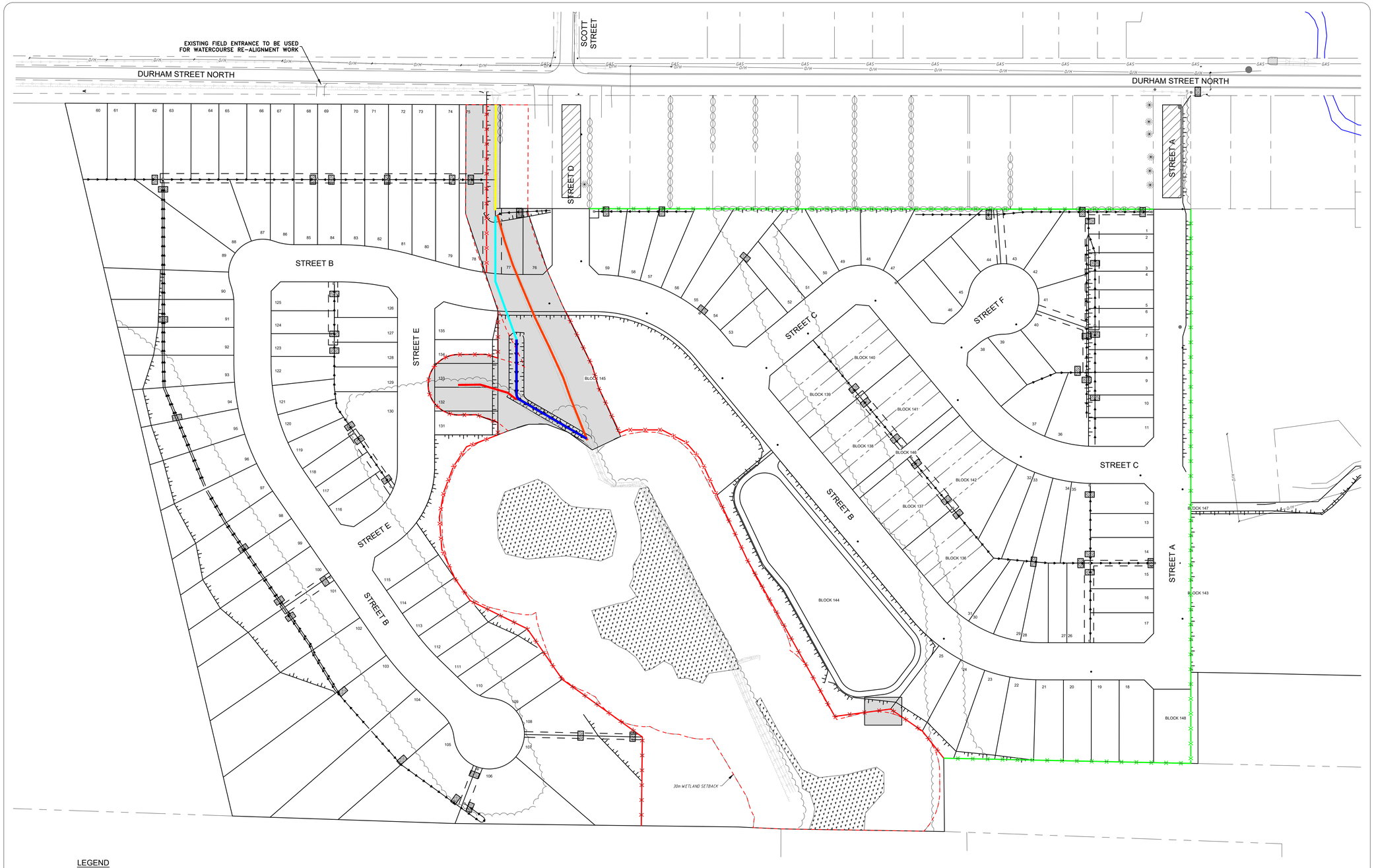
COLBORNE, ONTARIO
TOWNSHIP OF CRAMAHE

DRAWING LIST

DRAWING No.	DRAWING TITLE
WC-1	WATERCOURSE RE-ALIGNMENT PLAN - PHASE 1A
WC-ESC-1	EROSION & SEDIMENT CONTROL PLAN
PP-WC-1	PLAN & PROFILE - EXISTING WATERCOURSE (EAST-WEST) STA. 0+000 to 0+110
PP-WC-2	PLAN & PROFILE - EXISTING WATERCOURSE (EAST-WEST) STA. 0+110 to 0+220
PP-WC-3	PLAN & PROFILE - EXISTING WATERCOURSE (NORTH-SOUTH) STA. 0+000 to 0+080
WC-DE-1	EXISTING WATERCOURSE DETAILS
PP-WC-4	PLAN & PROFILE - PROPOSED WATERCOURSE (EAST-WEST) STA. 0+000 to 0+110
PP-WC-5	PLAN & PROFILE - PROPOSED WATERCOURSE (EAST-WEST) STA. 0+110 to 0+230
WC-DE-2	PROPOSED WATERCOURSE DETAILS



04/26/2023



LEGEND

- STRAW BALE FLOW CHECK DAM OPSD 219.180
- LIGHT DUTY, SILT FENCE BARRIER OPSD 219.110
- HEAVY DUTY, SILT FENCE BARRIER OPSD 219.130
- MUD MAT
- WETLAND
- LTC PERMIT APPLICATION AREA
- EXISTING WATERCOURSE TO BE REMOVED
- EXISTING WATERCOURSE TO REMAIN WITH MODIFIED NORTH BANK
- PROPOSED CULVERT
- PROPOSED WATERCOURSE

GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH

NOTES

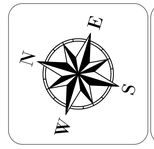
1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE THE PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT OF EXPOSED SOIL AND INSTALLING SILT FENCES AND OTHER SEDIMENT TRAPS.
2. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING EROSION AND SEDIMENT CONTROL MEASURES ARE INSTALLED CORRECTLY.
3. FOR STRAW BALE FLOW CHECK DAM, USE OPSD 219.100. FOR LIGHT DUTY AND HEAVY DUTY SILT FENCE BARRIER, USE OPSD 219.110 AND 219.130, RESPECTIVELY.
4. THE OWNER AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CONSERVATION AUTHORITY.
5. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE PRIOR TO ANY EXCAVATION OR CONSTRUCTION WORK COMMENCE.
6. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE REGULARLY MONITORED AND MAINTAINED UNTIL LANDSCAPING HAS BEEN ESTABLISHED.
7. ALL CATCH BASINS AND MANHOLES WHICH MAY COLLECT SEDIMENT FROM THE DISTURBED AREAS OF THE SITE SHALL HAVE FILTER CLOTH OR OTHER APPROVED MEANS OF SEDIMENT CONTROL INSTALLED AND MAINTAINED UNTIL THE CONTRIBUTING SURFACES HAVE ADEQUATELY STABILIZED, I.E. ASPHALT, SOD, OR 80% GRASS COVER.
8. MUD MAT MUST BE A MINIMUM OF 20 m IN LENGTH AND THE FULL WIDTH OF THE ENTRANCE (10 m MINIMUM). THE PAD SHOULD BE A MINIMUM OF 300 mm THICK BUT 450 mm THICKNESS IS RECOMMENDED. THE PAD SHOULD BE UNDERLAIN WITH A GEOTEXTILE (OR GRADED AGGREGATE FILTER) AND CONSIST OF 50 mm DIAMETER CLEAR STONE FOR THE FIRST 10 m (EXTENDING FROM THE STREET) AND THE REMAINDER OF THE LENGTH TO CONSIST OF 150 mm DIAMETER CLEAR STONE.

EMERGENCY CONTACT INFORMATION

SPILLS ACTION CENTRE
PHONE: 416-325-3000
TOLL-FREE: 1-800-268-6060

BENCHMARKS

1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765



JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

WATERCOURSE RE-ALIGNMENT PLAN

DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: April 2023	
CHECKED BY: AMR	SCALE: HORIZONTAL - 1:1000 VERTICAL - N/A	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: WC-1

F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\2105024 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - WC

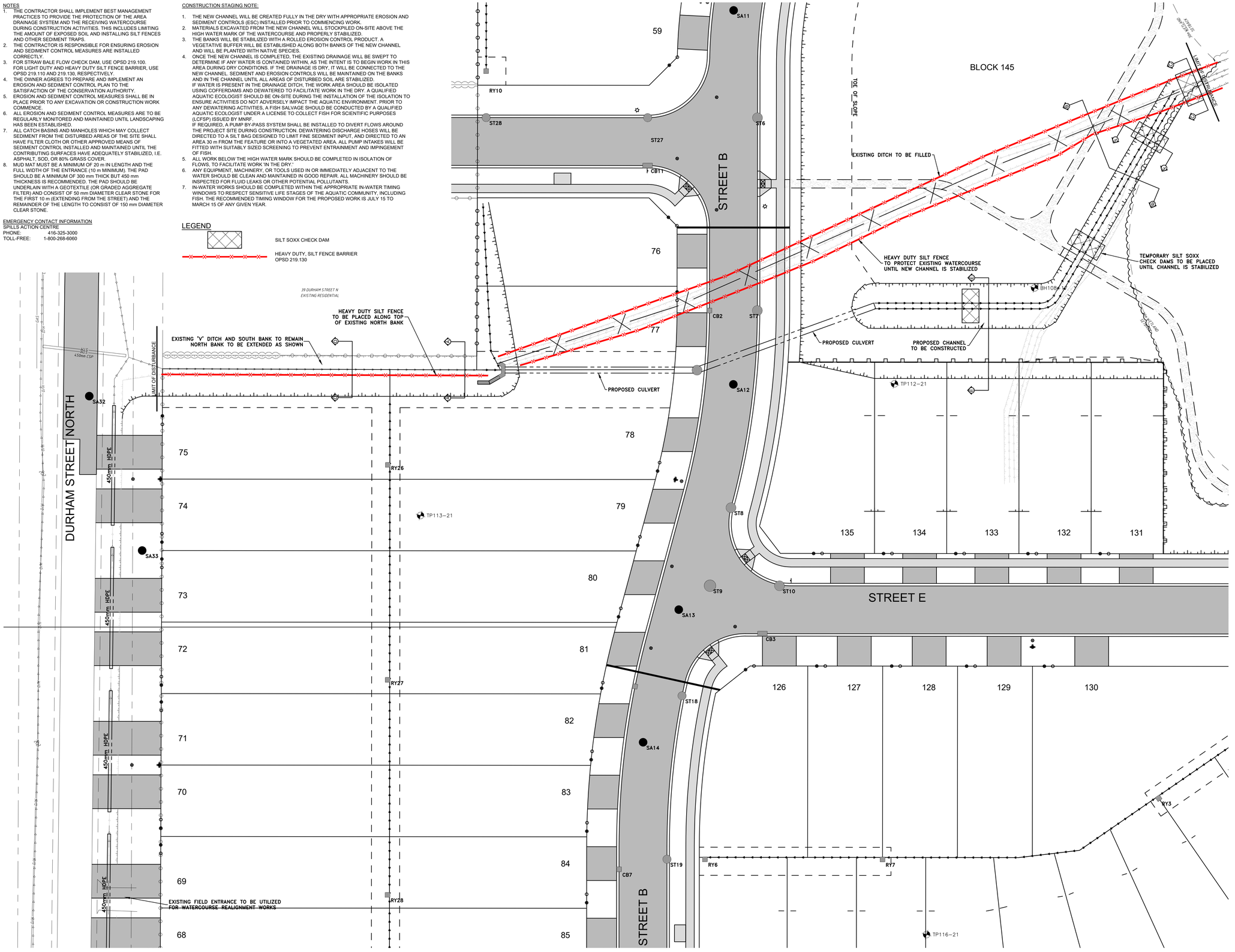
04/26/2023

NOTES
1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES TO PROVIDE THE PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE DURING CONSTRUCTION ACTIVITIES. THIS INCLUDES LIMITING THE AMOUNT OF EXPOSED SOIL AND INSTALLING SILT FENCES AND OTHER SEDIMENT TRAPS.
2. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING EROSION AND SEDIMENT CONTROL MEASURES ARE INSTALLED CORRECTLY.
3. FOR STRAW BALE FLOW CHECK DAM, USE OPSD 219.100. FOR LIGHT DUTY AND HEAVY DUTY SILT FENCE BARRIER, USE OPSD 219.110 AND 219.130, RESPECTIVELY.
4. THE OWNER AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CONSERVATION AUTHORITY.
5. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IN PLACE PRIOR TO ANY EXCAVATION OR CONSTRUCTION WORK COMMENCE.
6. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE REGULARLY MONITORED AND MAINTAINED UNTIL LANDSCAPING HAS BEEN ESTABLISHED.
7. ALL CATCH BASINS AND MANHOLES WHICH MAY COLLECT SEDIMENT FROM THE DISTURBED AREAS OF THE SITE SHALL HAVE FILTER CLOTH OR OTHER APPROVED MEANS OF SEDIMENT CONTROL INSTALLED AND MAINTAINED UNTIL THE CONTRIBUTING SURFACES HAVE ADEQUATELY STABILIZED, I.E. ASPHALT, SOD, OR 80% GRASS COVER.
8. MUD MAT MUST BE A MINIMUM OF 20 m IN LENGTH AND THE FULL WIDTH OF THE ENTRANCE (10 m MINIMUM). THE PAD SHOULD BE A MINIMUM OF 300 mm THICK BUT 450 mm THICKNESS IS RECOMMENDED. THE PAD SHOULD BE UNDERLAIN WITH A GEOTEXTILE (OR GRADED AGGREGATE FILTER) AND CONSIST OF 50 mm DIAMETER CLEAR STONE FOR THE FIRST 10 m (EXTENDING FROM THE STREET) AND THE REMAINDER OF THE LENGTH TO CONSIST OF 150 mm DIAMETER CLEAR STONE.

EMERGENCY CONTACT INFORMATION
SPILLS ACTION CENTRE
PHONE: 416-325-3000
TOLL-FREE: 1-800-268-6060

CONSTRUCTION STAGING NOTE:
1. THE NEW CHANNEL WILL BE CREATED FULLY IN THE DRY WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS (ESC) INSTALLED PRIOR TO COMMENCING WORK.
2. MATERIALS EXCAVATED FROM THE NEW CHANNEL WILL STOCKPILED ON-SITE ABOVE THE HIGH WATER MARK OF THE WATERCOURSE AND PROPERLY STABILIZED.
3. THE BANKS WILL BE STABILIZED WITH A ROLLED EROSION CONTROL PRODUCT. A VEGETATIVE BUFFER WILL BE ESTABLISHED ALONG BOTH BANKS OF THE NEW CHANNEL AND WILL BE PLANTED WITH NATIVE SPECIES.
4. ONCE THE NEW CHANNEL IS COMPLETED, THE EXISTING DRAINAGE WILL BE SWEPT TO DETERMINE IF ANY WATER IS CONTAINED WITHIN, AS THE INTENT IS TO BEGIN WORK IN THIS AREA DURING DRY CONDITIONS. IF THE DRAINAGE IS DRY, IT WILL BE CONNECTED TO THE NEW CHANNEL. SEDIMENT AND EROSION CONTROLS WILL BE MAINTAINED ON THE BANKS AND IN THE CHANNEL UNTIL ALL AREAS OF DISTURBED SOIL ARE STABILIZED.
IF WATER IS PRESENT IN THE DRAINAGE DITCH, THE WORK AREA SHOULD BE ISOLATED USING COFFERDAMS AND DEWATERED TO FACILITATE WORK IN THE DRY. A QUALIFIED AQUATIC ECOLOGIST SHOULD BE ON-SITE DURING THE INSTALLATION OF THE ISOLATION TO ENSURE ACTIVITIES DO NOT ADVERSELY IMPACT THE AQUATIC ENVIRONMENT. PRIOR TO ANY DEWATERING ACTIVITIES, A FISH SALVAGE SHOULD BE CONDUCTED BY A QUALIFIED AQUATIC ECOLOGIST UNDER A LICENSE TO COLLECT FISH FOR SCIENTIFIC PURPOSES (LCFSP) ISSUED BY MNRF.
IF REQUIRED, A PUMP BY-PASS SYSTEM SHALL BE INSTALLED TO DIVERT FLOWS AROUND THE PROJECT SITE DURING CONSTRUCTION. DEWATERING DISCHARGE HOSES WILL BE DIRECTED TO A SILT BAG DESIGNED TO LIMIT FINE SEDIMENT INPUT, AND DIRECTED TO AN AREA 30 m FROM THE FEATURE OR INTO A VEGETATED AREA. ALL PUMP INTAKES WILL BE FITTED WITH SUITABLY SIZED SCREENING TO PREVENT ENTRAINMENT AND IMPINGEMENT OF FISH.
5. ALL WORK BELOW THE HIGH WATER MARK SHOULD BE COMPLETED IN ISOLATION OF FLOWS, TO FACILITATE WORK 'IN THE DRY.'
6. ANY EQUIPMENT, MACHINERY, OR TOOLS USED IN OR IMMEDIATELY ADJACENT TO THE WATER SHOULD BE CLEAN AND MAINTAINED IN GOOD REPAIR. ALL MACHINERY SHOULD BE INSPECTED FOR FLUID LEAKS OR OTHER POTENTIAL POLLUTANTS.
7. IN-WATER WORKS SHOULD BE COMPLETED WITHIN THE APPROPRIATE IN-WATER TIMING WINDOWS TO RESPECT SENSITIVE LIFE STAGES OF THE AQUATIC COMMUNITY, INCLUDING FISH. THE RECOMMENDED TIMING WINDOW FOR THE PROPOSED WORK IS JULY 15 TO MARCH 15 OF ANY GIVEN YEAR.

LEGEND
- SILT SOXX CHECK DAM
- HEAVY DUTY, SILT FENCE BARRIER OPSD 219.130



GENERAL NOTES:
- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

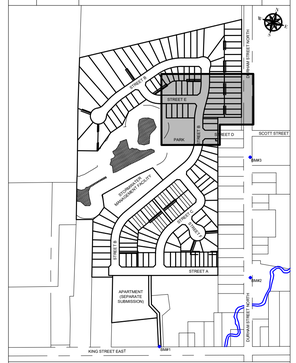
METRIC NOTE:
- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:
- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH



KEY PLAN
SCALE - N.T.S.

BENCHMARKS
1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765

A. M. REDDEN
100177602
Apr. 24, 2023
LICENSED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

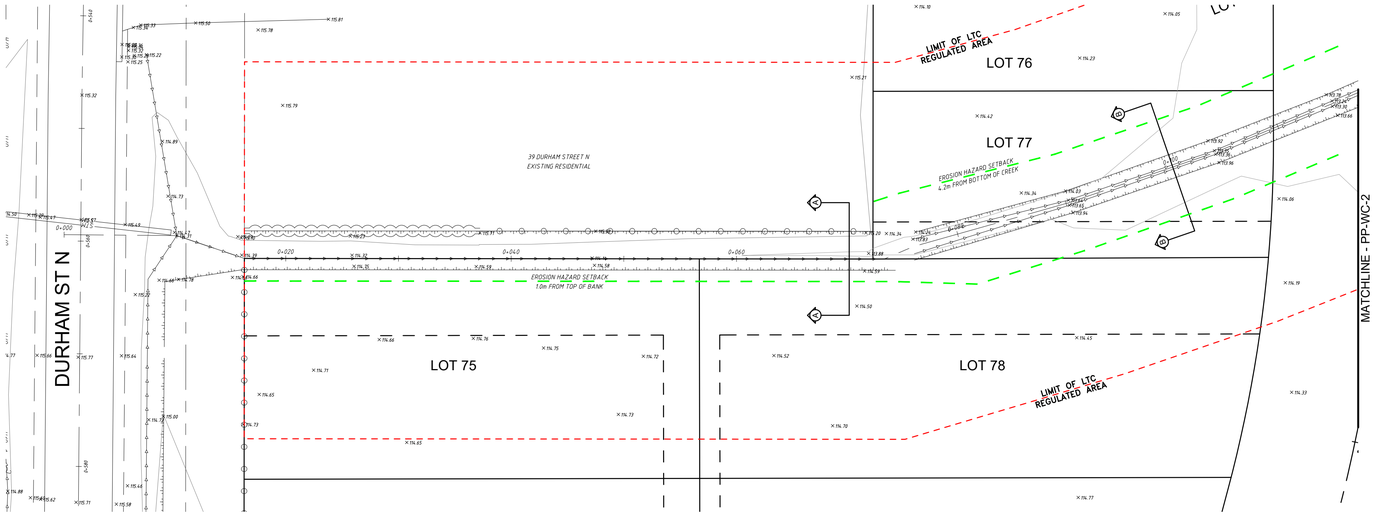
WATERCOURSE RE-ALIGNMENT
SEDIMENT AND EROSION CONTROL PLAN

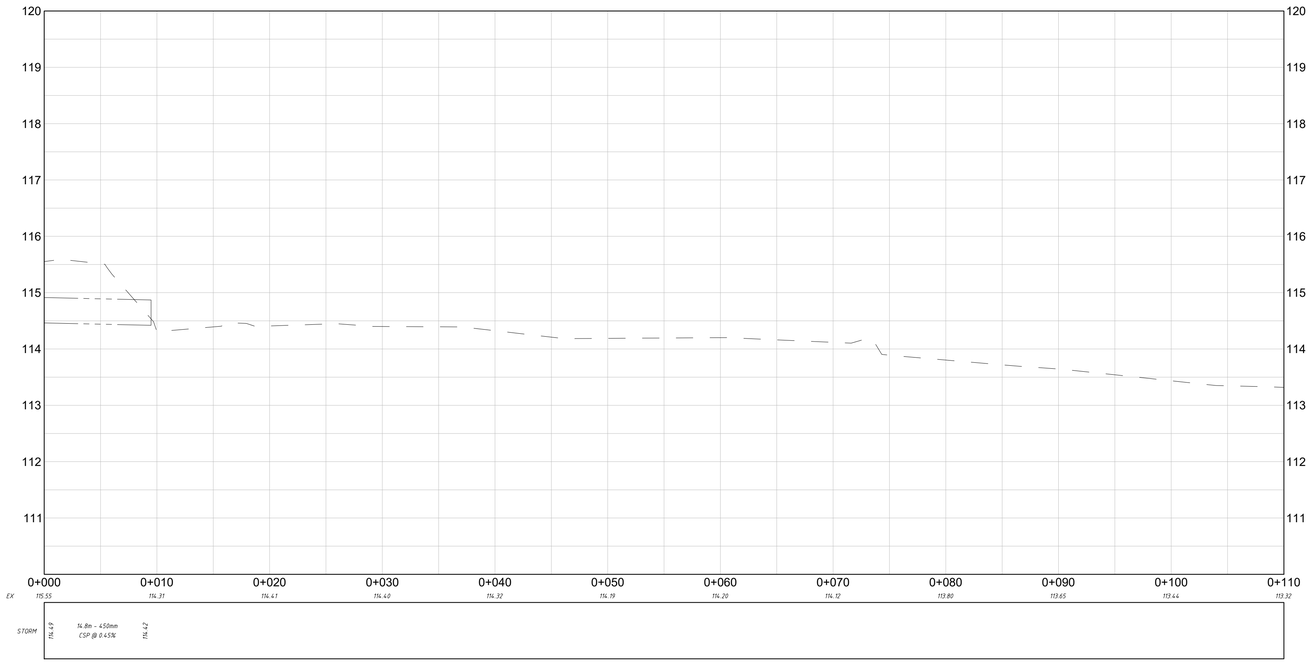
DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: April 2023	
CHECKED BY: AMR	SCALE: HORIZONTAL - 1:300 VERTICAL - N/A	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: WC-ESC-1

F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\2105024 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - WC - ESC

04/26/2023

EXISTING WATERCOURSE (EAST-WEST)





GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

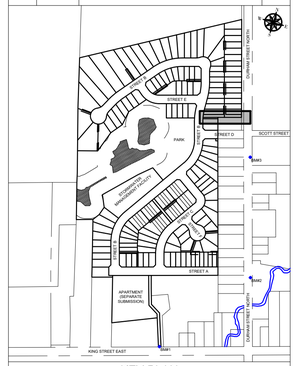
GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH



KEY PLAN
SCALE - N.T.S.

BENCHMARKS

1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765

LICENSED PROFESSIONAL ENGINEER
A. M. REDDEN
100177606
Apr. 26, 2023
PROVINCE OF ONTARIO

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

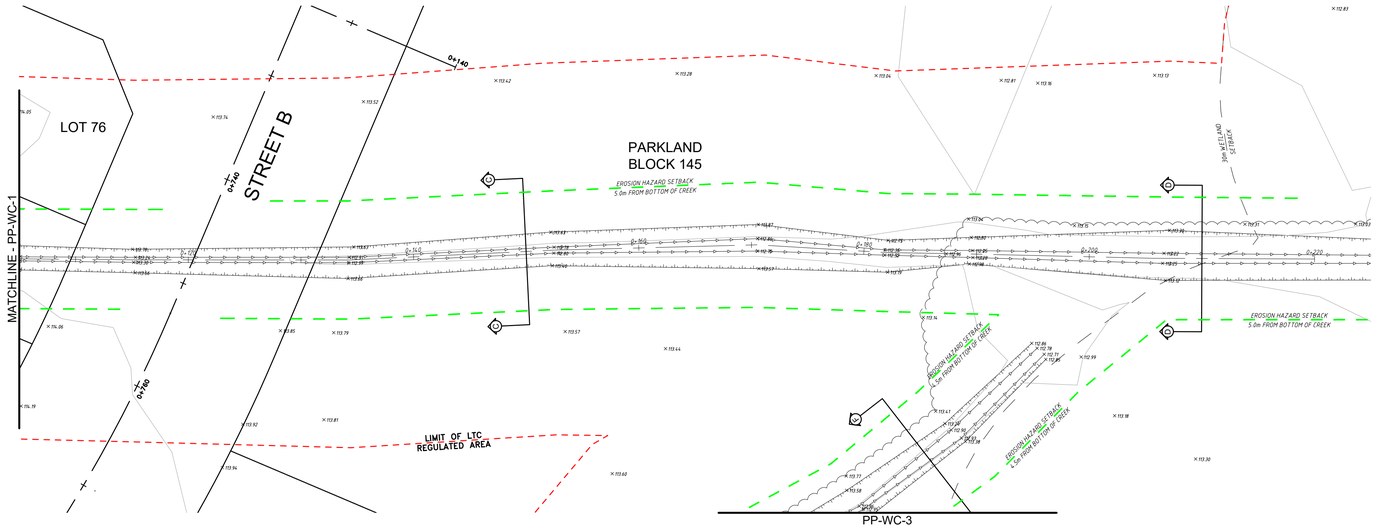
PLAN & PROFILE
EXISTING WATERCOURSE (EAST-WEST)
STA. 0+000 to 0+110

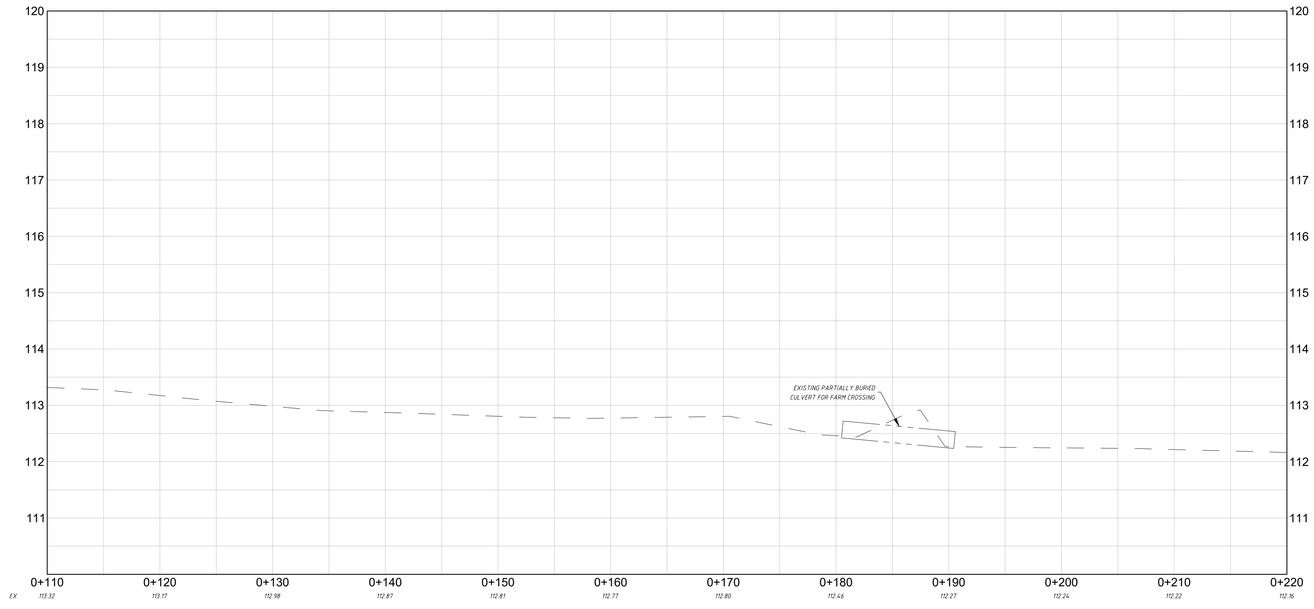
DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: April 2023	
CHECKED BY: AMR	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: PP-WC-1

F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\2105024 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - WC - PP EX

04/26/2023

EXISTING WATERCOURSE (EAST-WEST)





GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

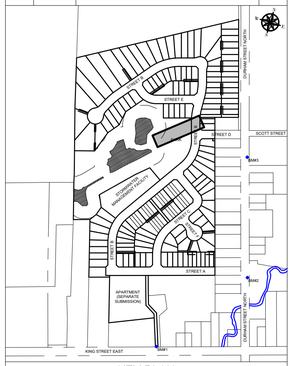
GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH



KEY PLAN
SCALE - N.T.S.

BENCHMARKS

1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765

LICENSED PROFESSIONAL ENGINEER
A. M. REDDEN
100177608
Apr. 26, 2023
PROVINCE OF ONTARIO

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

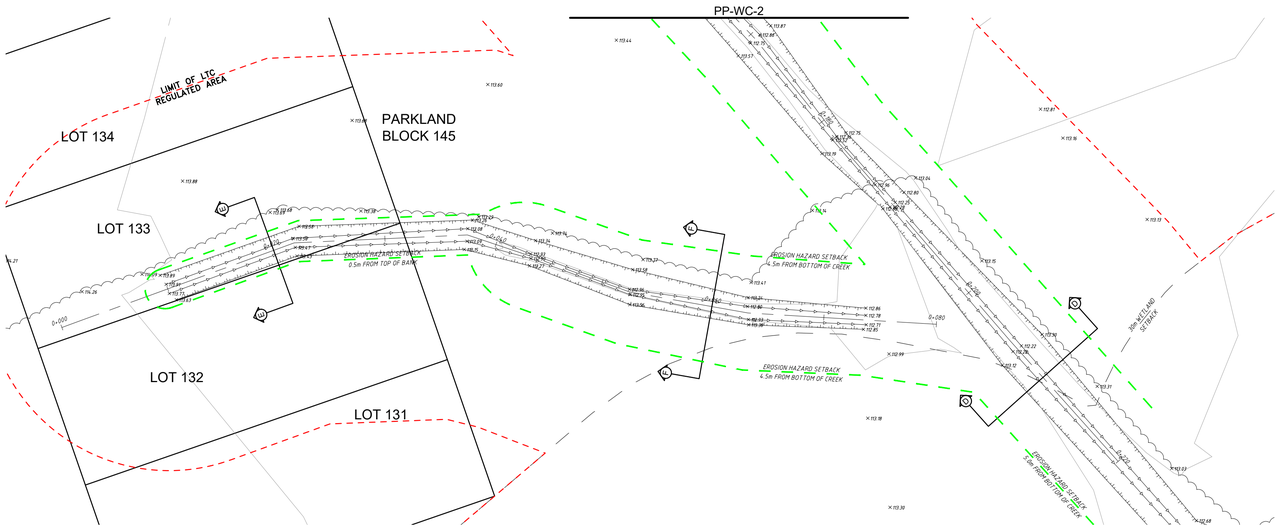
PLAN & PROFILE
EXISTING WATERCOURSE (EAST-WEST)
STA. 0+110 to 0+220

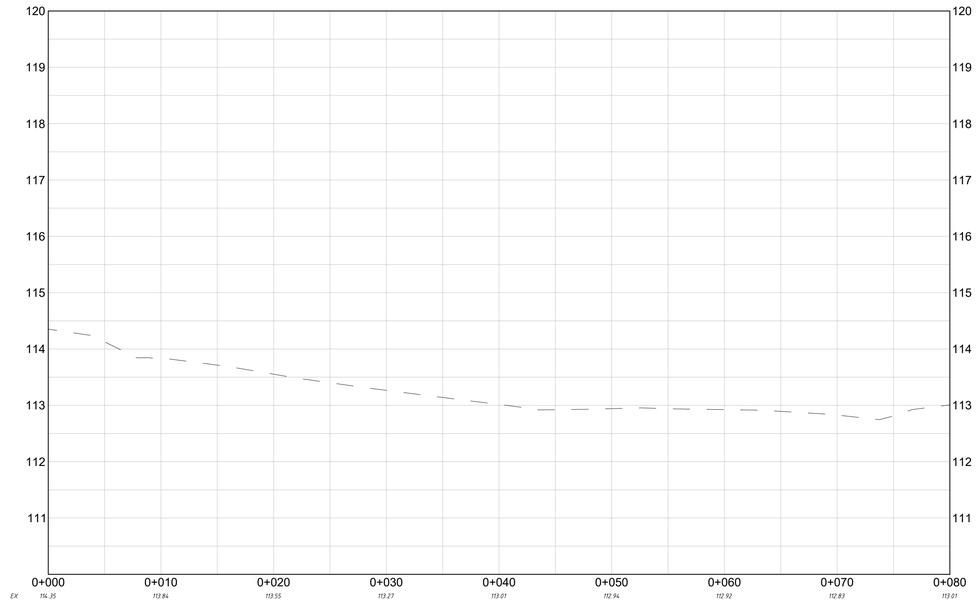
DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: April 2023	
CHECKED BY: AMR	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: PP-WC-2

F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\2105024 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - WC - PP EX

04/26/2023

EXISTING WATERCOURSE (NORTH-SOUTH)





GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

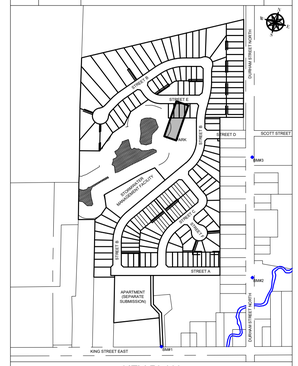
GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

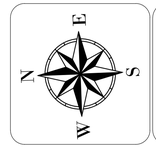
NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH



KEY PLAN
SCALE - N.T.S.

BENCHMARKS

1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765



JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

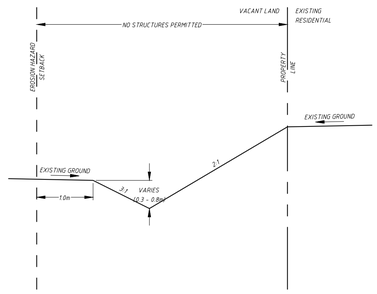
FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

PLAN & PROFILE
EXISTING WATERCOURSE (NORTH-SOUTH)
STA. 0+000 to 0+080

DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: April 2023	
CHECKED BY: AMR	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: PP-WC-3

F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\210524 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\210524 - WC - PP EX

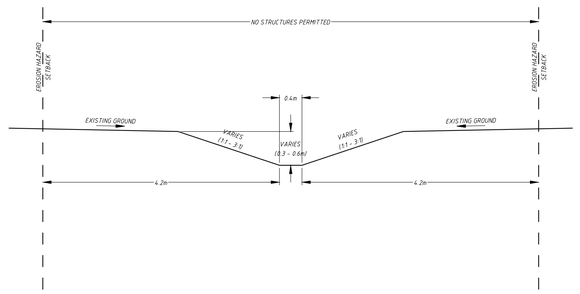
EROSION HAZARD SETBACK CALCULATION:
(2H:1V OR GREATER)
= H FROM TOP OF BANK
= 0.8m FROM TOP OF BANK MIN
= ROUNDED TO 1.0m



SECTION A-A (EAST-WEST)

STA. 0+020 to 0+075
SCALE - N.T.S.

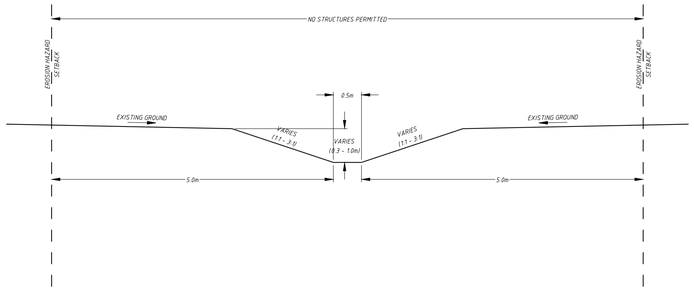
EROSION HAZARD SETBACK CALCULATION:
(LESS THAN 2H:1V)
= 2H + 3 TO BOTTOM OF BANK
= 2(0.6) + 3
= 4.2m TO BOTTOM OF BANK



SECTION B-B (EAST-WEST)

STA. 0+075 to 0+120
SCALE - N.T.S.

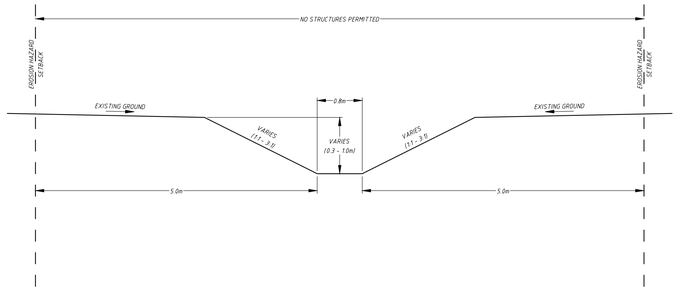
EROSION HAZARD SETBACK CALCULATION:
(LESS THAN 2H:1V)
= 2H + 3 TO BOTTOM OF BANK
= 2(1.0) + 3
= 5.0m TO BOTTOM OF BANK



SECTION C-C (EAST-WEST)

STA. 0+120 to 0+200
SCALE - N.T.S.

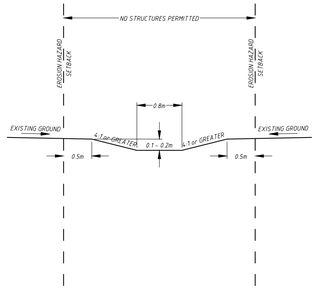
EROSION HAZARD SETBACK CALCULATION:
(LESS THAN 2H:1V)
= 2H + 3 TO BOTTOM OF BANK
= 2(1.0) + 3
= 5.0m TO BOTTOM OF BANK



SECTION D-D (EAST-WEST)

STA. 0+200 to DOWNSTREAM
SCALE - N.T.S.

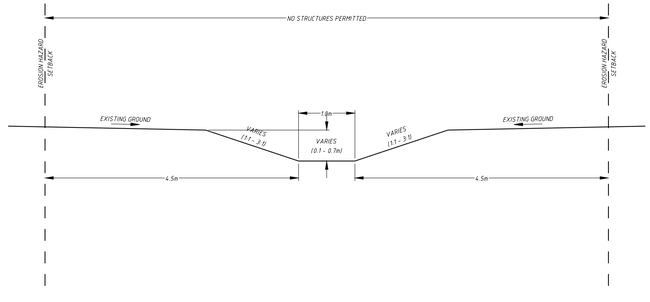
EROSION HAZARD SETBACK CALCULATION:
(2H:1V OR GREATER)
= H FROM TOP OF BANK
= 0.2m FROM TOP OF BANK MIN
= ROUNDED TO 0.5m



SECTION E-E (NORTH-SOUTH)

STA. 0+010 to 0+040
SCALE - N.T.S.

EROSION HAZARD SETBACK CALCULATION:
(LESS THAN 2H:1V)
= 2H + 3 TO BOTTOM OF BANK
= 2(0.7) + 3
= 4.4m TO BOTTOM OF BANK
= ROUNDED TO 4.5m



SECTION F-F (NORTH-SOUTH)

STA. 0+040 to 0+080
SCALE - N.T.S.

GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH

NOTE:

EROSION HAZARD SETBACK CALCULATION METHODOLOGY BASED ON "EASTFIELDS DRAINAGE FEATURE SLOPE STABILITY LETTER REPORT" PREPARED BY CAMBIUM INC, DATED MARCH 20, 2023

BENCHMARKS

1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765

LICENSED PROFESSIONAL ENGINEER
A. M. REDDEN
100177602
Apr. 26, 2023
PROVINCE OF ONTARIO

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

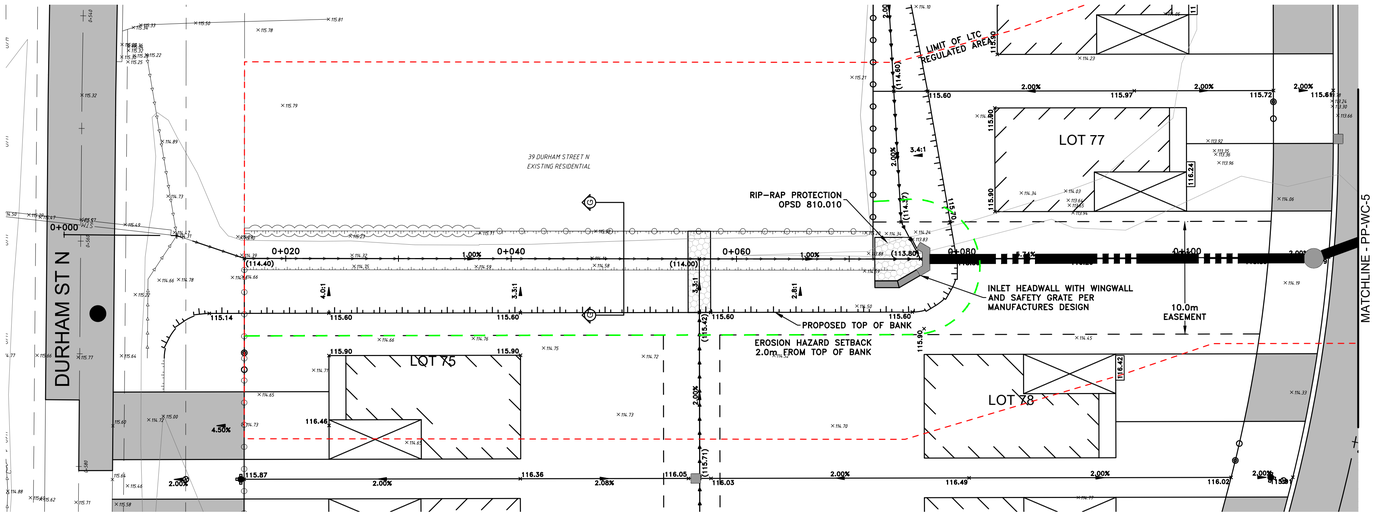
FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

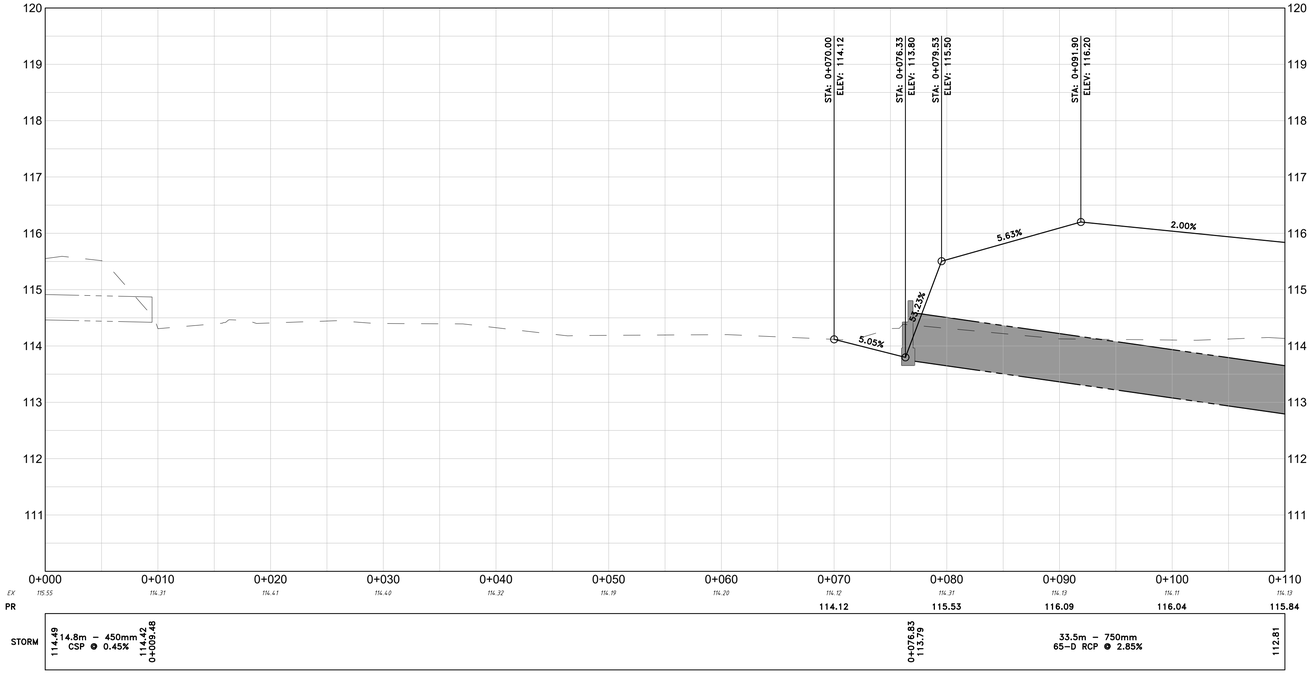
EXISTING
WATERCOURSE DETAILS

DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: April 2023	
CHECKED BY: AMR	SCALE: HORIZONTAL - N.T.S. VERTICAL - N.T.S.	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: WC-DE-1

04/26/2023

PROPOSED WATERCOURSE (EAST-WEST)





GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

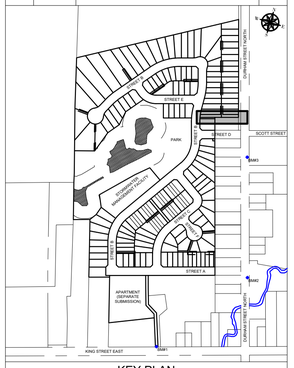
GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH



KEY PLAN
SCALE - N.T.S.

BENCHMARKS

1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765

LICENSED PROFESSIONAL ENGINEER
A. M. REDDEN
100177606
Apr. 24, 2023
PROVINCE OF ONTARIO

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

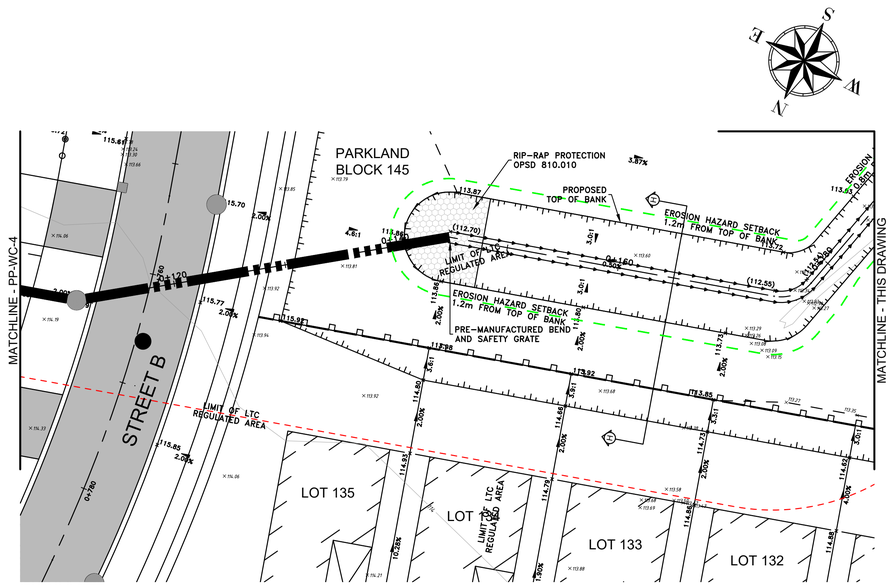
PLAN & PROFILE
PROPOSED WATERCOURSE (EAST-WEST)
STA. 0+000 to 0+110

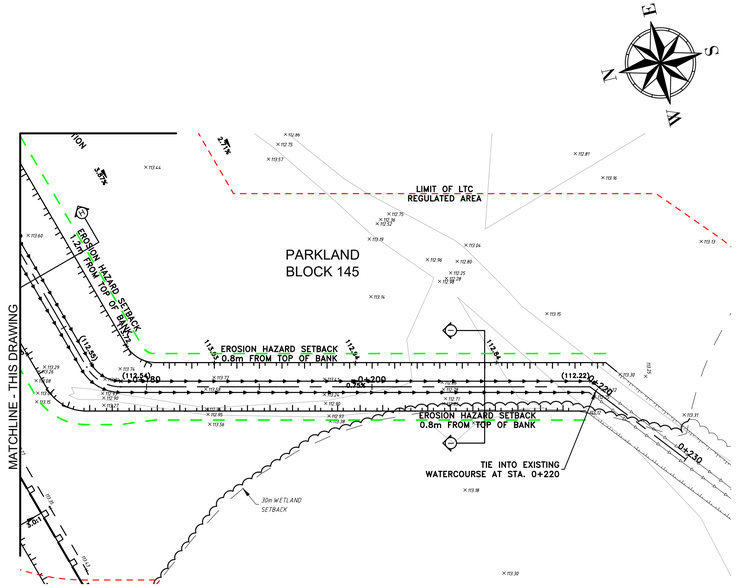
DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: April 2023	
CHECKED BY: AMR	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: PP-WC-4

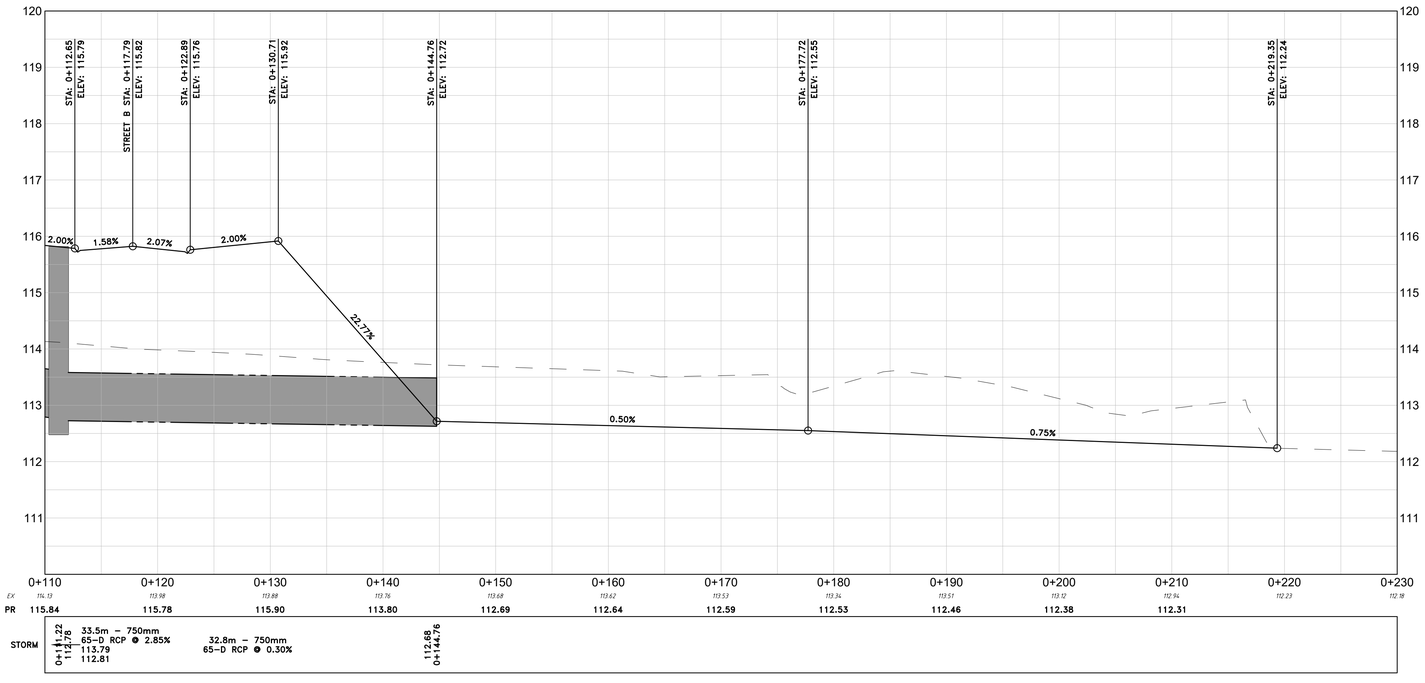
F:\FTP\PROJECT FILES\1 CIVIL 3D PROJECT FILES\2105024 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - WC - PP PR

04/26/2023

PROPOSED WATERCOURSE (EAST-WEST)







GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

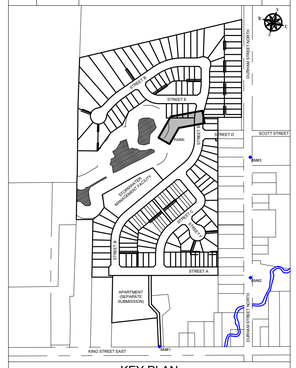
GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH



KEY PLAN
SCALE - N.T.S.

BENCHMARKS

1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765

LICENSED PROFESSIONAL ENGINEER
A. M. REDDEN
100177602
Apr. 26, 2023
PROVINCE OF ONTARIO

JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

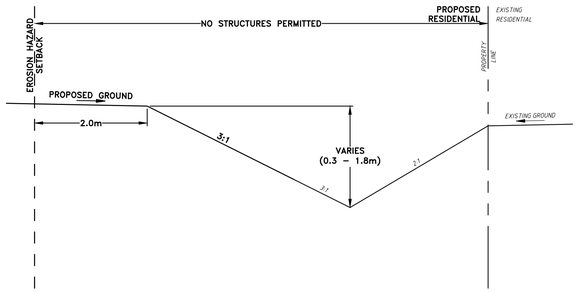
FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

PLAN & PROFILE
PROPOSED WATERCOURSE (EAST-WEST)
STA. 0+110 to 0+230

DRAWN BY: JGH	PROJECT NO: 210-5024
DESIGNED BY: JGH/AMR	DATE: April 2023
CHECKED BY: AMR	SCALE: HORIZONTAL - 1:250 VERTICAL - 1:50
APPROVED BY: AMR	CONTRACT NO:
	DRAWING NO: PP-WC-5

F:\FTP\PROJECT FILES\11 CIVIL 3D PROJECT FILES\2105024 - FIDELITY - EASTFIELDS COLBORNE\3 SHEETS\2105024 - WC - PP PR

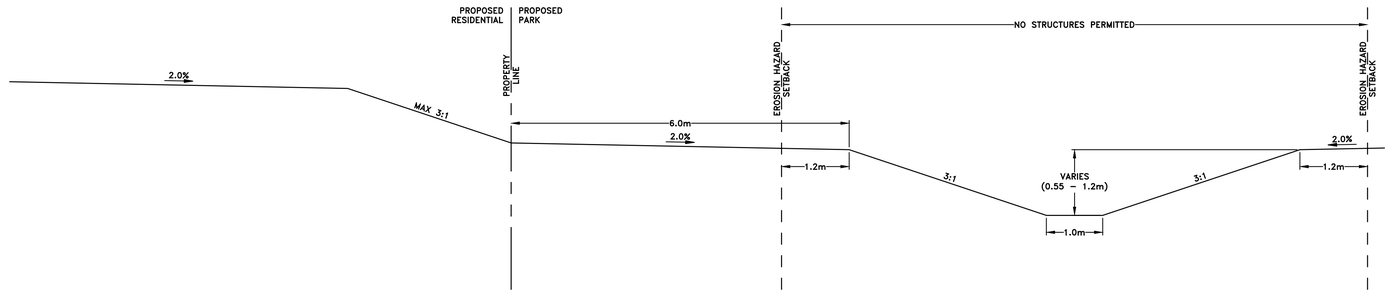
EROSION HAZARD SETBACK CALCULATION:
(2H:1V OR GREATER)
= H FROM TOP OF BANK
= 1.8m FROM TOP OF BANK MIN
= ROUNDED TO 2.0m



SECTION G-G

STA. 0+020 to 0+075
SCALE - N.T.S.

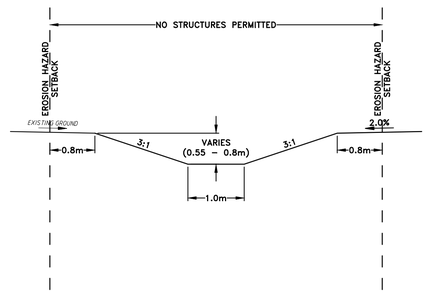
EROSION HAZARD SETBACK CALCULATION:
(2H:1V OR GREATER)
= H FROM TOP OF BANK
= 1.2m FROM TOP OF BANK MIN



SECTION H-H

STA. 0+145 to 0+175
SCALE - N.T.S.

EROSION HAZARD SETBACK CALCULATION:
(2H:1V OR GREATER)
= H FROM TOP OF BANK
= 0.8m FROM TOP OF BANK MIN



SECTION I-I

STA. 0+175 to 0+220
SCALE - N.T.S.

GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY
1	04/25/2023	LTC WATERCOURSE PERMIT	JH

BENCHMARKS

1. TOP NUT OF FIRE HYDRANT ON KING STREET EAST AT THE SITE ACCESS ELEV = 105.748
2. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH IN FRONT OF COLBORNE CURLING CLUB ELEV = 109.261
3. TOP NUT OF FIRE HYDRANT ON DURHAM STREET NORTH JUST SOUTH OF SCOTT STREET ELEV = 118.765

LICENSED PROFESSIONAL ENGINEER
A. M. REDDEN
100177602
Apr. 24, 2023
PROVINCE OF ONTARIO

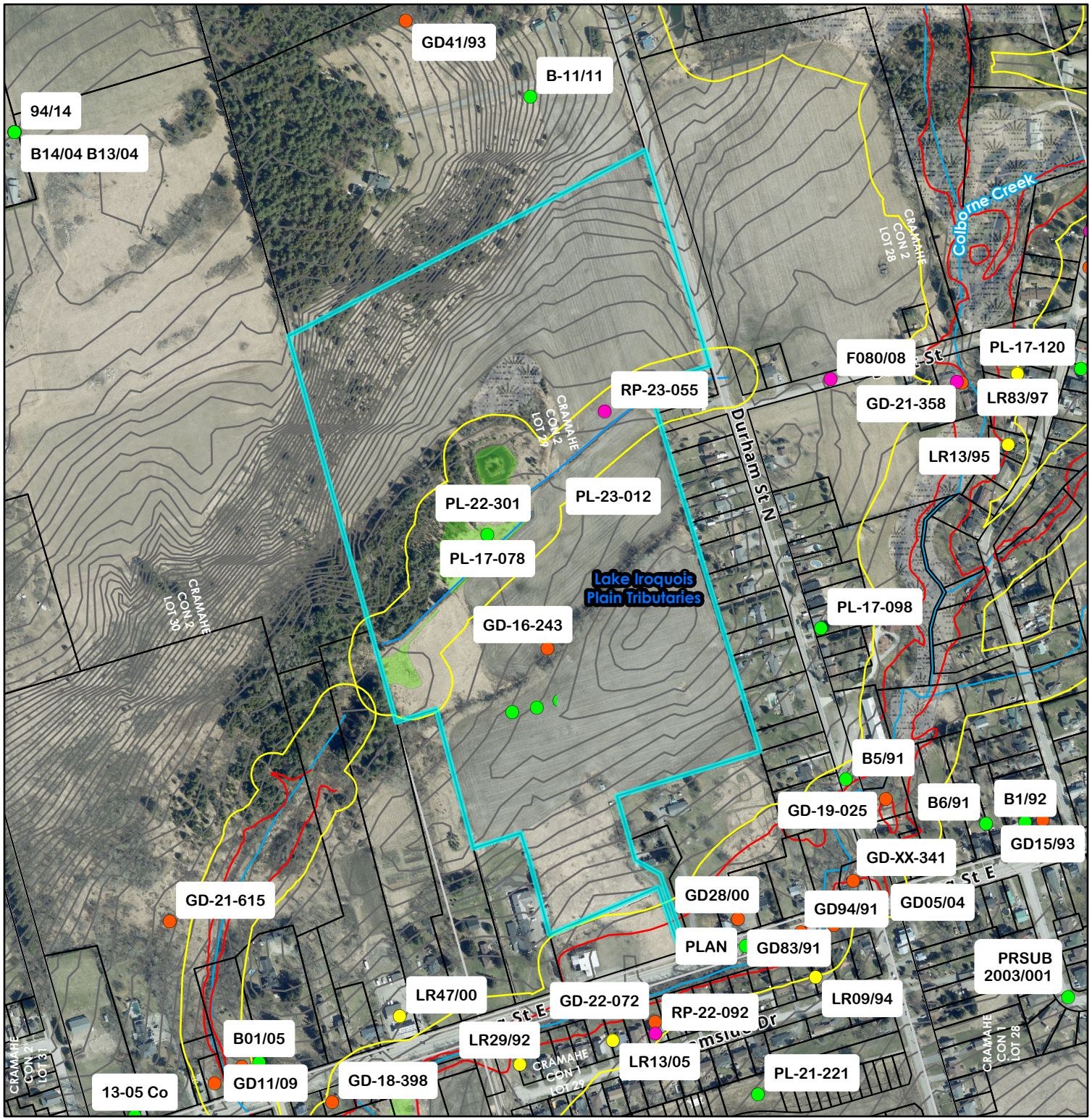
JEWELL ENGINEERING

EASTFIELDS SUBDIVISION
COLBORNE

FIDELITY GROUP OF COMPANIES
TOWNSHIP OF CRAMAHE

PROPOSED
WATERCOURSE DETAILS

DRAWN BY: JGH	PROJECT NO: 210-5024	
DESIGNED BY: JGH/AMR	DATE: April 2023	
CHECKED BY: AMR	SCALE: HORIZONTAL - N.T.S. VERTICAL - N.T.S.	
APPROVED BY: AMR	CONTRACT NO:	DRAWING NO: WC-DE-2



RP-23-055

Durham Street North
Cramahe (C)
Con 2, Lot 29

Legend

- O.Reg. 163/06 Screening Area
- Parcels

Water

- Stream
- Virtual Flow Connector

Wetlands (MNRF)

- Unevaluated wetland
- Evaluated wetland (PSW)
- Evaluated wetland (non-PSW)

Field Verified Wetland

- Yes (Present)
- No (Not Present)

Flood & Erosion Lines

- Floodlines
- MurrayCanal_7600_CGVD28
- Planning Files
- Section 28 Permits
- Legal Requests
- General Development

0 80 160 320
Metres

Map produced by Lower Trent Conservation

Note: Property lines shown on this map are approximate only and may be an inaccurate representation of the legal property limits. A legal survey is required to define the legal property limits.

LOWER TRENT CONSERVATION

User: technicaladmin March 7, 2023 4:25 PM

Conservation Authorities Act
Loi sur les offices de protection de la nature

ONTARIO REGULATION 163/06

LOWER TRENT REGION CONSERVATION AUTHORITY: REGULATION OF DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES

Consolidation Period: From February 8, 2013 to the e-Laws currency date.

Last amendment: O. Reg. 67/13.

This Regulation is made in English only.

Definition

1. In this Regulation,

"Authority" means the Lower Trent Region Conservation Authority. O. Reg. 163/06, s. 1.

Development prohibited

2. (1) Subject to section 3, no person shall undertake development or permit another person to undertake development in or on the areas within the jurisdiction of the Authority that are,

(a) adjacent or close to the shoreline of the Great Lakes-St. Lawrence River System or to inland lakes that may be affected by flooding, erosion or dynamic beaches, including the area from the furthest offshore extent of the Authority's boundary to the furthest landward extent of the aggregate of the following distances:

(i) the 100 year flood level, plus the appropriate allowance for wave uprush shown in the most recent document entitled "Lake Ontario Shoreline Management Plan", or as identified in the most recent document entitled "Cramahe Shorelands Project" for the Township of Cramahe or in the most recent document entitled "Alnwick/Haldimand Lake Ontario Shorelands Project" for the Township of Alnwick/Haldimand, available at the head office of the Authority,

(ii) the predicted long term stable slope projected from the existing stable toe of the slope or from the predicted location of the toe of the slope as that location may have shifted as a result of shoreline erosion over a 100-year period shown in the most recent document entitled "Lake Ontario Shoreline Management Plan", or as identified in the most recent document entitled "Cramahe Shorelands Project" for the Township of Cramahe or in the most recent document entitled "Alnwick/Haldimand Lake Ontario Shorelands Project" for the Township of Alnwick/Haldimand, available at the head office of the Authority,

(iii) where a dynamic beach is associated with the waterfront lands, the appropriate allowance inland to accommodate dynamic beach movement shown in the most recent document entitled "Lake Ontario Shoreline Management Plan", or as identified in the most recent document entitled "Cramahe Shorelands Project" for the Township of Cramahe or in the most recent document entitled "Alnwick/Haldimand Lake Ontario Shorelands Project" for the Township of Alnwick/Haldimand, available at the head office of the Authority, and

(iv) an allowance of 15 metres inland;

(b) river or stream valleys that have depressional features associated with a river or stream, whether or not they contain a watercourse, the limits of which are determined in accordance with the following rules:

(i) where the river or stream valley is apparent and has stable slopes, the valley extends from the stable top of bank, plus 15 metres, to a similar point on the opposite side,

(ii) where the river or stream valley is apparent and has unstable slopes, the valley extends from the predicted long term stable slope projected from the existing stable slope or, if the toe of the slope is unstable, from the predicted location of the toe of the slope as a result of stream erosion over a projected 100-year period, plus 15 metres, to a similar point on the opposite side,

(iii) where the river or stream valley is not apparent, the valley extends the greater of,

(A) the distance from a point outside the edge of the maximum extent of the flood plain under the applicable flood event standard, plus 15 metres, to a similar point on the opposite side, and

(B) the distance from the predicted meander belt of a watercourse, expanded as required to convey the flood flows under the applicable flood event standard, plus 15 metres, to a similar point on the opposite side;

(c) hazardous lands;

(d) wetlands; or

(e) other areas where development could interfere with the hydrologic function of a wetland, including areas within 120 metres of all provincially significant wetlands and areas within 30 metres of all other wetlands. O. Reg. 163/06, s. 2 (1); O. Reg. 67/13, s. 1 (1, 2).

(2) All areas within the jurisdiction of the Authority that are described in subsection (1) are delineated as the "Regulation Limit" shown on a series of maps filed at the head office of the Authority under the map title "Ontario Regulation 97/04: Regulation for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses". O. Reg. 67/13, s. 1 (3).

(3) If there is a conflict between the description of areas in subsection (1) and the areas as shown on the series of maps referred to in subsection (2), the description of areas in subsection (1) prevails. O. Reg. 67/13, s. 1 (3).

Permission to develop

3. (1) The Authority may grant permission for development in or on the areas described in subsection 2 (1) if, in its opinion, the control of flooding, erosion, dynamic beaches, pollution or the conservation of land will not be affected by the development. O. Reg. 163/06, s. 3 (1).

(2) The permission of the Authority shall be given in writing, with or without conditions. O. Reg. 163/06, s. 3 (2).

(3) Subject to subsection (4), the Authority's executive committee, or one or more employees of the Authority that have been designated by the Authority for the purposes of this section, may exercise the powers and duties of the Authority under subsections (1) and (2) with respect to the granting of permissions for development in or on the areas described in subsection 2 (1). O. Reg. 67/13, s. 2.

(4) A designate under subsection (3) shall not grant a permission for development with a maximum period of validity of more than 24 months. O. Reg. 67/13, s. 2.

Application for permission

4. A signed application for permission to undertake development shall be filed with the Authority and shall contain the following information:

1. Four copies of a plan of the area showing the type and location of the proposed development.
2. The proposed use of the buildings and structures following completion of the development.
3. The start and completion dates of the development.
4. The elevations of existing buildings, if any, and grades and the proposed elevations of buildings and grades after the development.
5. Drainage details before and after the development.
6. A complete description of the type of fill proposed to be placed or dumped.
7. Such other technical studies or plans as the Authority may request. O. Reg. 163/06, s. 4; O. Reg. 67/13, s. 3.

Alterations prohibited

5. Subject to section 6, no person shall straighten, change, divert or interfere in any way with the existing channel of a river, creek, stream or watercourse or change or interfere in any way with a wetland. O. Reg. 163/06, s. 5.

Permission to alter

6. (1) The Authority may grant permission to straighten, change, divert or interfere with the existing channel of a river, creek, stream or watercourse or to change or interfere with a wetland. O. Reg. 163/06, s. 6 (1); O. Reg. 67/13, s. 4 (1).

(2) The permission of the Authority shall be given in writing, with or without conditions. O. Reg. 163/06, s. 6 (2).

(3) Subject to subsection (4), the Authority's executive committee, or one or more employees of the Authority that have been designated by the Authority for the purposes of this section, may exercise the powers and duties of the Authority under subsections (1) and (2) with respect to the granting of permissions for alteration. O. Reg. 67/13, s. 4 (2).

(4) A designate under subsection (3) shall not grant a permission for alteration with a maximum period of validity of more than 24 months. O. Reg. 67/13, s. 4 (2).

Application for permission

7. A signed application for permission to straighten, change, divert or interfere with the existing channel of a river, creek, stream or watercourse or change or interfere with a wetland shall be filed with the Authority and shall contain the following information:

1. Four copies of a plan of the area showing plan view and cross-section details of the proposed alteration.
2. A description of the methods to be used in carrying out the alteration.
3. The start and completion dates of the alteration.
4. A statement of the purpose of the alteration.
5. Such other technical studies or plans as the Authority may request. O. Reg. 163/06, s. 7; O. Reg. 67/13, s. 5.

Cancellation of permission

8. (1) The Authority may cancel a permission granted under section 3 or 6 if it is of the opinion that the conditions of the permission have not been met. O. Reg. 163/06, s. 8 (1); O. Reg. 67/13, s. 6 (1).

(2) Before cancelling a permission, the Authority shall give a notice of intent to cancel to the holder of the permission indicating that the permission will be cancelled unless the holder shows cause at a hearing why the permission should not be cancelled. O. Reg. 163/06, s. 8 (2).

(3) Following the giving of the notice under subsection (2), the Authority shall give the holder at least five days notice of the date of the hearing. O. Reg. 163/06, s. 8 (3); O. Reg. 67/13, s. 6 (2).

Period of validity of permissions and extensions

9. (1) The maximum period, including an extension, for which a permission granted under section 3 or 6 may be valid is,

(a) 24 months, in the case of a permission granted for projects other than projects described in clause (b); and

(b) 60 months, in the case of a permission granted for,

(i) projects that, in the opinion of the Authority or its executive committee, cannot reasonably be completed within 24 months from the day the permission is granted, or

(ii) projects that require permits or approvals from other regulatory bodies that, in the opinion of the Authority or its executive committee, cannot reasonably be obtained within 24 months from the day permission is granted. O. Reg. 67/13, s. 7.

(2) The Authority or its executive committee may grant a permission for an initial period that is less than the applicable maximum period specified in subsection (1) if, in the opinion of the Authority or its executive committee, the project can be completed in a period that is less than the maximum period. O. Reg. 67/13, s. 7.

(3) If the Authority or its executive committee grants a permission under subsection (2) for an initial period that is less than the applicable maximum period of validity specified in subsection (1), the Authority or its executive committee may grant an extension of the permission if,

(a) the holder of the permission submits a written application for an extension to the Authority at least 60 days before the expiry of the permission;

(b) no extension of the permission has previously been granted; and

(c) the application sets out the reasons for which an extension is required and, in the opinion of the Authority or its executive committee, demonstrates that circumstances beyond the control of the holder of the permission will prevent completion of the project before the expiry of the permission. O. Reg. 67/13, s. 7.

(4) When granting an extension of a permission under subsection (3), the Authority or its executive committee may grant the extension for the period of time requested by the holder in the application or for such period of time as the Authority or its executive committee deems appropriate, as long as the total period of validity of the permission does not exceed the applicable maximum period specified in subsection (1). O. Reg. 67/13, s. 7.

(5) For the purposes of this section, the granting of an extension for a different period of time than the period of time requested does not constitute a refusal of an extension. O. Reg. 67/13, s. 7.

(6) The Authority or its executive committee may refuse an extension of a permission if it is of the opinion that the requirements of subsection (3) have not been met. O. Reg. 67/13, s. 7.

(7) Before refusing an extension of a permission, the Authority or its executive committee shall give notice of intent to refuse to the holder of the permission, indicating that the extension will be refused unless,

(a) the holder requires a hearing, which may be before the Authority or its executive committee, as the Authority directs; and

(b) at the hearing, the holder satisfies the Authority, or the Authority's executive committee, as the case may be,

(i) that the requirements of clauses (3) (a) and (b) have been met, and

(ii) that circumstances beyond the control of the holder will prevent completion of the project before the expiry of the permission. O. Reg. 67/13, s. 7.

(8) If the holder of the permission requires a hearing under subsection (7), the Authority or its executive committee shall give the holder at least five days notice of the date of the hearing. O. Reg. 67/13, s. 7.

(9) After holding a hearing under subsection (7), the Authority or its executive committee shall,

(a) refuse the extension; or

(b) grant an extension for such period of time as it deems appropriate, as long as the total period of validity of the permission does not exceed the applicable maximum period specified in subsection (1). O. Reg. 67/13, s. 7.

(10) Subject to subsection (11), one or more employees of the Authority that have been designated by the Authority for the purposes of this section may exercise the powers and duties of the Authority under subsections (2), (3) and (4), but not those under subsections (6), (7), (8) and (9). O. Reg. 67/13, s. 7.

(11) A designate under subsection (10) shall not grant an extension of a permission for any period that would result in the permission having a period of validity greater than 24 months. O. Reg. 67/13, s. 7.

Appointment of officers

10. The Authority may appoint officers to enforce this Regulation. O. Reg. 163/06, s. 10.

Flood event standards

11. (1) The applicable flood event standards used to determine the maximum susceptibility to flooding of lands or areas within the watersheds in the area of jurisdiction of the Authority are the Timmins Flood Event Standard and the 100 year flood level plus wave uprush, described in Schedule 1. O. Reg. 163/06, s. 11 (1).

(2) The Timmins Flood Event Standard applies to all watersheds within the area of jurisdiction of the Authority except for,

(a) the main channels of Rice Lake and Trent River, where the applicable standard is rainfall or snowmelt, or a combination of rainfall and snowmelt, that would produce the water surface elevations above Canadian Geodetic Datum described in Table 1;

(b) Lake Ontario in the Great Lakes-St. Lawrence River System where the 100 year flood level plus wave uprush applies.

TABLE 1
WATER SURFACE ELEVATIONS

Location	Elevation
Rice Lake	187.9 metres
Trent River:	
Below Dam #1 (Trenton)	77.2 metres
Below Dam #2 (Sidney)	81.3 metres
Below Dam #3 (Glen Miller)	87.7 metres
Below Dam #4 (Batawa)	95.7 metres
Below Dam #5 (Trent)	101.7 metres
Below Dam #6 (Frankford)	107.9 metres
Below Dam #7 (Glen Ross)	113.5 metres
Below Dam #8 (Meyers)	117.9 metres
Below Dam #9 (Hagues Reach)	128.1 metres
Below Dam # 10 (Ranney Falls)	143.4 metres
Below Dam #11 (Campbellford)	148.3 metres
Below Dam #12 (Crowe Bay)	154.3 metres
Below Dam #13 (Healy Falls)	175.5 metres
Below Dam #14 (Hastings)	186.7 metres

O. Reg. 163/06, s. 11 (2).

12. REVOKED: O. Reg. 67/13, s. 8.

13. OMITTED (REVOKES OTHER REGULATIONS). O. Reg. 163/06, s. 13.

SCHEDULE 1

1. The Timmins Flood Event Standard means a storm that produces over a 12-hour period,

(a) in a drainage area of 25 square kilometres or less, rainfall that has the distribution set out in Table 2; or

(b) in a drainage area of more than 25 square kilometres, rainfall such that the number of millimetres of rain referred to in each case in Table 2 shall be modified by the percentage amount shown in Column 2 of Table 3 opposite the size of the drainage area set out opposite thereto in Column 1 of Table 3.

TABLE 2

15 millimetres of rain in the first hour
20 millimetres of rain in the second hour
10 millimetres of rain in the third hour
3 millimetres of rain in the fourth hour
5 millimetres of rain in the fifth hour
20 millimetres of rain in the sixth hour
43 millimetres of rain in the seventh hour
20 millimetres of rain in the eighth hour
23 millimetres of rain in the ninth hour
13 millimetres of rain in the tenth hour
13 millimetres of rain in the eleventh hour
8 millimetres of rain in the twelfth hour

TABLE 3

Column 1	Column 2
Drainage Area (Square Kilometres)	Percentage
26 to 50 both inclusive	97
51 to 75 both inclusive	94
76 to 100 both inclusive	90
101 to 150 both inclusive	87
151 to 200 both inclusive	84
201 to 250 both inclusive	82
251 to 375 both inclusive	79
376 to 500 both inclusive	76
501 to 750 both inclusive	74
751 to 1000 both inclusive	70
1001 to 1250 both inclusive	68
1251 to 1500 both inclusive	66
1501 to 1800 both inclusive	65
1801 to 2100 both inclusive	64
2101 to 2300 both inclusive	63
2301 to 2600 both inclusive	62
2601 to 3900 both inclusive	58
3901 to 5200 both inclusive	56
5201 to 6500 both inclusive	53
6501 to 8000 both inclusive	50

2. The 100 year flood level means the peak instantaneous still water level plus an allowance for wave uprush and other water-related hazards that has a probability of occurrence of one per cent during any given year.

O. Reg. 163/06, Sched. 1.

Back to top

Lower Trent Region

Conservation Authority

Ontario Regulation 163/06

Policy Document

Approved by

Lower Trent Region Conservation Authority

Board of Directors

February 10, 2022

2 GENERAL POLICIES

Background:

Lower Trent Region Conservation Authority (LTC) will be guided by the following general administrative guidance with respect to the implementation of its regulatory responsibilities:

- Development, interference and/or alteration activities shall not be undertaken in a regulated area without written permission from LTC.
- Where a regulated area pertains to more than one water-related hazard (e.g., lands susceptible to flooding that are part of a wetland), policies will be applied jointly, and where applicable, the more restrictive policies will apply.
- Technical studies and/or assessments, site plans and/or other plans submitted as part of an application for permission to undertake development, interference and/or alteration in a regulated area must be completed by a qualified professional to the satisfaction of LTC in conformity with the most current provincial technical guidelines or guidelines accepted by LTC through a Board Resolution.

Note: Information regarding technical standards and guidelines is contained within the Appendices.

Similar to the MNR recommended 6-metre erosion access allowance (Section 3.4, Technical Guide for River and Stream Systems: Erosion Hazard Limit, MNR), LTC recommends that a 6-metre access allowance is applied to all hazard lands. Note that emergency access is required along the hazard as well as between the buildings and the lot line to allow for heavy equipment access to the hazard area.

The guidelines for development within the 15 metre adjacent lands to a hazard include an access setback. Three main principles support the inclusion of an access setback:

- providing for emergency access to hazard areas;
- providing for construction access for regular maintenance and access to the site in the event of a natural hazard or failure of a structure; and
- providing protection against unforeseen or predicted external conditions which could have an adverse effect on the natural conditions or processes acting on or within a hazard prone area.

Activities in regulated areas that are carried out by other provincial ministries or the federal government do not require a permit. Activities conducted on provincial crown land by third-party proponents in a regulated area may require a permit, unless acting as an agent of the Crown.

Works for which permission is required under the Regulation may also be subject to other legislation, policies and standards that are administered by other agencies and municipalities, such as the Planning Act, Public Lands Act, Nutrient Management Act, Drainage Act, Environmental Assessment Act (EA Act) or the federal Fisheries Act, etc. It is the responsibility of the applicant (or applicant's agent) to ensure that all necessary approvals are obtained prior to undertaking any works for which a permit under this Regulation has been obtained.

LTC Policies – General Policies:

Within areas defined by the regulation (i.e., regulated areas), including Lake Ontario shoreline hazard lands and an allowance, river or stream valleys and an allowance, wetlands or other areas where

development could interfere with the hydrologic function of a wetland (areas of interference), watercourses, or hazardous lands, the following general policies will apply:

1) Development, interference and/or alteration will not be permitted within a regulated area, except in accordance with the policies contained in this document.
2) Notwithstanding Policy 2. (1), the LTC Board of Directors, sitting as the Hearing Board, may grant permission for development, interference and/or alteration where the applicant provides evidence acceptable to the Board that documents that the development and/or activity will have no adverse effect on the control of flooding, erosion, dynamic beaches, pollution or the conservation of land with respect to Lake Ontario shoreline, river or stream valleys, hazardous land, wetlands, and areas of interference or will not result in an unacceptable interference with a watercourse or wetland.
3) In addition to specific conditions outlined through this document, development, interference and/or alteration within a regulated area may be permitted only where:
    a) risk to public safety is not increased;
    b) there is no increase in habitation in the hazard area with the exception of allowable flood fringes or wave uprush hazard areas;
    c) susceptibility to natural hazards is not increased nor new hazards created (e.g., there will be no impacts on adjacent properties with respect to natural hazards);
    d) safe ingress/egress is available for proposed development that increases habitation outside of hazard lands;
    e) pollution, sedimentation and erosion during construction and post construction is minimized using best management practices including site, landscape, infrastructure and/or facility design, construction controls, and appropriate remedial measures;
    f) access for emergency works and maintenance of flood or erosion control works is available;
    g) proposed development is constructed, repaired and/or maintained in accordance with accepted engineering principles and approved engineering standards or to the satisfaction of LTC, whichever is applicable based on the structural scale and scope, and purpose of the project;
    h) there are no adverse hydraulic or fluvial effects on rivers, creeks, streams, or watercourses;
    i) there are no adverse sedimentation or littoral effects on the Lake Ontario shoreline;
    j) there are no adverse effects on the hydrologic function of wetlands; and,
    k) the control of flooding, erosion, dynamic beaches, pollution and/or the conservation of land is not adversely affected during and post development.

Prohibited Uses:

4) Notwithstanding the General Policies referenced above, in accordance with Section 3.1 of the Provincial Policy Statement, development will not be permitted within hazardous lands as defined in the Conservation Authorities Act, where the use is:
    - an institutional use associated with hospitals, nursing homes, pre-school, school nurseries, day care and schools, where there is a threat to the safe evacuation of the sick, the elderly, persons with disabilities or the young during an emergency as a result of flooding, failure of floodproofing and/or protection works, and/or erosion;
    - an essential emergency service such as that provided by fire, police and ambulance stations and electrical substations, which would be impaired during an emergency as result of flooding, failure of flood-proofing measures and/or protection works, and/or erosion; or,
    - uses associated with the disposal, manufacture, treatment or storage of hazardous substances.

7 WATERCOURSES

7.1 Ontario Regulation 163/06

The LTC Regulation contains the following sections dealing with watercourses.

The LTC Regulation contains the following sections dealing with watercourses:

Alterations prohibited

5. Subject to section 6, no person shall straighten, change, divert or interfere in any way with the existing channel of a river, creek, stream or watercourse…

Permission to alter

6.(1) The Authority may grant a person permission to straighten, change, divert or interfere with the existing channel of a river, creek, stream or watercourse

6. (2) The permission of the Authority shall be given in writing, with or without conditions.

7.2 Policy Standards

The following sections outline the policy standards for implementing the LTC Regulation with respect to watercourses. The term "interference" below includes all alterations mentioned within the Regulation (straighten, change, divert or interfere in any way). LTC, in their role through the planning process, should review planning applications to ensure watercourse alterations associated with development are appropriate.

LTC may require technical studies be undertaken to demonstrate the suitability of development proposals. Technical studies should be carried out by a qualified professional, with recognized expertise in the appropriate discipline, and should be prepared using established procedures and recognized methodologies to the satisfaction of LTC.

7.2.1 Interference with a Watercourse

Background

The following policies apply to watercourses as defined in the Conservation Authorities Act: "An identifiable depression in the ground in which a flow of water regularly or continuously occurs."

LTC Policies

1) Interference with a watercourse shall not be permitted.

2) Proposals for channelization and/or re-alignment will not be considered where the purpose of the proposal is to increase the development potential on the lands.

3) Notwithstanding Section 7.2.1 1), public infrastructure (e.g. roads, sewers, flood and erosion control works) and various utilities (e.g. pipelines) may be permitted within a watercourse subject to the activity being approved through a satisfactory Environmental Assessment process or through other studies deemed necessary by the Conservation Authority and/ or if

the interference on the natural features and hydrologic and ecological functions of the watercourse has been deemed to be acceptable by the Conservation Authority.

4) Notwithstanding Section 7.2.1 1), stream, bank, and channel stabilization to protect existing development or conservation or restoration projects may be permitted within a watercourse if the interference on the natural features and hydrologic and ecological functions of the watercourse has been deemed to be acceptable by the Conservation Authority.

5) Notwithstanding Section 7.2.1 1), any works that are to be located below the bed of the river within a watercourse shall be located below the long-term scour depth to the satisfaction of the Conservation Authority.

6) Notwithstanding Section 7.2.1 1), minor interference and/or alteration may be permitted within a watercourse if it has been demonstrated to the satisfaction of the Conservation Authority that the interference is acceptable on the natural features and hydrologic and ecological functions of the watercourse.

7) Notwithstanding Section 7.2.1 1), major interference (e.g. realignment, dam, enclosure) with a watercourse may be permitted where supported by the recommendations of a sub-watershed study, Environmental Assessment; or other technical approved study. A Complete Application Checklist for Creek Realignments can be found in **Appendix M.** The checklist will be filled out as part of the pre-consultation process for this type of application.

8) Notwithstanding Section 7.2.1 1), watercourse crossings may be permitted if it has been demonstrated to the satisfaction of the Conservation Authority that the interference on the natural features and hydrologic and ecological functions of the watercourse has been deemed to be acceptable by the Conservation Authority. At a minimum, the submitted plans must demonstrate the following based on morphological characteristics of the watercourse system[4];

    a) culverts have an open bottom where it is feasible, or where it is not feasible, the culverts should be appropriately embedded into the watercourse;

    b) crossing location, width, and alignment should be compatible with stream morphology, which typically requires location of the crossing on a straight and shallow/riffle reach of the watercourse with the crossing situated at right angles to the watercourse;

    c) the crossing is sized and located such that there is no increase in upstream or downstream erosion or flooding;

    d) the design should consider fish and wildlife passage;

    e) have regard for upstream and downstream effects when installing/replacing a culvert.

    f) the design should incorporate site stabilization and erosion control measures;

[4] Refer to Adaptive Management of Stream Corridors in Ontario (Stream Corridors Project Management Team, 2001) for more information.

g) the submitted plans should incorporate detailed information related to installation and sequencing; and,

h) is consistent with Ontario Ministry of Transportation (MTO) Highway Drainage Design Standard WC-1 (January 2008) and follows the MTO Drainage Management Manual Guidelines.

LOWER TRENT CONSERVATION
714 Murray Street, R.R. 1, Trenton, Ontario K8V 0N1
Tel: 613-394-4829 Fax: 613-394-5226 Website: www.ltc.on.ca Email: information@ltc.on.ca
Registered Charitable Organization No. 107646598RR0001

May 26, 2023 LTC File: **RP-23-055**

Property Owner: 2852243 Ontario Inc.
Jim Pillsworth
Email to: jpillsworth@fidelityeng.com

Agent: Amanda Redden
Jewell Engineering Inc.
Email to: reddena@jewelleng.ca

Re: 37 B Durham Street North, Eastfields Subdivision Lands, Township of Cramahe (Village of Colborne), Northumberland County, Geographic Township of Cramahe, Concession 2, Part of Lot 29

Application for Permission under Ontario Regulation 163/06 – *Lower Trent Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*

LTC Staff Cannot Grant Approval

Dear Applicants,

Lower Trent Region Conservation Authority (LTRCA) received the above noted application to undertake a watercourse re-alignment along a tributary stream of Colborne Creek on the subject lands within an area that is regulated by LTRCA under Ontario Regulation 163/06. Staff have reviewed the applications and the property information available on record including, but not limited to provincial mapping, aerial and satellite imagery and supplementary documents provided as part of the permit submission.

In 2022, LTRCA updated the Regulation Policy Document with respect to Ontario Regulation 163/06. The entire Ontario Regulation 163/06 Policy Document, with all appendices, can be viewed on the LTRCA website at this link: http://www.ltc.on.ca/planning/pag/. Please note that *7.2.1 Interference with a Watercourse* is the applicable section of the Policy Document for the proposed development on this property.

According to our review of the development proposal with consideration for the policies contained within the applicable sections noted above, we can confirm that the proposed development is in direct conflict with the following policies:

7.2.1 Interference with a Watercourse

1) Interference with a watercourse shall not be permitted.

2) Proposals for channelization and/or re-alignment will not be considered where the purpose of the proposal is to increase the development potential of the lands.

The policies contained in the document represent thresholds and guidelines that have been approved by the LTRCA Board of Directors to enable designated staff to approve permit applications. It is our opinion that the proposed development does not comply with the above noted policies and therefore, staff approval cannot be granted.

Based on the above noted information, there are three options available for you to proceed with your application:

- You may review the information above and withdraw your application for permission under Ontario Regulation 163/06;
- You may modify your development proposal to comply with the LTC Board-approved policies; or,
- You may request a Hearing before the Board as you have a right to a hearing where staff are recommending refusal of the application.

If you intend to proceed with the third bulleted option above the next available date for a Hearing is **July 13, 2023** as our Board Meetings are held on the second Thursday of the month. Please confirm **in writing** by **June 7, 2023** which of the above-noted options you would prefer so that the necessary arrangements can be made. Please note that the LTC Hearing Guidelines have been attached with this letter for your information.

We look forward to hearing back from you on your chosen option. If you require further assistance, please do not hesitate to contact me at 613-394-3915 ext. 224.

Sincerely,

Gage Comeau

Gage Comeau, M. Sc. Provincial Offences Officer
Manager, Watershed Management, Planning and Regulations
Lower Trent Conservation

Encl: Appendix G – Hearing Guidelines

LOWER TRENT
CONSERVATION

714 Murray Street, R.R. 1, Trenton, Ontario K8V 0N1
Tel: 613-394-4829 Fax: 613-394-5226 Website: www.ltc.on.ca Email: information@ltc.on.ca
Registered Charitable Organization No. 107646598RR0001

June 6, 2023

LTC File #: RP-23-055

Owner: 2852243 Ontario Inc.
Jim Pillsworth
Email to: jpillsworth@fidelityeng.com

Agent: Amanda Redden, P. Eng.
Jewell Engineering Inc.
Email to: reddena@jewelleng.ca

NOTICE OF HEARING

IN THE MATTER OF

The Conservation Authorities Act,

R.S.O. 1990, Chapter 27

AND IN THE MATTER OF an application by **JEWELL ENGINEERING INC. for 2852243 ONTARIO INC.**

FOR THE PERMISSION OF THE CONSERVATION AUTHORITY

Pursuant to Regulations made under

Section 28, Subsection 12 of the said Act

TAKE NOTICE THAT a Hearing before the Hearing Board of the Lower Trent Region Conservation Authority will be held under Section 28, Subsection 12 of the *Conservation Authorities Act* at the offices of the said Authority located at 714 Murray Street, RR #1 Trenton, Ontario K8V 0N1 at the hour of **1:00 p.m., on the 13th day of July, 2023** with respect to the application by **JEWELL ENGINEERING INC. for 2852243 ONTARIO INC.** to permit development within an area regulated by the Authority in order to ensure there are no adverse effects on the control of flooding or erosion as a result of the proposed alteration to the watercourse feature. Specifically, this Hearing is to request permission to undertake a watercourse re-alignment along a tributary stream of Colborne Creek in the Village of Colborne, Township of Cramahe, Concession 2, Part of Lot 29, on the property known as 37 B Durham Street North in Northumberland County.

TAKE NOTICE THAT you are invited to make a delegation and submit supporting written material to the Hearing Board for the meeting of July 13, 2023. If you intend to appear, please contact Gage Comeau, Manager, Watershed Management, Planning & Regulations. **Written material will be required by July 4, 2023, to enable the Hearing Board members to review the material prior to the meeting.**

TAKE NOTICE THAT this hearing is governed by the provisions of the *Statutory Powers Procedure Act*. Under the Act, a witness is automatically afforded a protection that is similar to the protection of the *Ontario Evidence Act*. This means that the evidence that a witness gives may not be used in subsequent civil proceedings or in prosecutions against the witness under a Provincial Statute. It does not relieve the witness of the obligation of this oath since matters of perjury are not affected by the automatic affording of the protection. The significance is that the legislation is Provincial and cannot affect Federal matters. If a witness requires the protection of the *Canada Evidence Act* that protection must be obtained in the usual manner. The Ontario Statute requires the tribunal to draw this matter to the attention of the witness, as this tribunal has no knowledge of the effect of any evidence that a witness may give.

AND FURTHER TAKE NOTICE that if you do not attend at this Hearing, the Hearing Board of the Conservation Authority may proceed in your absence, and you will not be entitled to any further notice in the proceedings.

DATED the 6th day of June, 2023.

The Board of Directors of the Lower Trent Region Conservation Authority

Per: Rhonda Bateman

CAO/ Secretary Treasurer: Rhonda T. Bat

LOWER TRENT
CONSERVATION

APPENDIX G

HEARING GUIDELINES

February 10, 2022

TABLE OF CONTENTS

Appendices:

Appendix G-1: Notice of Hearing – Section 28 (12)

Appendix G-2: Hearing Procedures

Appendix G-3: Chair's Remarks When Dealing with Hearing with respect to Ontario Regulation 163/06.

Appendix G-4: Notice of Decision – Hearing Pursuant to Section 28(12)

Appendix G-5: Notice of Decision – Hearing Pursuant to Section 28(12) (with permit)

Appendix G-6: Notice of Hearing - Section 28.0.1 (7)

Appendix G-7: Chair's Remarks When Dealing with Section 28.0.1 (7)

Revision Notes:

May 12, 2016 – Original Hearing Guidelines – Approved by Board (Resolution G67/16)

Revision 1: April 13, 2017 – Clarifications and Consistency Updates (Resolution G44/17)

Revision 2: November 16, 2018 – Admin Updates

Revision 3: March 26, 2021 – Include Electronic Hearings (Resolution G51/21)

Revision 4: February 10, 2022 – MZO Hearings and OLT Reference (Resolution G20/22)

G-1. PURPOSE OF HEARING GUIDELINES:

The Conservation Authorities Act requires that the applicant be provided with an opportunity for a hearing by the local Conservation Authority Board, or Executive Committee (sitting as a Hearing Board) as the case may be, for an application to be refused or approved with contentious conditions. Further, a permit may be refused if, in the opinion of the Authority, the proposal adversely affects the control of flooding, erosion, dynamic beaches, pollution or the conservation of land. The Hearing Board is empowered by law to make a decision, governed by the *Statutory Powers Procedures Act (SPPA*).

The Hearing Rules are adopted under the authority of Section 25.1 of the *Statutory Powers Procedures Act (SPPA)*. The SPPA applies to the exercise of a statutory power of decision where there is a requirement to hold or to afford the parties to the proceeding an opportunity for a hearing before making a decision. The SPPA sets out minimum procedural requirements governing such hearings and provides rule-making authority for to establish rules to govern such proceedings.

The Hearing Board shall hear and decide whether the application will be approved with or without conditions or refused. In the case of hearings related to applications submitted purposed to Section 28.0.1, the Hearing Board shall determine what conditions, if any, will be attached to the permission. See Section G-6 for further details.

These guidelines have been prepared as an update to previous hearing guidelines and are intended to provide a step-by-step process to conducting hearings required under Section 28 (12), (13), (14) of the Conservation Authorities Act. It is expected that hearings meet the legal requirements of the *Statutory Powers Procedures Act* without being unduly legalistic or intimidating to the participants. Additional considerations have been included related to hearings under Section 28.0.1 (7) in Section G-6 of this document.

G-1.1 Hearing Guideline Updates

Note that these Guidelines have been revised based on changes in legislation to incorporate various considerations as noted below:

- Revised in May 2018 - Housekeeping amendments made reflecting changes to appeal process as a result of the *Building Better Communities and Conserving Watersheds Act, 2017* and subsequent *Order in Council*. Note: changes to appeal process are no longer valid.
- Revised in March 2021 - Amendments made to incorporate the use of electronic hearings.
- Revised in February 2022 - Amendments made to incorporate hearings under 28.0.1 and update references to the Ontario Land Tribunal (OLT).

G-1.2 Additional Hearing Considerations – 2021

With the passage of *Bill 229, Protect, Support and Recover from COVID-19 Act (Budget Measures), 2020*, a new section of the Conservation Authorities Act came into force. Section 28.0.1 (Permission for development, zoning order) applies to applications for permission submitted to an Authority where a zoning order has been made by the Minister of Municipal Affairs and Housing authorizing the proposed development project. While the Act outlines that the Authority must issue these permissions, an Authority has the ability to attach conditions to the permission. In the case of these applications for

permission, applicants must be given the opportunity for a hearing before the Authority, prior to conditions being attached.

As such, hearings under section 28.0.1 of the Act differ from those under section 28, in that the intent of the hearing is not to determine whether or not to issue a permission, but rather, to finalize the conditions of a permission. The purpose of the interim update to the Hearing Guidelines is to incorporate direction for hearings under section 28.0.1 of the Conservation Authorities Act in Section G-6 of this document.

Further, with the passage of Bill 245, Accelerating Access to Justice Act, 2021, on June 1st, 2021 the Local Planning Appeal Tribunal, Environmental Review Tribunal, Board of Negotiation, Conservation Review Board and Mining and Lands Tribunal were merged into a new single tribunal called the Ontario Land Tribunal (OLT). Amendments have been throughout the Hearing Guidelines to update references to the Mining and Lands Tribunal to now reference the Ontario Land Tribunal.

G-2. PRE-HEARING PROCEDURES

G-2.1 Role of the Hearing Board

In considering the application, the Hearing Board is acting as a decision-making tribunal. The tribunal is to act fairly. Under general principles of administrative law relating to the duty of fairness, the tribunal is obliged not only to avoid any bias but also to avoid the appearance or reasonable apprehension of bias. The following are three examples of steps to be taken to avoid apprehension of bias where it is likely to arise.

a) No member of the Authority taking part in the hearing should have prior involvement with the application that could lead to a reasonable apprehension of bias on the part of that member. Where a member has a personal interest, the test is whether a reasonable well-informed person would consider that the interest might have an influence on the exercise of the official's public duty. Where a member is a municipal councillor, the *Municipal Conflict of Interest Act* applies. In the case of preciously expressed opinion, the test is that of an open mind, i.e. is the member capable of persuasion in participating in the decision making.
b) If material relating to the merits of an application that is the subject of a Hearing is distributed to Board members before the Hearing, the material should be distributed to the applicant. The applicant may be afforded an opportunity to distribute similar pre-hearing material. These materials can be distributed to the applicable parties electronically.
c) The applicant will be given an opportunity to attend the Hearing before a decision is made; however, the applicant does not have to be present for a decision to be made.

G-2.2 Application

An applicant has the right to a hearing when:

- staff are recommending refusal of an application because it doesn't comply with the approved policies;
- Staff are unable to approve the permit application because the application does not comply with approved policies; or

- the applicant objects to the conditions of approval.

The applicant is entitled to reasonable notice of the hearing pursuant to the *Statutory Powers Procedures Act.*

G-2.3 Notice of Hearing

The Notice of Hearing shall be sent to the applicant within sufficient time to allow the applicant to prepare for the hearing. To ensure that reasonable notice is given, it is recommended that prior to sending the Notice of Hearing, the applicant be consulted to determine an agreeable date and time based on the local Conservation Authority's regular meeting schedule.

The Notice of Hearing must contain the following:

a) Reference to the applicable legislation under which the hearing is to be held (i.e., the Conservation Authorities Act)
b) The date, time, place and the purpose of the hearing, or for electronic hearings: the time, purpose of the hearing, and details about the manner in which the hearing will be held. Note: for electronic hearings the Notice must also contain a statement that the applicant should notify the Authority if they believe holding the hearing electronically is likely to cause them significant prejudice. The Authority shall assume the applicant has no objection to the electronic hearing if no such notification is received.
c) Particulars to identify the applicant, property and the nature of the application which are the subject of the hearing. Note: If the applicant is not the landowner but the prospective owner, the applicant must have written authorization from the registered landowner.
d) The reasons for the proposed refusal or conditions of approval shall be specifically stated. This should contain sufficient detail to enable the applicant to understand the issues so they can be adequately prepared for the hearing. It is sufficient to reference in the Notice of Hearing that the recommendation for refusal or conditions of approval is based on the reasons outlined in previous correspondence or a hearing report that will follow.
e) A statement notifying the applicant that the hearing may proceed in the applicant's absence and that the applicant will not be entitled to any further notice of the proceedings. Except in extreme circumstances, it is recommended that the hearing not proceed in the absence of the applicant.
f) Reminder that the applicant is entitled to be represented at the hearing by a representative such as legal counsel, if desired. The Conservation Authority may be represented at the Hearing by counsel and/or staff.
g) A copy of the Authority's Hearing Guidelines.

It is recommended that the Notice of Hearing be directed to the applicant and/or landowner by registered mail or other method where confirmation of delivery can be verified.

Refer to **Appendix G-1** for an example **Notice of Hearing**.

G-2.4 Pre-submission of Reports

It is the practice of the Lower Trent Region Conservation Authority to submit reports to the Board members in advance of the hearing (i.e., inclusion on an Authority Agenda) and the applicant will be

provided with the same opportunity. The applicant will be given reasonable time to prepare a report once the reasons for the staff recommendations have been received. Subsequently, this may affect the timing and scheduling of the staff hearing reports. The applicant will be required to provide sufficient copies of this report for inclusion in the Agenda.

G-2.5 Hearing Information

Prior to the hearing, the applicant should be advised of the local Conservation Authority's hearing procedures. (a copy of this document should be provided with the staff report).

G-3. HEARING

G-3.1 Public Hearing

Pursuant to the *Statutory Powers Procedure Act*, hearings, including electronic hearings, are required to be held in public. For electronic hearings, public attendance should be synchronous with the hearing. The exception is in very rare cases where public interest in public hearings is outweighed by the fact that intimate financial, personal or other matters would be disclosed at hearings.

G-3.2 Hearing Participants

The Conservation Authorities Act does not provide for third party status at the Hearing. The Hearing however is open to the public. Any information provided by third parties should be incorporated within the presentation of information by, or on behalf of, the applicant or Authority staff as appropriate.

G-3.3 Attendance of Hearing Board Members

In accordance with case law relating to the conduct of hearings, those members of the Authority who will decide whether to grant or refuse the application must be present during the full course of the hearing. If it is necessary for a member to leave, the remaining members can continue with the Hearing and render a decision.

G-3.4 Adjournments

The Board may adjourn a hearing on its own motion or that of the applicant or Authority staff where it is satisfied that an adjournment is necessary for an adequate hearing to be held. Any adjournments form part of the hearing record.

G-3.5 Orders and Directions

The Authority is entitled to make orders or directions to maintain order and prevent the abuse of its hearing processes. A hearing procedures example has been included as **Appendix G-2.**

G-3.6 Information Presented at Hearings

a) The *Statutory Powers Procedure Act* requires that a witness be informed of their right to object pursuant to the *Canada Evidence Act*. The *Canada Evidence Act* indicates that a witness shall not

be excused from answering questions on the basis that the answer may be incriminating. Further, answers provided during the hearing are not admissible against the witness in any criminal trial or proceeding. This information should be provided to the applicant as part of the Notice of Hearing.

b) It is the decision of the hearing members as to whether information is presented under oath or affirmation. It is not a legal requirement. The applicant must be informed of the above, prior to or at the start of the hearing.
c) The Board may authorize receiving a copy rather than the original document. However, the Board can request certified copies of the document if required.
d) Privileged information, such as solicitor/client correspondence, cannot be heard.
e) Information that is not directly within the knowledge of the speaker (hearsay), if relevant to the issues of the hearing, can be heard.
f) The Board may take into account matters of common knowledge such as geographic or historic facts, times measures, weights, etc. or generally recognized scientific or technical facts, information or opinions within its specialized knowledge without hearing specific information to establish their truth.

G-3.7 Conduct of Hearing

G-3.7.1 Record of Attending Hearing Board Members

A record should be made of the members of the Hearing Board.

G-3.7.2 Opening Remarks

The Hearing Board Chair should convene the hearing with opening remarks which; identify the applicant, the nature of the application, and the property location; outline the hearing procedures; and advise on requirements of the *Canada Evidence Act*. Please reference **Appendix G-3** for the Opening Remarks Template. In an electronic hearing, all the parties and members of the Hearing Board must be able to clearly hear one another and any witnesses throughout the hearing.

G-3.7.3 Presentation of Authority Staff Information

Staff of the Authority presents the reasons supporting the recommendation for the refusal or conditions of approval of the application. Any reports, documents or plans that form part of the presentation should be properly indexed and received.

Staff of the Authority should not submit new technical information at the Hearing as the applicant will not have had time to review and provide a professional opinion to the Hearing Board.

Consideration should be given to the designation of one staff member or legal counsel who coordinates the presentation of information on behalf of Authority staff and who asks questions on behalf of Authority staff.

G-3.7.4 Presentation of Applicant Information

The applicant has the opportunity to present information at the conclusion of the Authority staff presentation. Any reports, documents or plans which form part of the submission should be properly indexed and received.

The applicant shall present information as it applies to the permit application in question. For instance, does the requested activity affect the control of flooding, erosion, dynamic beaches, pollution or conservation of land? The hearing does not address the merits of the activity or appropriateness of such a use in terms of planning.

- The applicant may be represented by legal counsel or agent, if desired.
- The applicant may present information to the Board and/or have invited advisors to present information to the Board.
- The applicant's presentation may include technical witnesses, such as an engineer, ecologist, hydro-geologist etc.

The applicant should not submit new technical information at the hearing as the Staff of the Authority will not have had time to review and provide a professional opinion to the Hearing Board.

G-3.7.5 Questions

Members of the Hearing Board may direct questions to each speaker as the information is being heard. The applicant and/or agent can make any comments or questions on the staff report. Staff will be given an opportunity to respond to questions posed by either the Board or the applicant. Staff may also rebut comments or pose questions to the applicant at this time.

Pursuant to the *Statutory Powers Procedure Act*, the Board can limit questioning where it is satisfied that there has been full and fair disclosure of the facts presented. Please note that the courts have been particularly sensitive to the issue of limiting questions and there is a tendency to allow limiting of questions only where it has clearly gone beyond reasonable or proper bounds.

G-3.7.6 Deliberation

After all the information is presented, the Board may adjourn the hearing and retire in private to confer. The Board may reconvene on the same date or at some later date to advise the applicant of the Board's decision. The Board members should not discuss the hearing with others prior to the decision of the Board being finalized.

G-4. DECISION

The applicant must receive written notice of the decision. The applicant should be informed of the right to appeal the decision within 30 days upon receipt of the written decision to the Ontario Land Tribunal.

It is important that the hearing participants have a clear understanding of why the application was refused or approved. The Board should itemize and record information of particular significance which

led to their decision.

G-4.1 Notice of Decision

The decision notice should include the following information:

a) The identification of the applicant, property and the nature of the application that was the subject of the hearing.
b) The decision to refuse or approve the application. A copy of the Hearing Board resolution should be attached.

It is recommended that the written Notice of Decision be forwarded to the applicant by registered mail or other method where confirmation of delivery can be verified.

A sample Notice of Decision and cover letter has been included as **Appendix G-4**. Note that if the decision of the Board is to approve the application, the written notice of decision can be included as part of the Permit Cover Letter. An example of Permission Granted through Hearing has been included as **Appendix G-5**.

G-4.2 Adoption

A resolution advising of the Board's decision and particulars of the decision should be adopted.

G-5. RECORD

The Authority shall compile a record of the hearing. In the event of an appeal, a copy of the record should be forwarded to the Ontario Land Tribunal. The record must include the following:

a) The application for the permit.
b) The Notice of Hearing.
c) Any orders made by the Board (e.g. for adjournments).
d) All information received by the Board.
e) Attendance of Hearing Board members.
f) The transcript/minutes, if one exists, of the oral presentations made at the hearing.
g) The decision and reasons for decision of the Board.
h) The Notice of Decision sent to the applicant.

G-6. HEARINGS UNDER SECTION 28.0.1 CAA

Section 28.0.1 of the Conservation Authorities Act came into force with the Royal Assent of *Bill 229, Protect, Support and Recover from COVID-19 Act (Budget Measures), 2020*. This section applies to any application submitted to an authority under a regulation made under Section 28 of the Act for permission to carry out all or part of a development project associated with an approved Minister's Zoning Order (MZO). For such applications, an Authority must grant permission to the applicant to carry out the activity, provided an MZO has been made by the Minister of Municipal Affairs and Housing, and provided that the authority's regulated area in which the development activity is proposed to take place

is not located in the Greenbelt Area designated under section 2 of the Greenbelt Act. A permission which is granted under s.28.0.1 may be subject to conditions as prescribed by the issuing Authority.

Understanding that an Authority must grant permission for applications submitted pursuant to an approved MZO (pending the above-noted conditions are met), hearings for these applications differ from those under Section 28(12) of the Act, in that a hearing cannot be held to determine if a permission should be refused. The Authority may refuse to grant a permit only if i) a zoning order has not been made to authorize the development project, ii) the project is proposed to be carried out in the Greenbelt Area, and iii) if all other prescribed requirements have not been satisfied. Per s.28.0.1 (7) of the Act, the applicant for a permission will be given the opportunity to be heard by the Authority prior to any conditions being attached to the granted permission.

The following table is intended to provide a step-by-step process to conducting hearings required under Section 28.0.1 (7) of the Conservation Authorities Act. It is recognized that much of the guidance provided in the body of the Section 28 Hearing Guidelines will be applicable to the s. 28.0.1 (7) hearing process. Where processes differ, the table outlines the necessary considerations for the s. 28.0.1 (7) processes. Where the processes are the same, the table refers to the appropriate sections of the Section 28(3) hearing guidelines.

Sections of the *Section 28 Conservation Authorities Act Hearing Guidelines*	**Specific Guidance and/or Processes for S. 28.0.1 (7) Hearings**
1.0 Purpose of Hearing Guidelines	The *Conservation Authorities Act* requires that the applicant be provided with an opportunity for a hearing by the local Conservation Authority Board, or Executive Committee (sitting as a Hearing Board) as the case may be, for an application to be refused or approved with contentious conditions. In the case of hearings related to applications submitted pursuant to s. 28.0.1 of the *Conservation Authorities Act*, the Authority must grant permission to the applicant, provided the requirements set out under this section are met. In this scenario, a hearing will only be held to determine conditions which will be attached to a permission. Further, a permit may be refused if in the opinion of the Authority the proposal adversely affects the control of flooding, pollution or conservation of land, and additional erosion and dynamic beaches. In the case of applications submitted pursuant to s. 28.0.1 of the *Conservation Authorities Act*, the Authority may refuse to grant a permit only if i) a zoning order has not been made to authorize the development project, ii) the project is proposed to be carried out in the Greenbelt Area, and iii) if all other prescribed requirements have not been satisfied. The Hearing Board is empowered by law to make a decision, governed by the *Statutory Powers Procedures Act*.

	The Hearing Rules are adopted under the authority of Section 25.1 of the *Statutory Powers Procedures Act* (SPPA). The SPPA applies to the exercise of a statutory power of decision where there is a requirement to hold or to afford the parties to the proceeding an opportunity for a hearing before making a decision. The SPPA sets out minimum procedural requirements governing such hearings and provides rule-making authority for to establish rules to govern such proceedings. The Hearing Board shall hear and decide whether the application will be approved with or without conditions or refused. In the case of hearings related to applications submitted purposed to Section 28.0.1, the Hearing Board shall determine what conditions, if any, will be attached to the permission. See Section G-6 for further details. These guidelines have been prepared as an update to the October 1992 hearing guidelines and are intended to provide a step-by-step process to conducting hearings required under Section 28 (12), (13), (14) of the *Conservation Authorities Act*. It is hoped that the guidelines will ensure that hearings meet the legal requirements of the *Statutory Powers Procedures Act* without being unduly legalistic or intimidating to the participants. Additional considerations have been included related to hearings under Section 28.0.1 (7) in Section G-6
2.0 Prehearing Procedures	Not applicable to S.28.0.1(7) hearings
2.1 Role of the Hearing Board	In considering the application, the Hearing Board is acting as a decision-making tribunal. The tribunal is to act fairly. Under general principles of administrative law relating to the duty of fairness, the tribunal is obliged not only to avoid any bias but also to avoid the appearance or reasonable apprehension of bias. The following are three examples of steps to be taken to avoid apprehension of bias where it is likely to arise. (a) No member of the Authority taking part in the hearing should have prior involvement with the application that could lead to a reasonable apprehension of bias on the part of that member. Where a member has a personal interest, the test is whether a reasonably well-informed person would consider that the interest might have an influence on the exercise of the official's public duty. Where a member is a municipal councillor, the *Municipal Conflict of Interest Act* applies. In the case of a previously expressed opinion, the test is that of an

	open mind, i.e. is the member capable of persuasion in participating in the decision making (b) If material relating to the merits of an application that is the subject of a hearing is distributed to Board members before the hearing, the material shall be distributed to the applicant at the same time. The applicant may be afforded an opportunity to distribute similar pre-hearing material. These materials can be distributed electronically. (c) The applicant will be given an opportunity to attend the hearing before a decision is made; however, the applicant does not have to be present for a decision to be made. (d) Where a hearing is required for applications submitted pursuant to s. 28.0.1 of the *Conservation Authorities Act* (e.g., to determine the conditions of the permission), final decisions on the conditions shall not be made until such a time as the applicant has been given the opportunity to attend a hearing.
2.2 Application	The right to a hearing arises where staff is recommending refusal of an application or is recommending conditions to the approval of an application. Additionally, in the case of applications submitted pursuant to s. 28.0.1 of the CA Act, the authority shall not attach conditions to a permission unless the applicant has been given an opportunity to be heard by the authority. The applicant is entitled to reasonable notice of the hearing pursuant to the *Statutory Powers Procedures Act*.
2.3 Notice of Hearing	*Refer to Section 2.3*
2.4 Presubmission of Reports	*Refer to Section 2.4*
3.0 Hearing	Not applicable to S.28.0.1(7) hearings
3.1 Public Hearing	*Refer to Section 3.1*
3.2 Hearing participants	*Refer to Section 3.2*
3.3 Attendance of Hearing Board Members	*Refer to Section 3.3*
3.4 Adjournments	*Refer to Section 3.4*
3.5 Orders and Directions	*Refer to Section 3.5*
3.6 Information Presented at Hearings	*Refer to Section 3.6*
3.7 Conduct of Hearing	N/A
3.7.1 Record of Attending Hearing Board Members	*Refer to Section 3.7.1*
3.7.2 Opening Remarks	*Refer to Section 3.7.2*
3.7.3 Presentation of Authority Staff Information	*Refer to Section 3.7.3*
3.7.4 Presentation of Applicant Information	*Refer to Section 3.7.4*
3.7.5 Questions	*Refer to Section 3.7.5*

3.7.6 Deliberation	*Refer to Section 3.7.6*
4.0 Decision	*Refer to Section 4.0*
4.1 Notice of Decision	The decision notice should include the following information: (a) The identification of the applicant, property and the nature of the application that was the subject of the hearing. (b) The decision to refuse or approve the application, and in the case of applications under s. 28.0.1 of the CA Act, the decision to approve the application with or without conditions. A copy of the Hearing Board resolution should be attached. It is recommended that the written Notice of Decision be forwarded to the applicant by registered mail. A sample Notice of Decision and cover letter has been included as **Appendix G-4**.
4.2 Adoption	*Refer to section 4.2*
5.0 Record	*Refer to Section 5.0*
Appendix G-6	A new Appendix G-6 has been prepared which provides an example "Notice of Hearing" for hearings under Section 28.0.1 (7) of the *Conservation Authorities Act*
Appendix G-7	A new Appendix G-7 has been prepared which provides an example "Notice of Decision" for hearings under Section 28.0.1 (7) of the *Conservation Authorities Act*

Appendix G-1

NOTICE OF HEARING

IN THE MATTER OF

The Conservation Authorities Act, R.S.O. 1990, Chapter 27

AND IN THE MATTER OF an application by **XXXXXX**

FOR THE PERMISSION OF THE CONSERVATION AUTHORITY

Pursuant to Regulations made under Section 28, Subsection 12 of the said Act

TAKE NOTICE THAT a Hearing before the Full Board of the Lower Trent Region Conservation Authority will be held under Section 28, Subsection 12 of the Conservation Authorities Act at the offices of the said Authority located at 714 Murray Street, RR #1 Trenton, Ontario K8V 5P4 at the hour of **, on the day of , 20**___, [for electronic hearings, include details about the manner in which the hearing will be held] with respect to the application by ***(NAM*E)** to permit development within an area regulated by the Authority in order to ensure no adverse effect on ***(the control of flooding, erosion, dynamic beaches or pollution or, conservation of land./alter or interfere with a watercourse or wetland*)** on Lot , Plan/Lot , Concession, ***(Stree*t) in the City of , Regional Municipality of , River Watershed.

TAKE NOTICE THAT you are invited to make a delegation and submit supporting written material to the Hearing Board for the meeting of ***(meeting numbe*r)**. If you intend to appear, [for electronic hearings: or if you believe holding the hearing is likely to cause significant prejudice], please contact ***(name*)**. Written material will be required by ***(date*)**, to enable the Hearing Board members to review the material prior to the meeting.

TAKE NOTICE THAT this hearing is governed by the provisions of the *Statutory Powers Procedure Act*. Under the Act, a witness is automatically afforded a protection that is similar to the protection of the Ontario Evidence Act. This means that the evidence that a witness gives may not be used in subsequent civil proceedings or in prosecutions against the witness under a Provincial Statute. It does not relieve the witness of the obligation of this oath since matters of perjury are not affected by the automatic affording of the protection. The significance is that the legislation is Provincial and cannot affect Federal matters. If a witness requires the protection of the Canada Evidence Act that protection must be obtained in the usual manner. The Ontario Statute requires the tribunal to draw this matter to the attention of the witness, as this tribunal has no knowledge of the effect of any evidence that a witness may give.

AND FURTHER TAKE NOTICE that if you do not attend at this Hearing, the Hearing Board of the Conservation Authority may proceed in your absence, and you will not be entitled to any further notice in the proceedings.

DATED the ___ day of , _____20__.

APPENDIX G – HEARING GUIDELINES

The Board of Directors of the Lower Trent Region Conservation Authority

Per:

Staff Member, Title: _____

Chief Administration Officer/ Secretary Treasurer: _____

Appendix G-2

HEARING PROCEDURES

1. Motion to sit as Hearing Board.
2. Roll Call followed by the Chair's opening remarks. For electronic hearings, the Chair shall ensure that all parties and the Hearing Board are able to clearly hear one another and any witnesses throughout the hearing.
3. Staff will introduce to the Hearing Board the applicant/owner, his agent and others wishing to speak.
4. Staff will indicate the nature and location of the subject application and the conclusions.
5. Staff will present the staff report included in the Authority agenda.
6. The applicant and/or his agent will speak and also make any comments on the staff report, if he so desires.
7. The Hearing Board will allow others to speak, and, if necessary, the applicant in rebuttal.
8. The Hearing Board will question, if necessary, both the staff and the applicant/agent.
9. The Hearing Board will move into camera. For electronic hearings, the Hearing Board will separate from the other participants.
10. Members of the Hearing Board will move and second a motion.
11. A motion will be carried which will culminate in the decision.
12. The Hearing Board will move out of camera. For electronic meeting, the Hearing Board will reconvene with other participants.
13. The Chair or Acting Chair will advise the owner/applicant of the Hearing Board decision.
14. If decision is "to refuse" or "approve with conditions", the Chair or Acting Chair shall notify the owner/applicant of his/her right to appeal the decision to the Ontario Land Tribunal within 30 days of receipt of the reasons for the decision.
15. Motion to move out of Hearing Board and sit as the Board of Directors.

Appendix G-3

CHAIR'S REMARKS WHEN DEALING WITH HEARINGS WITH RESPECT TO ONTARIO REGULATION 163/06.

Date: Month XX, XXXX
O.Reg. 163/06: Permit Application # RP-XX-XXX
Applicant: Name

We are now going to conduct a hearing under Section 28 of the Conservation Authorities Act in respect of an application by _____: , for permission to:_____

The Authority has adopted regulations under section 28 of the Conservation Authorities Act which requires the permission of the Authority for development within an area regulated by the Authority in order to ensure no adverse effect on the control of flooding, erosion, dynamic beaches, pollution or conservation of land, or to permit alteration to a shoreline or watercourse or interference with a wetland. This Hearing is about granting permission to develop under the Authority regulations; a separate matter from approvals under the *Planning Act*.

The Staff has reviewed this proposed work and a copy of the staff report has been given to the applicant.

The Conservation Authorities Act (Section 28 [12]) provides that:

"Permission required under a regulation made under clause (1) (b) or (c) shall not be refused or granted subject to conditions unless the person requesting permission has been given the opportunity to require a hearing before the authority or, if the authority so directs, before the authority's executive committee."

In holding this hearing, the Hearing Board is to determine whether or not a permit is to be issued, with or without conditions. In doing so, we can only consider the application in the form that is before us, the staff report, such evidence as may be given and the submissions to be made on behalf of the applicant. Only information disclosed prior to the hearing is to be presented at the hearing. It is not our place to suggest alternative development methods.

It is to be noted that if the Hearing Board decision is "to refuse" or not support the proposed work within the permit submission, the Chair or Acting Chair shall notify the owner/applicant of his/her right to appeal the decision to the Ontario Land Tribunals.

The proceedings will be conducted according to the *Statutory Powers Procedure Act*. Under Section 5 of the Canada Evidence Act, a witness may refuse to answer any question. The procedure in general shall be informal without the evidence before it being given under oath or affirmation.

If the applicant has any questions to ask of the Hearing Board or of the Authority representative, they must be directed to the Chair of the Board.

At this time, if any member of this Board has intervened on behalf of the Applicant with regards to this matter, they should recuse themselves so there is no apprehension of bias and that a fair and impartial Hearing may be conducted.

Appendix G-4

(Date) **BY REGISTERED MAIL**

(name) , (address)

Dear:

RE: NOTICE OF DECISION
Hearing Pursuant to Section 28(12) of the Conservation Authorities Act
Proposed Residential Development
Lot , Plan ; ?? Drive, City of
(Application #)

In accordance with the requirements of the Conservation Authorities Act, the Lower Trent Region Conservation Authority provides the following Notice of Decision:

On ***(meeting date and numbe***r), the Hearing Board of the Lower Trent Region Conservation Authority refused/approved your application/approved your application with conditions. A copy the Board's Resolution # _____ has been attached for your records. Please note that this decision is based on the following reasons: ***(the proposed development/alteration to a watercourse adversely affects the control of flooding, erosion, dynamic beaches, pollution or conservation of land***.)

In accordance with Section 28 (15) of the Conservation Authorities Act, an applicant who has been refused permission or who objects to conditions imposed on a permission may, within 30 days of receiving the reasons under subsection (14), appeal to the Minister who may refuse the permission; or grant permission, with or without conditions. Through Order in Council 332/2018 the responsibility for hearing the appeal has been transferred to the Ontario Land Tribunal. For your information, should you wish to exercise your right to appeal the decision, a letter by you or your agent/counsel setting out your appeal must be sent within 30 days of receiving this decision addressed to:

Ontario Land Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario M5G 1E5

A carbon copy of this letter should also be sent to Lower Trent Region Conservation Authority. Should you require any further information, please do not hesitate to contact ***(staff contac***t) or the undersigned.

Yours truly,

Chief Administration Officer/ Secretary Treasurer

Enclosure

Appendix G-5

Date

FILE #: RP-XX-XXX
PERMIT#: P-XX-XXX

Name of Applicant
Address of Applicant

ATTENTION: **It is important that you read and understand the contents of this letter and ensure that all necessary parties (i.e., landowner(s) and anyone conducting site works) are aware of any special mitigation requirements contained herein.**

RE: Location where Permission Applies

Application for permission to (development, interference and/or alteration) pursuant to Ontario Regulation 163/06 – *Lower Trent Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*.

As you are aware, your application to allow for (Proposed development/interference/alteration) on the property noted above was heard and approved by the Lower Trent Region Conservation Authority's (LTC) Hearing Board on Hearing Date. The following resolution was passed (draft resolution for final approval at the upcoming LTC's Board of Directors' meeting – Next Meeting Date):

RES: HC2/17 **Moved by: Board Member** **Seconded by: Board Member**
THAT the permit application RP-XX-XXX by Applicant for permission (development/interference/alteration) in the (Regulated Area) be approved.
Carried

Please accept this letter as formal notice of the decision of the Hearing Board.

The proposed (development/alteration/interference) is situated within regulated areas associated with (Regulated Area). Attached you will find a copy of Permit No. P-XX-XXX issued for the works noted above in accordance with Ontario Regulation 163/06. The permit has been issued based on the information, plans and specifications submitted with the application as well as your acceptance of the general conditions of approval detailed in the application. The plans and specifications are attached as part of the approved documentation.

The following mitigation measures are expected to be implemented as part of the approval from LTC:

1) *Listed Conditions of Permission;*

Should you require any further information, please do not hesitate to contact ***(staff contac***t) or the undersigned.

Appendix G-6

NOTICE OF HEARING

(Subsection 28.0.1 (7) of the Conservation Authorities Act)

IN THE MATTER OF

The Conservation Authorities Act, R.S.O. 1990, Chapter 27

AND IN THE MATTER OF an application by

FOR THE PERMISSION OF THE CONSERVATION AUTHORITY

Pursuant to Regulations made under Section 28.0.1, Subsection 7 of the said Act

TAKE NOTICE THAT a Hearing before the Executive Committee of the Conservation Authority will be held under Section 28.0.1, Subsection 7 of the Conservation Authorities Act at the offices of the said Authority (located at 714 Murray Street, RR #1 Trenton, Ontario K8V 5P4), at the hour of XX:XX, on the XX day of XXX , 20XX, [for electronic hearings, include details about the manner in which the hearing will be held] with respect to the application by (NAME) to permit development within an area regulated by the Authority in association with a Minister's Zoning Order (REGULATION NUMBER) on Lot , Plan/Lot , Concession , (Street) in the City of , Regional Municipality of , River Watershed.

TAKE NOTICE THAT you are invited to make a delegation and submit supporting written material to the Executive Committee for the meeting of (meeting number). If you intend to appear [For electronic hearings: or if you believe that holding the hearing electronically is likely to cause significant prejudice], please contact (name). Written material will be required by (date), to enable the Committee members to review the material prior to the meeting.

TAKE NOTICE THAT pursuant to Section 28.0.1 of the Conservation Authorities Act, a conservation authority is required to grant the permission applied for and may only impose conditions to the permission. The Hearing will therefore focus on the conditions to be imposed to the granting of the permission.

TAKE NOTICE THAT this hearing is governed by the provisions of the *Statutory Powers Procedure Act*. Under the Act, a witness is automatically afforded a protection that is similar to the protection of the *Ontario Evidence Act*. This means that the evidence that a witness gives may not be used in subsequent civil proceedings or in prosecutions against the witness under a Provincial Statute. It does not relieve the witness of the obligation of this oath since matters of perjury are not affected by the automatic affording of the protection. The significance is that the legislation is Provincial and cannot affect Federal matters. If a witness requires the protection of the Canada Evidence Act that protection must be obtained in the usual manner. The Ontario Statute requires the tribunal to draw this matter to the attention of the witness, as this tribunal has no knowledge of the affect of any evidence that a witness may give.

AND FURTHER TAKE NOTICE that if you do not attend at this Hearing, the Executive 24 Committee of the Conservation Authority may proceed in your absence, and you will not be entitled to any

further notice in the proceedings.

DATED the ___ day of , _____202X

The Executive Committee of the Conservation Authority

Per:

Chief Administrative Officer/Secretary-Treasurer

Appendix G-7

HEARING BOARD CHAIR'S REMARKS WHEN DEALING WITH HEARINGS

(Section 28.0.1, Subsection 7 of the Conservation Authorities Act)

WITH RESPECT TO ONTARIO REGULATION 163/06.

We are now going to conduct a hearing under section 28.0.1 of the Conservation Authorities Act in respect of an application by _____: , for permission to:_____

Under Section 28.0.1 of the Conservation Authorities Act, an Authority is required to grant permission for any application submitted under a regulation made under subsection 28(1) for permission to carry out all or part of a development project, in an area regulated by the Authority, associated with a Minister's Zoning Order, provided the criteria listed under subsection 28.0.1 (1) are met. A permission is subject to any conditions as may be prescribed by the Authority.

The Staff has reviewed this proposed work and prepared a staff report, including the proposed conditions of approval for the proposed work, which has been given to the applicant and the Board. The applicant was invited to file material in response to the staff report, a copy of which has also been provided to the Board.

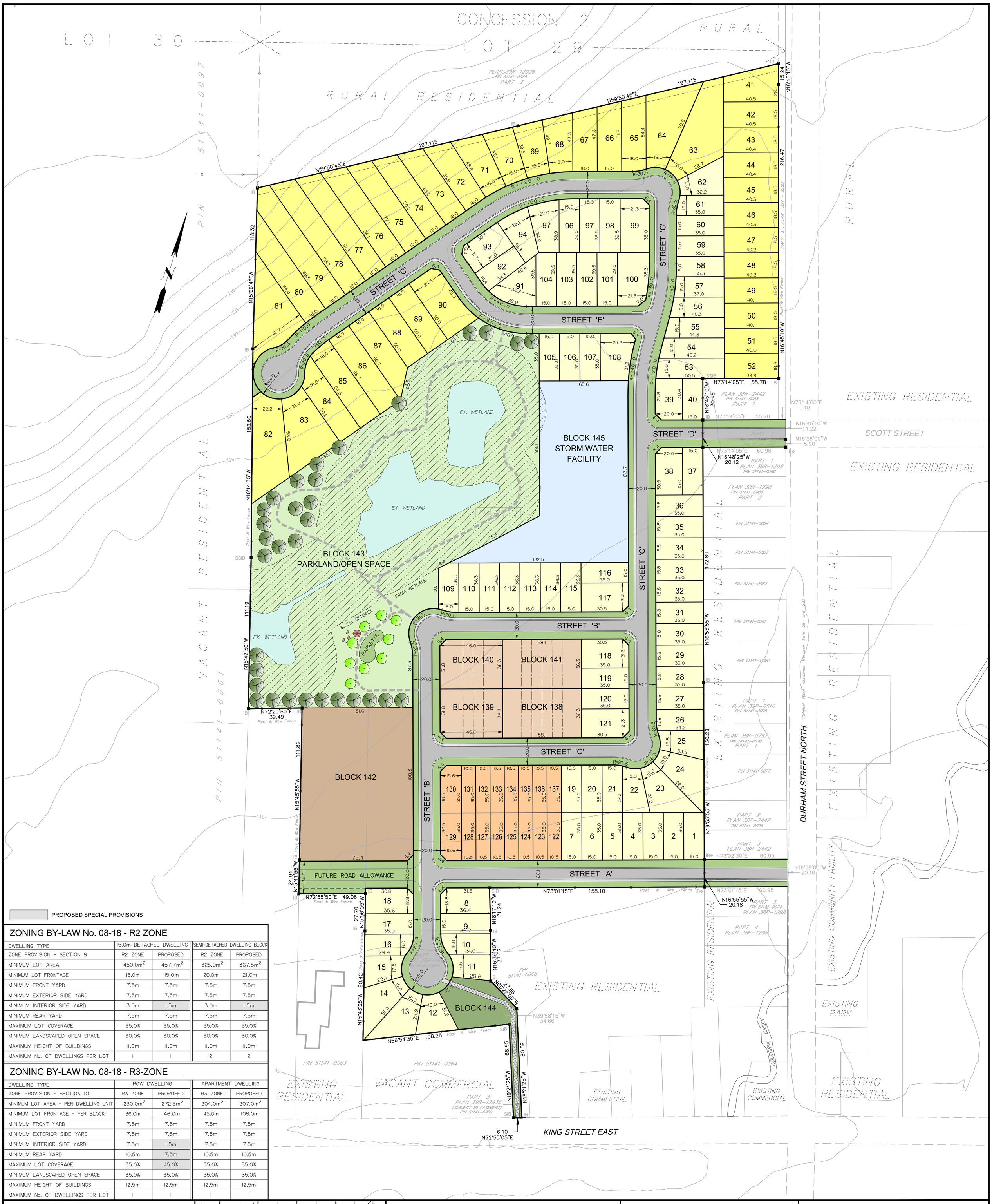
Under Section 28.0.1 (7) of the Conservation Authorities Act, the person requesting permission has the right to a hearing before the Authority/Executive Committee.

In holding this hearing, the Authority Board/Executive Committee is to determine the prescribed conditions to be attached to the approved permission. In doing so, we can only consider the application in the form that is before us, the staff report, such evidence as may be given and the submissions to be made on behalf of the applicant. Only Information disclosed prior to the hearing is to be presented at the hearing.

The proceedings will be conducted according to the *Statutory Powers Procedure Act*. Under Section 5 of the *Canada Evidence Act*, a witness may refuse to answer any question on the ground that the answer may tend to incriminate the person, or may tend to establish his/her liability to a civil proceeding at the instance of the Crown or of any person.

The procedure in general shall be informal without the evidence before it being given under oath or affirmation unless decided by the hearing members.

If the applicant has any questions to ask of the Hearing Board or of the Authority representative, they must be directed to the Chair of the board.



PROPOSED SPECIAL PROVISIONS

ZONING BY-LAW No. 08-18 - R2 ZONE

DWELLING TYPE	15.0m DETACHED DWELLING		SEMI-DETACHED DWELLING BLOCK	
ZONE PROVISION - SECTION 9	R2 ZONE	PROPOSED	R2 ZONE	PROPOSED
MINIMUM LOT AREA	450.0m²	457.7m²	325.0m²	367.5m²
MINIMUM LOT FRONTAGE	15.0m	15.0m	20.0m	21.0m
MINIMUM FRONT YARD	7.5m	7.5m	7.5m	7.5m
MINIMUM EXTERIOR SIDE YARD	7.5m	7.5m	7.5m	7.5m
MINIMUM INTERIOR SIDE YARD	3.0m	1.5m	3.0m	1.5m
MINIMUM REAR YARD	7.5m	7.5m	7.5m	7.5m
MAXIMUM LOT COVERAGE	35.0%	35.0%	35.0%	35.0%
MINIMUM LANDSCAPED OPEN SPACE	30.0%	30.0%	30.0%	30.0%
MAXIMUM HEIGHT OF BUILDINGS	11.0m	11.0m	11.0m	11.0m
MAXIMUM No. OF DWELLINGS PER LOT	1	1	2	2

ZONING BY-LAW No. 08-18 - R3-ZONE

DWELLING TYPE	ROW DWELLING		APARTMENT DWELLING	
ZONE PROVISION - SECTION 10	R3 ZONE	PROPOSED	R3 ZONE	PROPOSED
MINIMUM LOT AREA - PER DWELLING UNIT	230.0m²	272.3m²	204.0m²	207.0m²
MINIMUM LOT FRONTAGE - PER BLOCK	36.0m	46.0m	45.0m	108.0m
MINIMUM FRONT YARD	7.5m	7.5m	7.5m	7.5m
MINIMUM EXTERIOR SIDE YARD	7.5m	7.5m	7.5m	7.5m
MINIMUM INTERIOR SIDE YARD	7.5m	1.5m	7.5m	7.5m
MINIMUM REAR YARD	10.5m	7.5m	10.5m	10.5m
MAXIMUM LOT COVERAGE	35.0%	45.0%	35.0%	35.0%
MINIMUM LANDSCAPED OPEN SPACE	35.0%	35.0%	35.0%	35.0%
MAXIMUM HEIGHT OF BUILDINGS	12.5m	12.5m	12.5m	12.5m
MAXIMUM No. OF DWELLINGS PER LOT	1	1	1	1

DEVELOPMENT SITE PLAN

COLBORNE RIDGE SUBDIVISION

PARTS 1 AND 3, PLAN 12981
PART OF LOT 182, REID PLAN AND
PART OF LOT 29, CONCESSION 2
(FORMER VILLAGE OF COLBORNE)

TOWNSHIP OF CRAMAHE

COUNTY OF NORTHUMBERLAND

METRIC NOTE:

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

CONTOURS NOTE:

CONTOURS PREPARED USING DATA OBTAINED BY OTHERS. CONTOURS DRAWN AT INTERVALS OF 5.0m.

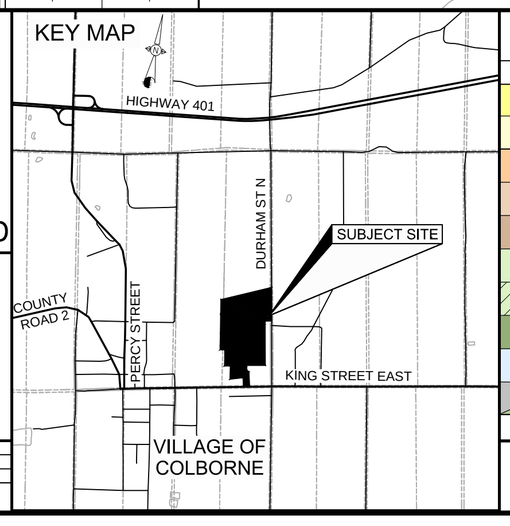
SCALE 1:1250

0 10 20 50 100 120m

No.	REVISION	DATE	APPR'D

DRAWN BY: LB | CHECKED BY: R.F.A. | DATE: 03/17/17

KEY MAP



LAND USE

	LAND USE	AREA(m²)	AREA%	UNITS
	'R2 ZONE' SINGLE DETACHED BUILDING LOTS LOTS 41-52 & 63-90 - 18.0m MIN. FRONTAGE	43417.1	21.4	40
	'R2 ZONE' SINGLE DETACHED BUILDING LOTS LOTS 1-40, 53-62 & 91-121 - 15.0m MIN. FRONTAGE	48515.8	24.0	81
	'R2 ZONE' SEMI-DETACHED BUILDING LOTS BLOCKS 122-137 - 10.0m MIN. FRONTAGE PER UNIT	6237.8	3.1	16
	'R3 ZONE' TOWNHOUSE BUILDING BLOCKS BLOCKS 138-141 - 36.0m MIN. FRONTAGE PER BLOCK	7536.8	3.7	20
	'R3 ZONE' APARTMENT BLOCK BLOCK 142	9320.6	4.6	45
	PARKLAND/OPEN SPACE BLOCK 143 - LANDS OUTSIDE OF EIS SETBACK	9654.5	4.8	
	ENVIRONMENTAL SENSITIVE AREA BLOCK 143 - LANDS WITHIN 30.0m SETBACK	28439.1	14.0	
	WALKWAY AND SERVICE CORRIDOR BLOCK 144	1989.1	0.9	
	STORM WATER FACILITY BLOCK 145	9875.2	4.9	
	20.0m MUNICIPAL ROAD ALLOWANCE STREETS 'A', 'B', 'C', 'D' & 'E' AND BLOCKS 146-148	37561.8	18.6	
	SUB TOTAL	202547.8m²	100.0%	202

LEGEND

- PROPOSED 7.8m WIDE ASPHALT AND CURB
- LANDSCAPED BOULEVARD
- SURVEYED WETLAND FROM EIS REPORT
- 30.0m SETBACK FROM SURVEYED WETLAND
- 1.5m WIDE SIDEWALK
- 3.0m WIDE WALKING TRAIL
- NATURE TRAIL (BARKCHIP)
- GAZEBO AND PICNIC TABLES
- PROPOSED TREE PLANTINGS
- EXISTING TREES AND VEGETATION TO BE PRESERVED ACCORDING TO EIS

PLAN COPYRIGHT

RUTH FERGUSON ALUTHGE
REGISTERED PROFESSIONAL PLANNER
R.P.P.
03/15/17

JOB No. 481-DSP

RFA PLANNING CONSULTANT INC
211 Dundas Street East, Suite 202,
Belleville, Ontario, K8N 1E2

Notice of Decision

With Respect to a Plan of Subdivision

Section 51(37) of the Planning Act

Plan of Subdivision D12-CR1702 – Eastfields Development, Colborne, Cramahe

The Council of the County of Northumberland, as the approval authority, made a decision on April 20, 2022 to approve Plan of Subdivision application D12-CR1702 in the Township of Cramahe.

Purpose of the Application:

The plan of subdivision would allow 202 new residential units on a property north of King Street and west of Durham Street in the Village of Colborne. The plan would create 121 lots for detached units, 16 lots for semi-detached units, five blocks for 20 townhouse units, a block for a 45-unit apartment building, a parkland/open space block, a stormwater facility block, walkways, and roads.

Effect of Public Input:

The Township of Cramahe Council considered all written and oral public comments about the plan. As a result of public input, sidewalks along Durham Street and privacy fencing in specified areas within the subdivision will be provided. Also, an updated traffic impact study and an environmental site assessment are required prior to subdivision registration.

When Draft Approval Is In Effect:

If the Clerk for the County of Northumberland does not receive a notice of appeal in respect of the decision within 20 days of this notice, the application is deemed draft approved on the day after the last day of appeal.

When And How To Submit an Appeal:

A notice of appeal must be received by the County Clerk no later than 4:30 p.m. on May 12, 2022.

The notice of appeal must be addressed to the Clerk, County of Northumberland, at the address shown below, and must;

1. set out the reasons for the appeal; and
2. be accompanied by a certified cheque or money order, payable to the Minister of Finance, in the amount of $1,100.00 for the appeal fee.

Mailing Address For Notice of Appeal:

Nancy MacDonald, Clerk
County of Northumberland
555 Courthouse Road,
Cobourg, Ontario K9A 5J6

Who Can Submit an Appeal:

Only the applicant, a public body, a person prescribed by the Planning Act, the municipality or the Minister may appeal this decision. The applicant, a public body, the municipality or the Minister may appeal any of the conditions prior to final approval by filing a notice of appeal with the County Clerk.

Only individuals, corporations or public bodies may appeal decisions in respect of a plan of subdivision to the Local Planning Appeal Tribunal. A notice of appeal may not be filed by an unincorporated association or group. However, a notice of appeal may be filed in the name of an individual who is a member of the association or the group on its behalf.

No person or public body shall be added as a party to the hearing of the appeal, including the lapsing provisions or the conditions, unless the person or public body, before the decision of the approval authority, made oral submissions at a public meeting or written submissions to the council, or made a written request to be notified of changes to the conditions or, in the Local Planning Appeal Tribunal's opinion, there are reasonable grounds to add the person or public body as a party.

For Further Information:

Information about Plan of Subdivision application D12-CR1702 and the decision is available for public inspection during office hours at the County of Northumberland Land Use Planning Office, 600 William Street, Cobourg

Please contact Dwayne Campbell, Manager of Land Use Planning, at (905) 372-3329 extension 2408 if you have any questions regarding the decision.

Date Notice Was Given: April 22, 2022

Decision

With Respect to a Plan of Subdivision

Section 51(31) of the Planning Act

Plan of Subdivision D12-CR1702 – Eastfields Development, Colborne, Cramahe

The Council of the County of Northumberland has decided to grant draft approval to plan of subdivision application D12-CR1702 in the Township of Cramahe, subject to the conditions attached.

Nancy MacDonald, County Clerk
County of Northumberland

Dated at Cobourg, Ontario on April 22, 2022

Conditions of Draft Approval for Plan of Subdivision D12-CR1702 – Eastfields Subdivision, Colborne

General

1. The Owner shall prepare the final plan in accordance with the approved draft plan, prepared by RFA Planning Consultants Incorporated, dated March 27, 2017, which illustrates:

    - 121 residential lots for detached units
    - 16 residential lots for semi-detached units
    - 4 blocks for 20 townhouse units
    - a block for a 45-unit apartment building
    - a parkland block
    - a walkway/service corridor block
    - a stormwater management block
    - blocks for future road allowances
    - a road reserve block
    - roadways

2. The Owner shall satisfy all requirements, financial and otherwise, of the Township of Cramahe, including entering into a Subdivision Agreement with the Township concerning the provision and installation of roads, sanitary sewers, water supply, drainage, fencing, lighting, landscaping, sidewalks, and other services.

3. The Owner shall obtain all necessary permits from the Lower Trent Region Conservation Authority.

4. The Owner shall submit an updated financial impact summary to the satisfaction of the Township of Cramahe.

5. The Owner shall submit an environmental site assessment(s) to identify previous uses on the site and determine the potential for site contamination and need for detailed assessment and/or recommendations. Any recommendations shall be incorporated into the Subdivision Agreement which shall contain provisions for the Owner agrees to implement the recommendations to the satisfaction of the Township of Cramahe.

Phasing

6. The Owner shall submit plans showing development phasing to the Township of Cramahe for review and approval. The phasing of the development shall be reflected in the Subdivision Agreement and on the approved subdivision design drawings. The phasing shall take into account the temporary termination of roadways, underground services, interim stormwater management, access for operations and maintenance vehicles and emergency vehicles, to the satisfaction of the Township of Cramahe.

The phasing of the development shall be proposed in an orderly progression, in consideration of such matters as the timing of area road improvements, infrastructure, and other services.

Roads

7. The Owner shall submit an updated traffic study to the satisfaction of the Township of Cramahe.

8. The Owner shall design and construct the roads included in the draft plan to an urban standard; such standard is to be set out in the subdivision agreement, to the satisfaction of the Township of Cramahe.

9. The Owner shall design roads to have a minimum 20 metre right-of-way width with a minimum 8.5 metre curb to curb width and a sidewalk on one side.

10. The Owner shall design the radius of any cul-de-sacs be a minimum of 19 metres with a minimum outside curb radius of 14.0 metres.

11. The Owner shall dedicate all road allowances included in this draft plan as public highways.

12. The Owner shall name roads to the satisfaction of the Township of Cramahe and County of Northumberland.

13. The Owner shall convey Blocks 146 and 147 in the draft plan to the Township of Cramahe for future road allowances.

14. The Owner shall convey any dead ends and open sides of road allowances created by this draft as a 0.3 metre reserve, including block 148, to the Township of Cramahe

15. The Developer shall agree in the Township of Cramahe subdivision agreement that the pavement structure for the roadways within the plan of subdivision shall be designed to accommodate highway vehicle loading for waste collection vehicles.

Engineering

16. The Owner shall submit a geotechnical study to the satisfaction of the Township of Cramahe. Any recommendations including those related to ground water elevations, road design and the suitability of the material for development, shall be incorporated into the Subdivision Agreement which shall contain provisions for the Owner to agree to implement the study recommendations to the satisfaction of the Township of Cramahe.

17. The Owner shall submit to the Township of Cramahe and appropriate authority, and agree to implement all works referenced in the following:
    i) servicing plan

ii) drainage and grading control plan
iii) stormwater management plan
iv) landscaping/fencing plan
v) utility distribution plan

18. The Owner shall submit a detailed breakdown of the construction costs for the works associated with the development of this Plan, including any cash surcharges or special levies, and including construction costs which shall be prepared and stamped by a professional engineer and submitted in a format acceptable to the Township of Cramahe for incorporation into the Subdivision Agreement.

19. The Owner shall submit subdivision design drawings, including design plans of all public works and services, prepared, and certified by a Professional Engineer and designed pursuant to Township of Cramahe requirements and to the satisfaction of the Township, and that such plans are to form part of the Subdivision Agreement.

20. The Owner shall submit a digital file of the approved engineering drawings to the Township of Cramahe.

Water Supply and Sanitary Sewage Services

21. The Owner shall provide for the extension of such sanitary sewer and water supply facilities which are external to, as well as within, the limits of this plan that are required to service this plan. In addition, the owner shall provide for the extension of sanitary sewer and water supply facilities within the limits of the plan and which are required to service other development external to this subdivision. Such sanitary sewer and water supply facilities are to be designed and constructed according to the standards and requirements of the Township of Cramahe.

22. The Township of Cramahe shall be satisfied that adequate water pollution control plant and water supply plant capacities are available to the proposed development and allocate services upon execution of the Subdivision Agreement. Prior to final approval of any phase the Township will confirm the servicing allocation for such phase.

23. The Owner shall design fire hydrants to be equipped with integral 4” Storz connection and two 2.5” CSA thread ports.

24. The Owner shall agree in the Subdivision Agreement that the connection of sanitary sewer and water supply into the existing systems is to be done under the supervision of the Township.

Stormwater Management

25. The Owner shall submit and obtain approval from the Township of Cramahe and the Lower Trent Region Conservation Authority for the following:

i) a detailed engineering report(s) that describes the storm drainage system for the proposed development and includes a detailed analysis of the proposed drainage pattern; plans illustrating how this drainage system will be tied into the surrounding drainage systems and whether it is part of an overall drainage scheme, the design capacity of the receiving system, the level of protection to be provided, and how external flows will be accommodated; the location and description of all outlets and other facilities; stormwater management techniques which may be required to control minor and major flows; proposed methods of controlling or minimizing erosion and siltation on-site and in downstream areas during and after construction; overall grading plans for the subject lands; and stormwater management practices to be used to treat stormwater, to mitigate the impacts of development on the quality and quantity of ground and surface water resources.

ii) Lot grading, stormwater management and erosion and sediment control plans, prepared by a qualified Professional Engineer. Such plans shall include the design and location of any temporary erosion and sediment control facilities (including ponds) as required, and the provision of any required environmental compliance certificate(s) from the Ministry of the Environment and Climate Change, to the satisfaction of the Township and Lower Trent Region Conservation Authority.

26. The Owner shall provide the Township of Cramahe with a report that details the Owner's share of all costs for stormwater management facilities that have been provided or will be provided to service this subdivision development. These costs shall include any upgrades required for existing storm sewers, expansion of stormwater management ponds and quality control devices as well as costs to provide future maintenance of facilities.

27. The Owner shall agree in the Subdivision Agreement to maintain all stormwater management and erosion and sedimentation control structures operating and in good repair during the construction period, in a manner satisfactory to the Township of Cramahe and Lower Trent Region Conservation Authority.

Utilities and Canada Post

28. The Owner shall grant easements as may be required for utilities, drainage, and servicing purposes to the appropriate authority, free of all charges and encumbrances. A utility distribution plan shall be submitted to the satisfaction of the Township of Cramahe

29. The Owner shall consult with Lakefront Utilities Incorporated regarding the installation of electricity infrastructure and distribution to service the development.

30. The Owner shall consult with the appropriate service providers regarding the installation of underground communication / telecommunication utility services for this

land to enable, at a minimum, the effective delivery of broadband internet services and communication / telecommunication services for 911 Emergency Services.

31. The Owners shall consult with Enbridge Gas regarding the installation of natural gas services for the development.

32. The Owner shall consult with Canada Post to identify the location of mailboxes within the development.

Trees and Landscaping

33. The Owner shall submit a landscaping plan to the Township of Cramahe. The landscaping plan shall be prepared by a Landscape Architect to the satisfaction of the Township of Cramahe and shall include all proposed street tree plantings and plantings associated with any stormwater management facilities, and parkland/open space blocks. All planted trees and vegetation are to be native species.

34. The Municipality may, at its sole discretion, accept cash in lieu for some or all boulevard trees, to be determined by the Municipality and established in the Subdivision Agreement.

Parkland, sidewalks, and public space

35. The Owner shall convey Block 143 on the draft to the Township of Cramahe as public parkland.

36. The Owner shall agree in the Subdivision Agreement to construct a sidewalk adjacent to Durham Street North from the south limit of lot 52 through to the north limit of lot 41, to the satisfaction of the Township of Cramahe. Alternatively, the Township of Cramahe may, at its sole discretion, require a cash contribution in lieu of construction of such sidewalk, the details of which will be included in the Subdivision Agreement.

37. The Owner shall convey Block 144 on the draft plan to the Township of Cramahe as a public walkway.

38. The Owner shall consult with the Inter Municipal Accessibility Advisory Committee regarding the design and construction of sidewalks, walkways, and public space areas.

39. The Owner shall agree in the Subdivision Agreement to provide a pedestrian walkway or dedicated pedestrian use only area throughout the subdivision to accommodate and promote safe walking. The Owner shall submit a plan illustrating pedestrian route details to the Kawartha Pine Ridge District School Board which shall be incorporated into the Subdivision Agreement to implement the plans and details to the satisfaction of the Kawartha Pine Ridge District School Board.

Fencing

40. The Owner shall agree in the Subdivision Agreement to design and construct privacy fencing along the rear and/or side yards of lots in the draft plan that abut the proposed park block (block 143) including lots 82 to 90, to the satisfaction of the Township of Cramahe.

41. The Owner shall agree in the Subdivision Agreement to install chain link fencing at the following locations:

    i) permitter of walkway block (block 144)
    ii) around the perimeter of the stormwater management facility (Block 145). The details, including design and cost estimates, related to the fencing will be contained in a detailed engineering report
    iii) along the south side of street 'A'/reserve block (block 148)

42. The Owner shall consult with the Township of Cramahe regarding privacy fencing along the rear and/or side yards of lots in the draft plan that abut the existing residential lots fronting on the west side of Durham Street North and the north side of King Street East.

Warning Clauses

43. The Owner shall agree in the Subdivision Agreement to include the following in all purchase and sale agreements for prospective home buyers:

    i) "Purchasers and/or tenants are advised that the planting of trees on municipal boulevards in front of residential units is a requirement of the Township of Cramahe and a conceptual location plan is included in the subdivision agreement with the municipality. While every attempt will be made to plant trees as shown, the Township of Cramahe reserves the right to relocate or delete any boulevard tree without further notice."

    ii) "Purchasers and/or tenants are advised that mail delivery will be from a designated community mailbox, the location of which will be identified by the Owner prior to any home closings."

    iii) "Purchasers and/or tenants are not permitted to alter the constructed and approved drainage pattern in any manner which includes but is not limited to re-grading, the installation of fences and the installation or planting trees, shrubs flower beds or gardens."

    iv) "Purchasers and/or tenants are advised that due to the proximity of this plan to an existing quarry, purchasers should be aware that noise and vibrations from quarry operations may interfere with some activities of the dwelling occupants."

    v) "Purchasers and/or tenants are advised that due to the proximity of this plan to rail lines and level crossings, purchasers should be aware that noise and vibrations from rail operations and train whistles may interfere with some activities of the dwelling occupants."

vi) “Purchasers and/or tenants are advised that the adjacent parkland or stormwater management facility may be left in a naturally-vegetated condition and receive minimal maintenance.”

vii) “Purchasers and/or tenants are advised that if school buses are required within the development in accordance with Kawartha Pine Ridge District School Board Transportation policies, as may be amended from time to time, school bus pick up points will generally be located on the through street at a location as determined by the Student Transportation Services of Central Ontario.”

Zoning By-law Compliance

44. The Owner shall apply to the Township of Cramahe and obtain approval of the zoning for the land uses shown on the draft plan and may include the use of holding zone (‘H’) in accordance with the Planning Act

45. The Owner shall submit a Surveyor's Certificate which confirms that the lots and blocks within this Plan conform to the minimum lot frontage and lot area to the satisfaction of the Township of Cramahe.

Other Subdivision Agreement Requirements

46. The Subdivision Agreement between the Owner and the Township of Cramahe shall contain, among other matters, the following provisions:

i) The Owner agrees to maintain the roads and other services and facilities to the satisfaction of the Township Engineer, until assumption of such roads, services and facilities by the Township of Cramahe

ii) The Owner agrees to provide individual lot grading plans consistent with the overall approved lot grading plan to the Chief Building Official as part of the building permit application process. Building permits will only be issued in compliance with the approved lot grading plan(s).

iii) The Owner agrees that topsoil shall not be removed from the site without prior approval of the Township of Cramahe and shall be kept stockpiled and stabilized for use as topsoil for final lot grading.

iv) The Owner agrees to notify the Township of Cramahe and the Lower Trent Conservation Authority Conservation at least 48 hours prior to the initiation of any on-site development.

v) The Owner agrees to install street lighting to the satisfaction of the Township of Cramahe.

vi) The Owner agrees to install temporary and permanent signage for the subdivision to the satisfaction of the Township of Cramahe.

vii) The Owner agrees to reimburse the Township of Cramahe for the cost of any peer reviews of the studies/reports submitted in support of the proposed Plan of Subdivision.

viii) The Owner agrees to reimburse the Township of Cramahe for all administrative, planning, legal, engineering, inspection and/or other costs or expenses incurred by the Municipality or any of its agents, in connection with the development.

ix) The Owner agrees to bear the expense of all off-site work attributable to the subdivision resulting from the approved public works design where such works are not subsidized under the policies and by-laws of the Township of Cramahe.

x) The Owner agrees to strictly adhere to the mitigation, restoration and monitoring measures as outlined in the report Species at Risk and Environmental Impact Study, prepared by Lakeside Green Environmental Consulting, revise dated June 2017.

xi) The Owner agrees that waste collection services within the subdivision will only be provided to detached, semi-detached and townhouse units at such time as the roads are assumed by the municipality and advise initial purchasers within the subdivision of such in all offers of purchase and sale. The apartment block (block 142) will require private waste collection service.

47. The Subdivision Agreement shall contain the appropriate wording regarding the payment of development charges to the Township of Cramahe in accordance with the provisions of the Cramahe and Northumberland County Development Charges By-Laws.

48. The Owner shall submit a detailed breakdown of the construction costs for the works associated with the development of this Plan, including any cash surcharges or special levies and including construction costs which shall be prepared and stamped by a professional engineer and submitted in a format acceptable to the Township of Cramahe for incorporation into the Subdivision Agreement

Final Approval

49. Prior to final approval of this plan for registration, the Northumberland County Planning Department shall be advised in writing by:

a) Cramahe Township how all conditions have been satisfied;

b) Lower Trent Region Conservation Authority that conditions 3, 25, 27 and 46(x) have been satisfied;

c) Northumberland County Works Department that conditions 15 and 46(xi) have been satisfied;

d) Lakefront Utilities Incorporated that condition 29 has been satisfied;

e) Communication/Telecommunication service provider that condition 30 has been satisfied;

f) Enbridge Gas that condition 31 has been satisfied;

g) Canada Post how condition 32 has been satisfied; and

h) Kawartha Pine Ridge District School Board that conditions 39 and 43(vii) have been satisfied.

Notes to Draft Approval

1. As the Owner of the draft approved plan, it is your responsibility to satisfy all conditions of draft approval in an expeditious manner. The conditions of draft approval will be reviewed periodically and may be amended at any time prior to final approval. The Planning Act provides that draft approval may be withdrawn at any time prior to final approval.

2. All plans of subdivision must be registered in the Land Titles system in accordance with Section 144 of the *Land Titles Act*,

3. If final approval is not given to this plan within five years of the draft approval date, and no extensions have been granted, draft approval shall lapse, and the file shall be closed. Extensions may be granted provided valid reason is given and is submitted to the County of Northumberland at least six months in advance of the lapsing date.

4. For conditions of draft approval that require agency clearance, the address and phone number of the agencies are below:

   Township of Cramahe
   P.O. Box 357
   Colborne, ON K0K 1S0
   Attn: Victoria Heffernan
   Phone: 905.355-2821

   Lower Trent Region Conservation Authority
   714 Murray Street, RR1
   Trenton, Ontario K8V 5P4
   Attn: Ashley Anastasio
   Phone: 613.394.4829

   Northumberland County Works Department
   555 Courthouse Road
   Cobourg, Ontario K9A 5J6

Attn: Brooke Gillispie
Phone: 905-372-3329

Lakefront Utility Incorporated
207 Division Street
Cobourg, Ontario K9A 4L3
Attn: Chris Callaghan
905-372-2193 x 5204

Enbridge Gas Inc
1653 Venture Drive
Kingston, ON K7P 0E9
Phone: 905-376-6288

Canada Post - Delivery Planning
PO BOX 8037 Ottawa T CSC
Ottawa, Ontario K1G 3H6
Attn: Stephen McGraw
Phone: 613.894.9519

Kawartha Pine Ridge District School Board
1994 Fisher Drive
Peterborough, Ontario K9J 6X6
Attn: Jeannette Thompson
Phone: (705) 742-9773

5. The final plan must include the following inscription along the right-hand margin of the plan:

Approved under Section 51 of the Planning Act and the authority of Ontario Regulation 177/14 on this _____ day of _____, 20____. _____ Nancy McDonald, Clerk County of Northumberland

CONCESSION 2

LOT 30

LOT 29

LOT 28

RURAL RESIDENTIAL

EX. WETLAND

PARKETTE

PARKLAND & OPEN SPACE

STREET 'B'

STREET 'E'

STREET 'D'

STREET 'C'

STREET 'F'

STREET 'A'

3.0m DRAINAGE EASEMENT

5.0 TYPICAL DRAINAGE EASEMENT

5m TO BOT. OF CREEK

4.25m TO BOT. OF CREEK

FROM WETLAND

30.0m SETBACK

STORM POND

FUTURE STREET 'A' EXTENSION

BLOCK 136

BLOCK 137

BLOCK 138

BLOCK 139

BLOCK 140

BLOCK 141

BLOCK 142

PROPOSED 2.5 STOREY 16 UNIT BUILDING 522.5sq.m.

EROSION HAZARD SETBACK 2 m BEYOND PROPOSED TOP OF BANK - NO BUILDING STRUCTURES PERMITTED

WACANT LAND

EXISTING RESIDENTIAL

SCOTT - STREET

DURHAM STREET NORTH

EXISTING COMMUNITY FACILITY

EXISTING VACANT COMMERCIAL

KING STREET EAST

REDLINE
AMENDED - APPROVED PLAN OF SUBDIVISION D12-CR1702

DEVELOPMENT SITE PLAN
EASTFIELDS SUBDIVISION - REDLINE PLAN

PARTS 1 AND 2, PLAN 39R-14479
PART OF LOT 182, REID PLAN AND
PART OF LOT 29, CONCESSION 2
(FORMER VILLAGE OF COLBORNE)

TOWNSHIP OF CRAMAHE

COUNTY OF NORTHUMBERLAND

METRIC NOTE:

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

CONTOURS NOTE:

CONTOURS PREPARED USING DATA OBTAINED BY OTHERS. CONTOURS DRAWN AT INTERVALS OF 5.0m.

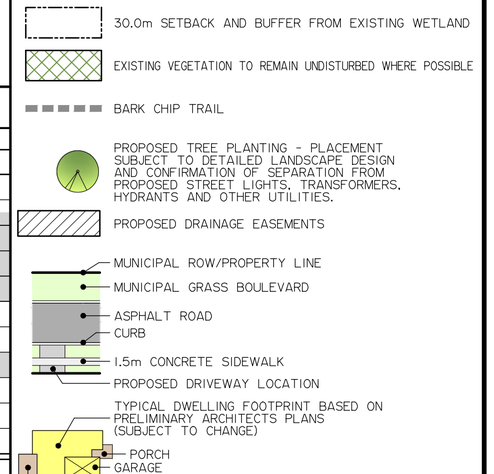
SCALE 1:1000

0 5 10 25 50 75 100m

No.	REVISION	DATE	APPR'D
3	REDLINE - DRAINAGE CHANNEL AND LOT ADJUSTMENTS	APRIL 03, 2023	R.F.A.
2	EXISTING DRAFT PLAN REVISED TO INCLUDE NEW ABSOLUTE TITLES BOUNDARY SURVEY, SLOPE STABILIZATION REQUIREMENTS AND STORM WATER FOR EASTFIELDS DRAFT PLAN OF SUBDIVISION	NOV. 25, 2022	R.F.A.
1	DRAFT PLAN APPROVED BY NORTHUMBERLAND COUNTY (APRIL 2022)	MARCH 17/17	R.F.A.

DRAWN BY: LB | CHECKED BY: R.F.A. | DATE: 03/17/17

KEY MAP



LAND USE SCHEDULE

LAND USE	AREA(m^2)	AREA%	UNITS
LOTS 7-17, 47, 50-59, 66-75, 79-87, 116-129 & 131-135 -12.2m MIN. SINGLE DETACHED LOTS (418.2m^2)	31829.3	15.7	60
LOTS 18-25, 36-46, 48, 49, 60- 65, 76-78, 88 -95, 110-115 & 130 -15.0m MIN. SINGLE DETACHED LOTS (507.8m^2)	33667.2	16.6	45
LOTS 96-109 -18.0m MIN. SINGLE DETACHED LOTS (618.9m^2)	25493.1	12.6	14
LOTS 1-6 & 26-35 -10.0m MIN. SEMI-DETACHED LOTS (350.0m^2)	7399.9	3.6	16
BLOCKS 136-142 - ROW DWELLINGS 36.0m MIN. FRONTAGE PER BLOCK (230.0m^2 PER UNIT)	9646.4	4.8	29
MULTI-UNIT DWELLING (50 UNITS/ha)	9691.5	4.8	48
STORM WATER FACILITY	7676.0	3.8	
PARKLAND/OPEN SPACE EXCLUDING EIS AREA = 10980.6 WETLAND & BUFFER (EIS) AREA = 28438.2	39418.8	19.4 (5.4) (14.0)	
FUTURE STREET 'A' EXTENSION	999.6	0.5	
20.0m MUNICIPAL ROAD ALLOWANCE = 1720.3m (STREETS 'A', 'B', 'C', 'D', 'E' & 'F') WALKWAYS, SERVICE EASEMENT AND RESERVE	35735.0	17.6	
SUB TOTAL	202588.0m^2	100.0%	212

LEGEND

- EXISTING WETLAND
- 30.0m SETBACK AND BUFFER FROM EXISTING WETLAND
- EXISTING VEGETATION TO REMAIN UNDISTURBED WHERE POSSIBLE
- BARK CHIP TRAIL
- PROPOSED TREE PLANTING - PLACEMENT SUBJECT TO DETAILED LANDSCAPE DESIGN AND CONFIRMATION OF SEPARATION FROM PROPOSED STREET LIGHTS, TRANSFORMERS, HYDRANTS AND OTHER UTILITIES.
- PROPOSED DRAINAGE EASEMENTS
- MUNICIPAL ROW/PROPERTY LINE
- MUNICIPAL GRASS BOULEVARD
- ASPHALT ROAD
- CURB
- 1.5m CONCRETE SIDEWALK
- PROPOSED DRIVEWAY LOCATION
- TYPICAL DWELLING FOOTPRINT BASED ON PRELIMINARY ARCHITECTS PLANS (SUBJECT TO CHANGE)
  - PORCH
  - GARAGE
  - DECK
- PROPOSED RETAINING WALL - LOCATION TO BE CONFIRMED BY ENGINEER

ZONING BY-LAW No. 08-18 - R2 ZONE

PROPOSED SPECIAL PROVISIONS

DWELLING TYPE	SINGLE DETACHED DWELLING		SEMI-DETACHED DWELLING	
ZONE PROVISION - SECTION 9	R2 ZONE	PROPOSED	R2 ZONE	PROPOSED
MINIMUM LOT AREA	450.0m^2	386.0m^2	325.0m^2	350.0m^2
MINIMUM LOT FRONTAGE	15.0m	12.2m	10.0m/UNIT 21.0m/BLOCK	10.0m/UNIT 20.0m/BLOCK
MINIMUM FRONT YARD	7.5m	6.0m	7.5m	6.0m
MINIMUM EXTERIOR SIDE YARD	7.5m	4.5m	7.5m	4.5m
MINIMUM INTERIOR SIDE YARD	3.0m	1.2m	3.0m	1.2m
MINIMUM REAR YARD	7.5m	7.5m	7.5m	11.4m
MAXIMUM HEIGHT OF BUILDINGS	11.0m	11.0m	11.0m	11.0m
MAXIMUM LOT COVERAGE	35.0%	45.0%	35.0%	45.0%
MINIMUM LANDSCAPED OPEN SPACE	30.0%	50.0%	30.0%	48.0%
MAXIMUM No. OF DWELLINGS PER LOT	1	1	1	1
MAXIMUM No. OF DWELLING UNITS PER LOT	2	2	2	2

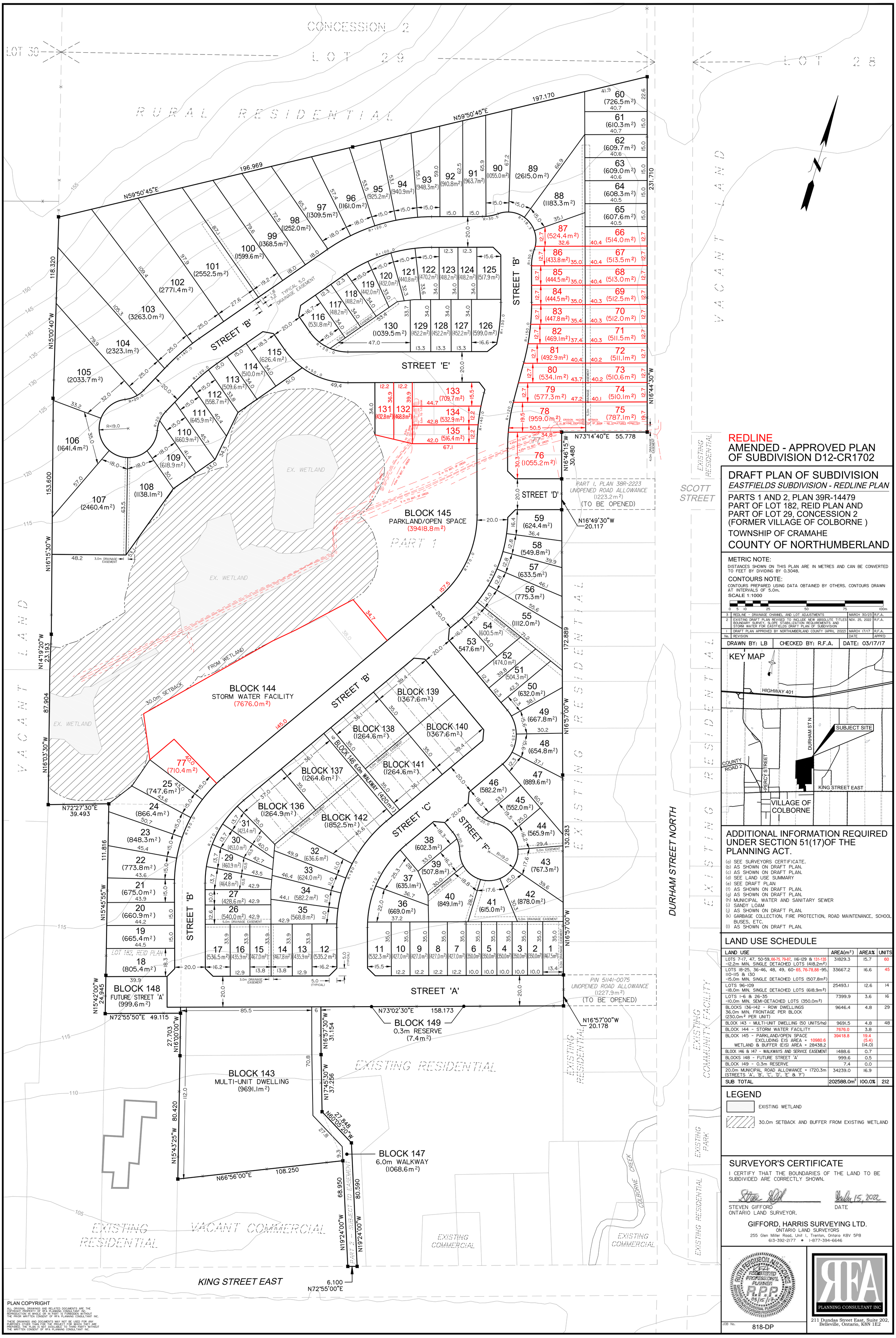
ZONING BY-LAW No. 08-18 - R3-ZONE

DWELLING TYPE	ROW DWELLING		MULTI-UNIT DWELLING	
ZONE PROVISION - SECTION 10	R3 ZONE	PROPOSED	R3 ZONE	PROPOSED
MINIMUM LOT AREA - PER UNIT	230.0m^2	256.0m^2	204.0m^2	200.0m^2
MINIMUM LOT FRONTAGE - PER BLOCK	36.0m	36.1m	45.0m	85.5m
MINIMUM FRONT YARD	7.5m	6.0m	7.5m	7.5m
MINIMUM EXTERIOR SIDE YARD	7.5m	4.5m	7.5m	N/A
MINIMUM INTERIOR SIDE YARD	7.5m	1.2m	7.5m	16.2m
MINIMUM REAR YARD	10.5m	7.5m	10.5m	10.5m
MAXIMUM HEIGHT OF BUILDINGS	12.5m	12.5m	12.5m	12.5m
MAXIMUM LOT COVERAGE	35.0%	55.0%	35.0%	16.2%
MINIMUM LANDSCAPED OPEN SPACE	35.0%	40.0%	35.0%	60.0%

RUTH FERGUSON ALLINHOUSE MCIP RPP REGISTERED PROFESSIONAL PLANNER 03/15/17

JOB No. 818-DSP

RFA PLANNING CONSULTANT INC
211 Dundas Street East, Suite 202,
Belleville, Ontario, K8N 1E2



REDLINE
AMENDED - APPROVED PLAN OF SUBDIVISION D12-CR1702

DRAFT PLAN OF SUBDIVISION
EASTFIELDS SUBDIVISION - REDLINE PLAN

PARTS 1 AND 2, PLAN 39R-14479
PART OF LOT 182, REID PLAN AND
PART OF LOT 29, CONCESSION 2
(FORMER VILLAGE OF COLBORNE)
TOWNSHIP OF CRAMAHE
COUNTY OF NORTHUMBERLAND

METRIC NOTE:
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

CONTOURS NOTE:
CONTOURS PREPARED USING DATA OBTAINED BY OTHERS. CONTOURS DRAWN AT INTERVALS OF 5.0m.

SCALE 1:1000

0 5 10 25 50 75 100m

No.	REVISION	DATE	APPR'D
3	REDLINE - DRAINAGE CHANNEL AND LOT ADJUSTMENTS	MARCH 30/23	R.F.A.
2	EXISTING DRAFT PLAN REVISED TO INCLUDE NEW ABSOLUTE TITLES BOUNDARY SURVEY, SLOPE STABILIZATION REQUIREMENTS AND STORM WATER FOR EASTFIELDS DRAFT PLAN OF SUBDIVISION	NOV. 25, 2022	R.F.A.
1	DRAFT PLAN APPROVED BY NORTHUMBERLAND COUNTY (APRIL 2022)	MARCH 17/17	R.F.A.

DRAWN BY: LB | CHECKED BY: R.F.A. | DATE: 03/17/17

KEY MAP

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17)OF THE PLANNING ACT.

(a) SEE SURVEYORS CERTIFICATE.
(b) AS SHOWN ON DRAFT PLAN.
(c) AS SHOWN ON DRAFT PLAN.
(d) SEE LAND USE SUMMARY
(e) SEE DRAFT PLAN
(f) AS SHOWN ON DRAFT PLAN.
(g) AS SHOWN ON DRAFT PLAN.
(h) MUNICIPAL WATER AND SANITARY SEWER
(i) SANDY LOAM
(j) AS SHOWN ON DRAFT PLAN.
(k) GARBAGE COLLECTION, FIRE PROTECTION, ROAD MAINTENANCE, SCHOOL BUSES, ETC.
(l) AS SHOWN ON DRAFT PLAN.

LAND USE SCHEDULE

LAND USE	AREA(m²)	AREA%	UNITS
LOTS 7-17, 47, 50-59, 66-75, 79-87, 116-129 & 131-135 -12.2m MIN. SINGLE DETACHED LOTS (418.2m²)	31829.3	15.7	60
LOTS 18-25, 36-46, 48, 49, 60-65, 76-78, 88-95, 110-115 & 130 -15.0m MIN. SINGLE DETACHED LOTS (507.8m²)	33667.2	16.6	45
LOTS 96-109 -18.0m MIN. SINGLE DETACHED LOTS (618.9m²)	25493.1	12.6	14
LOTS 1-6 & 26-35 -10.0m MIN. SEMI-DETACHED LOTS (350.0m²)	7399.9	3.6	16
BLOCKS 136-142 - ROW DWELLINGS 36.0m MIN. FRONTAGE PER BLOCK (230.0m² PER UNIT)	9646.4	4.8	29
BLOCK 143 - MULTI-UNIT DWELLING (50 UNITS/ha)	9691.5	4.8	48
BLOCK 144 - STORM WATER FACILITY	7676.0	3.8	
BLOCK 145 - PARKLAND/OPEN SPACE EXCLUDING EIS AREA = 10980.6 WETLAND & BUFFER (EIS) AREA = 28438.2	39418.8	19.4 (5.4) (14.0)	
BLOCK 146 & 147 - WALKWAYS AND SERVICE EASEMENT	1488.6	0.7	
BLOCKS 148 - FUTURE STREET 'A'	999.6	0.5	
BLOCK 149 - 0.3m RESERVE	7.4	0.0	
20.0m MUNICIPAL ROAD ALLOWANCE = 1720.3m (STREETS 'A', 'B', 'C', 'D', 'E' & 'F')	34239.0	16.9	
SUB TOTAL	202588.0m²	100.0%	212

LEGEND

EXISTING WETLAND

30.0m SETBACK AND BUFFER FROM EXISTING WETLAND

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ARE CORRECTLY SHOWN.

STEVEN GIFFORD
ONTARIO LAND SURVEYOR.

DATE: March 15, 2022

GIFFORD, HARRIS SURVEYING LTD.
ONTARIO LAND SURVEYORS
255 Glen Miller Road, Unit 1, Trenton, Ontario K8V 5P8
613-392-2177 • 1-877-394-6646

RUTH FERGUSON AULTHOUSE
REGISTERED PROFESSIONAL PLANNER
R.P.P.
03/15/17
MEMBER OF THE ONTARIO PROFESSIONAL PLANNERS INSTITUTE
CERTIFIED PROFESSIONAL PLANNERS ASSOCIATION OF CANADA

JOB No. 818-DP

RFA PLANNING CONSULTANT INC
211 Dundas Street East, Suite 202,
Belleville, Ontario, K8N 1E2

LOWER TRENT CONSERVATION

HEARING
Ontario Regulation 163/06 Permit Application: RP-23-055

Property Owner: 2852243 Ontario Inc.
Agent: Amanda Redden– Jewell Engineering
Eastfields Subdivision Lands (37 B Durham Street N)
Village of Colborne, Cramahe, Concession 2, Part of Lot 29

Presented to: Lower Trent Region Conservation Authority Hearing Board
Presented by: Gage Comeau, Manager, Watershed Management, Planning & Regulations

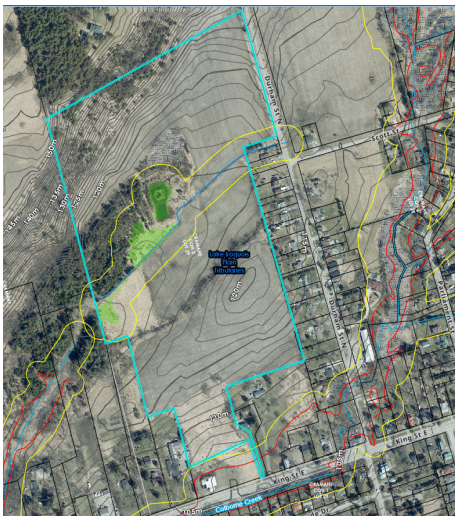
Date: July 13, 2023

Contents

2

Subject Property

- Property located to the North of King Street and East of Durham Street North in Colborne
- Small Wetlands and 2 tributary streams cut through the centre of the parcel



Subject Property

Subject Property – Reach 2

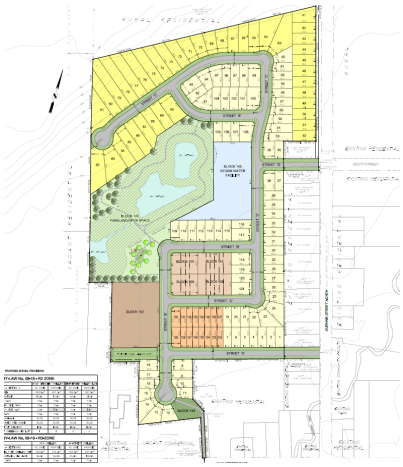
5

Subject Property -Reach 3A Photos

6

Background Considerations

- Draft Plan of Subdivision circulated to LTC in 2017
- 202 total units proposed
- LTC staff recommended approval at the time of submission
- Subdivision recirculated under a new owner in 2021 – LTC noted our comments were still relevant/applicable
- Notice of decision provided in April 2022



Background Considerations -Redline Submission

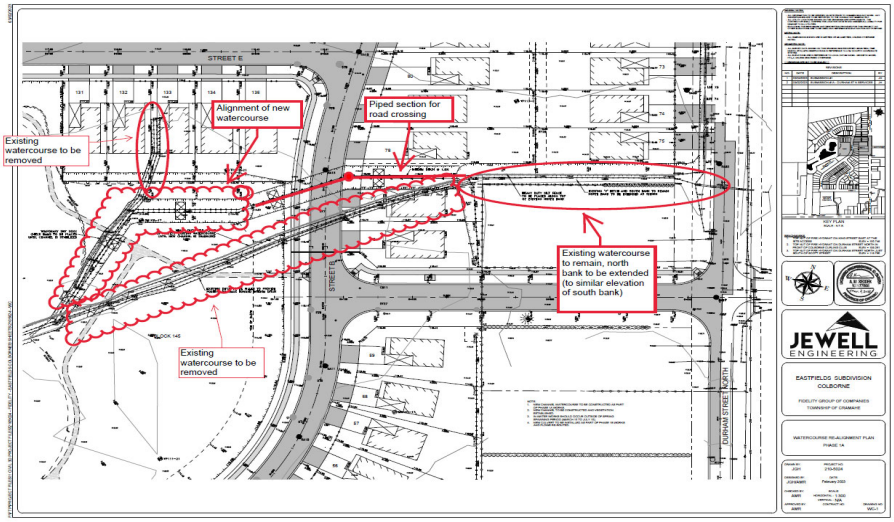
- Preconsultation meeting in September 2022
- Formal circulation of the Redline application on December 8, 2022
  - Purpose of the redline was to revise the overall road network, the type and positioning of 212 residential units and the location of the stormwater and parkland blocks
  - EIS Addendum showed a watercourse feature not present in the 2017 EIS submission or plans
  - Watercourse alteration/realignment proposed as part of Redline submission
  - February 2022 - Staff recommended deferral on the Redline submission until all features were mapped – noted requirement for permit related to the watercourse alteration/realignment

Background Considerations -Redline Submission

- April 2023 – staff were circulated on a second Redline submission
- New set of plans illustrated all 212 units could be accommodated without an alteration to the watercourse features
- Staff provided comments in support of the revised plans and second Redline submission

9

Development Proposal



10

Ontario Regulation 163/06 Policy Document

- **General Policies**
- c) Susceptibility to natural hazards is not increased nor new hazards created (e.g., there will be no impacts on adjacent properties with respect to natural hazards).
- h) There are no adverse hydraulic or fluvial effects on rivers, creeks, streams or watercourses;
- i) There are no adverse effects on the hydrologic function of wetlands; and,
- k) the control of flooding, erosion, dynamic beaches, pollution and/or the conservation of land is not adversely affected during and post development.

- **Section 7.2.1 Interference with a Watercourse**
- 1) Interference with a watercourse shall not be permitted.
- 2) Proposals for channelization and/or realignment will not be considered where the purpose of the proposal is to increase the development potential on the lands.

11

Staff Conclusion

Based on a review of the relevant policies that are applicable to this proposal, staff are not in a position to support the application as it does not conform with the policies.

Permit Application: RP-23-055

- Permit Application received: March 7, 2023
- Complete Application: May 26, 2023
- Denial Letter: May 26, 2023
- Request for Hearing: May 26, 2023
- Notice of Hearing: June 6, 2023
- Hearing Date: July 13, 2023

Fidelity Group

EASTFIELDS SUBDIVISION – WATERCOURSE RE-ALIGNMENT

PERMIT APPLICATION HEARING

JULY 13, 2023

JEWELL ENGINEERING

PERMIT APPLICATION

- Applicant:
  - Fidelity Group
- Location:
  - Eastfields Subdivision, Durham St. N, Colborne
- Permit Application RP-22-029:
  - To permit minor watercourse re-alignment/alterations within an area regulated by the Authority in order to facilitate efficient development and use of lands at Eastfields Subdivision
- Objective:
  - To obtain issuance of a permit based on the complete application submitted to LTC in March, 2023.

JEWELL ENGINEERING

PERMIT APPLICATION

- Supporting Documentation provided with the Permit Application:
  - Cover Letter/Project Description – Jewell Engineering – April 2023
  - Environmental Impact Study Review – Cambium Inc. – April 2023
  - DFO Review & Letter of Advice– April 2023
  - Detailed Drawings of Existing & Proposed Watercourse – Jewell Engineering – April 2023
  - Stormwater Management Report – Jewell Engineering – February 2023

JEWELL ENGINEERING

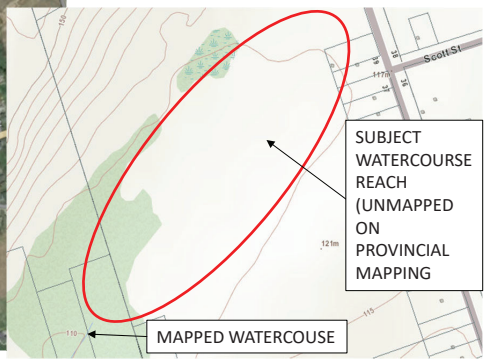
PRE-CONSULTATION

- Lower Trent Region Conservation Authority
  - Staff was consulted throughout the process to ensure an understanding of project requirements and intent
  - Consultation with staff identified points of concern to guide the proposed design and selection of the consultant team
- Department of Fisheries and Oceans (DFO):
  - The proposed solution was submitted to DFO for review
  - Subsequent meetings and written communication to ensure a thorough understanding of the proposal
  - DFO supports the proposal & provided Letter of Advice

JEWELL ENGINEERING

LOCATION

- Durham St N. @ Scott St. - Colborne



JEWELL ENGINEERING

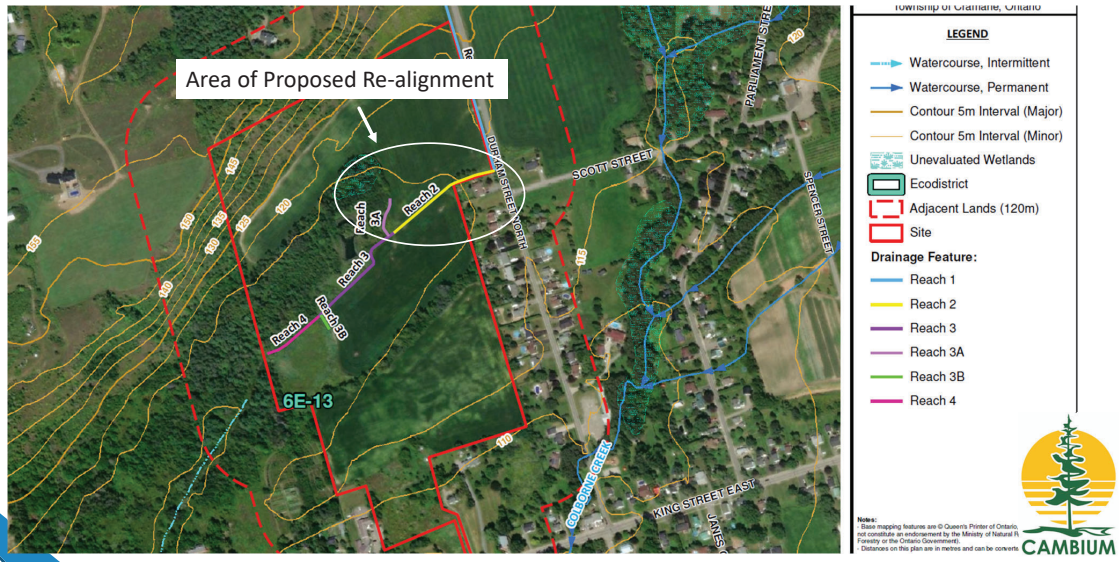
HISTORICAL IMAGERY

- Historical imagery from 1962 shows no visible drainage course on site
- EIS characterized the drainage course as an excavated feature

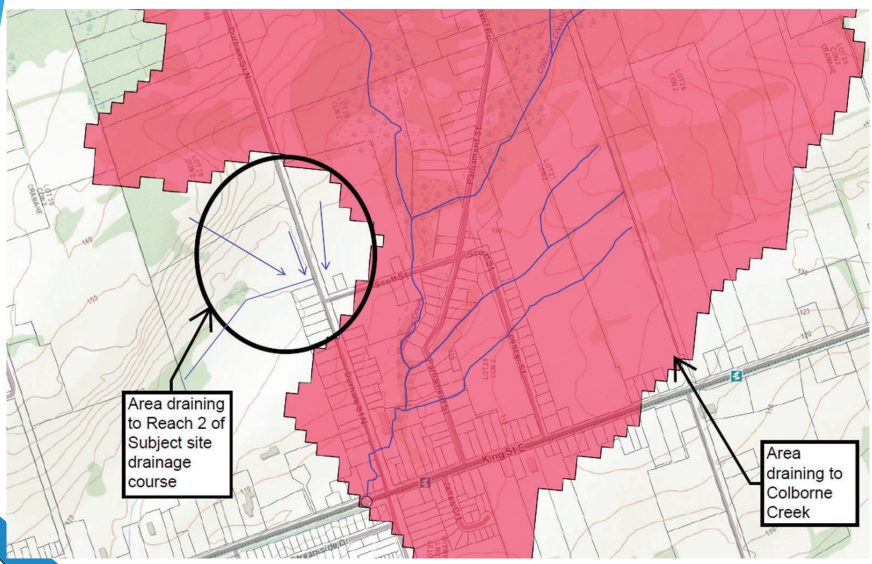
CAMBIUM

Cambium EIS, 2021

EXISTING DRAINAGE COURSE



EXISTING DRAINAGE COURSE



- receives minimal flows due to proximity to Colborne Creek system

JEWELL ENGINEERING

EXISTING DRAINAGE COURSE

- Commences on north side of 39 Durham St N
- Flow from upstream agricultural field is concentrated by the 450mm cross-culvert under Durham St (equivalent to driveway culvert)

Upstream View from Culvert

Google, 2014

JEWELL ENGINEERING

EXISTING DRAINAGE COURSE

- Culvert discharges through ditch to the west, running alongside a residential property

Reach 2 - Downstream View from Culvert

Cambium EIS, 2021

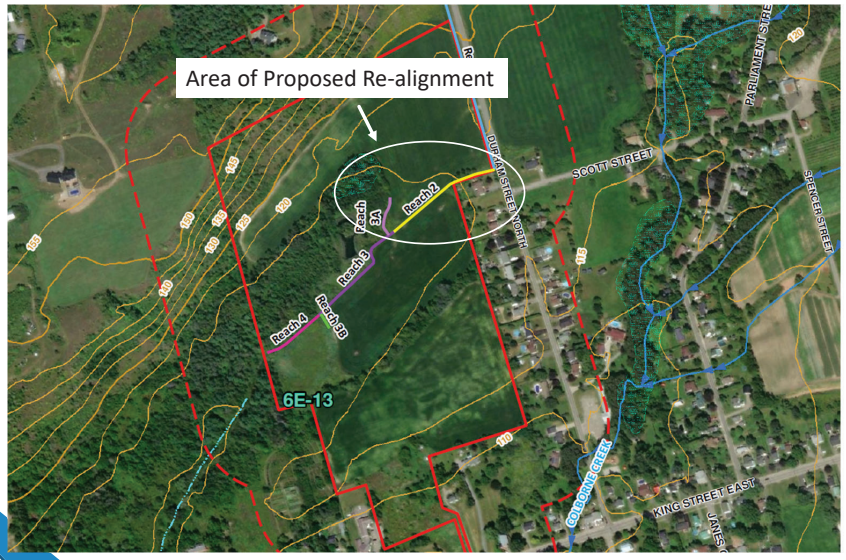
JEWELL ENGINEERING

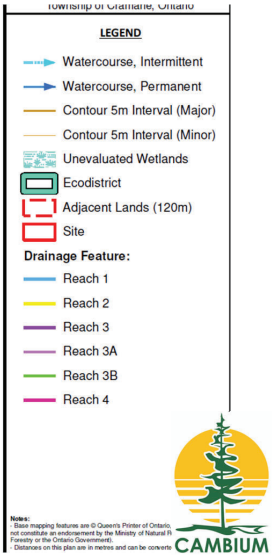
EXISTING DRAINAGE COURSE

- Drains west through active agricultural field in poorly protected channel
- Discharges at west side of property to wetland/mapped tributary of Colborne Creek

Cambium EIS, 2021

EXISTING DRAINAGE COURSE





SURFACE WATER & AQUATIC HABITAT ASSESSMENT

Reach 2

- No groundwater contributions
- Primarily receives roadside drainage
- Unlikely to exhibit a permanent flow regime
- Dug channel
- 3 - 4” flow depth
- 0.3 – 1.0m surveyed channel depth
- In-stream cover includes phragmites
- Choked with in-channel vegetation and no course substrates therefore highly unlikely to support fish species

Cambium EIS, 2021

CAMBIUM

13

SURFACE WATER & AQUATIC HABITAT ASSESSMENT

Reach 3A

- Intermittent flow
- Dug channel
- 1.5” - 4” flow depth
- 0.1 – 0.2m surveyed channel depth
- In-stream cover includes phragmites
- Choked with in-channel vegetation and no course substrates therefore highly unlikely to support fish species

Cambium EIS, 2021

CAMBIUM

14

ENVIRONMENTAL OBSERVATIONS SUMMARY

Proposed alteration not anticipated to have negative effects based on low sensitivity of existing drainage course:

- Man-made
- Dug Channel
- Limited substrates/habitat features
- Choked with vegetation
- DFO reviewed and accepted the proposal

Cambium EIS, 2021

CAMBIUM

15

ENVIRONMENTAL RECOMMENDATIONS

Recommendations:

- Provide Erosion & Sediment Control Plan
- In-water works outside of March 15 – July 15
- Portions can be removed, piped or re-aligned given that pre-development flows are maintained
- Lack of Fish community presence to be confirmed prior to construction
- Native non-invasive species to be used for riparian areas

Cambium EIS, 2021

CAMBIUM

16

LTC POLICY

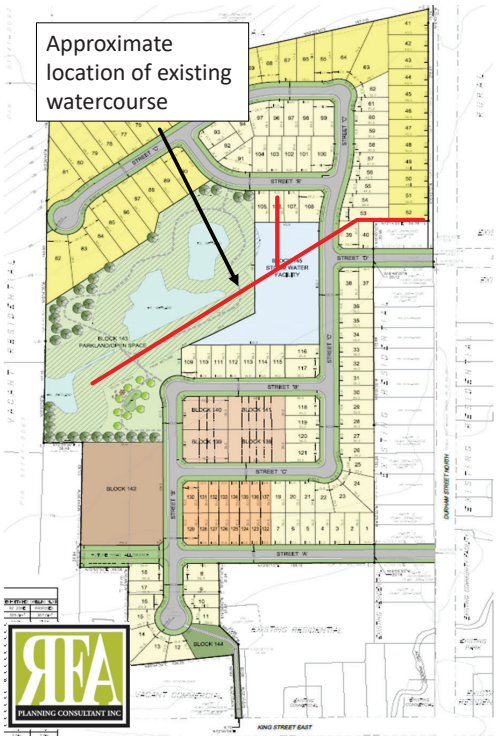
LTC O. Reg. 163/07 Policy Document defines a watercourse as:
"… an identifiable depression in the ground in which a flow of water regularly or continuously occurs"

Section 7 of LTC Policy Document that states "no person shall straighten, change, divert or interfere in any way with the existing channel of a river, creek, stream, or watercourse"

This drainage course is a man-made dug channel receiving roadside drainage with little environmental value.

CAMBIUM

17



PROJECT HISTORY – CURRENTLY APPROVED DRAFT PLAN

- Eastfields Subdivision was draft plan approved in April 2022 based on the plan and supporting documents prepared by the previous Owner in 2017
  - LTC comments indicated that the drainage ditch should be recognized as a watercourse
- The currently approved draft plan does not consider protection or conveyance of the drainage feature(s) on site
  - No easements, blocks etc. are provided
  - The existing drainage course crosses through proposed lots and the SWM facility

JEWELL ENGINEERING

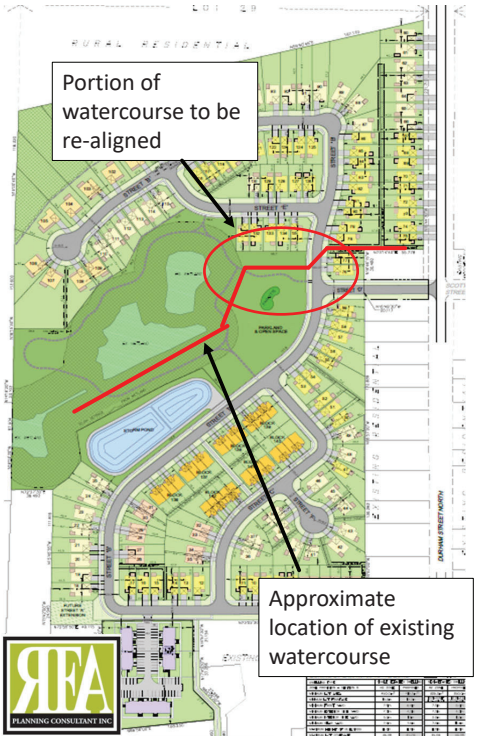
18

RED-LINE PLAN

- A red-line draft plan has been prepared to make several improvements to the original plan:
  - Accommodate the drainage feature on-site
  - Shift the multi-residential block closer to King St
  - Revise the road pattern at the south end of the site to facilitate maintenance of existing topography to the greatest extent possible
  - Provide a prominent centralized parkland block

JEWELL ENGINEERING

19



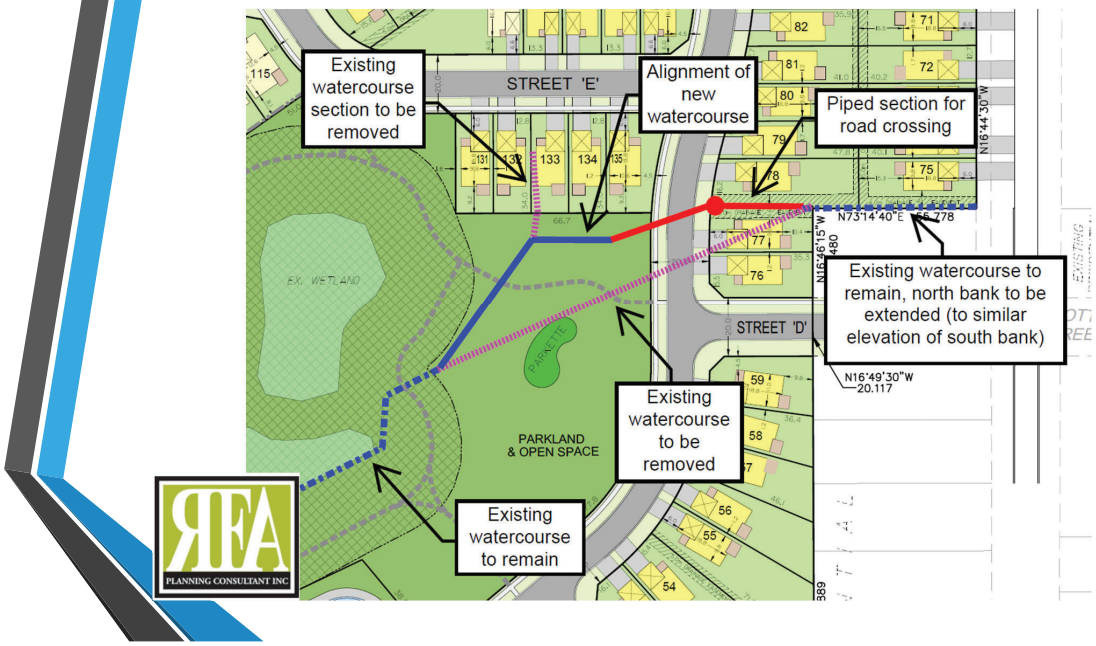
RED-LINE PLAN

- To facilitate this plan requires:
  - Culvert crossing to convey drainage under Street B
  - Minor re-alignment of upstream section to convey the drainage course within an easement for future maintenance access
  - Minor re-alignment of downstream section to provide optimal unsegregated parkland space
  - Elimination of small north-south branch (1.5” – 4” deep)
  - Board Approval for the re-alignment work

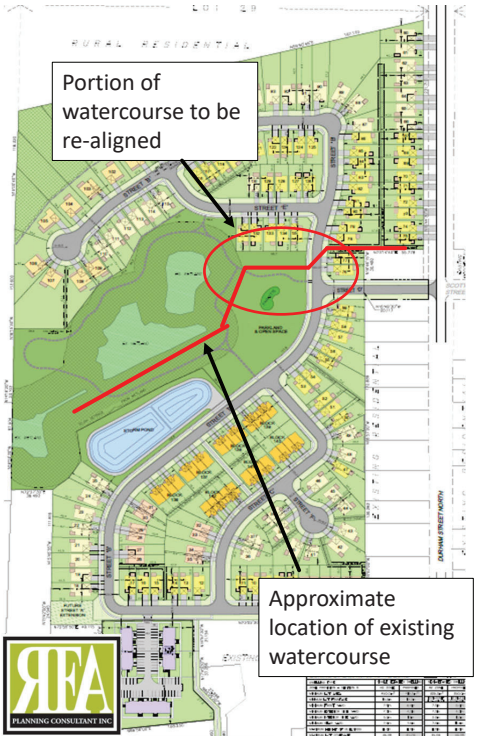
JEWELL ENGINEERING

20

PROPOSED MODIFICATIONS – REACH 2 & 3A



21



RED-LINE PLAN

- Other options have been considered but result in:
  - Segregated parkland block with a smaller functional area
  - High cost (potentially prohibitive) for lots 131-135 as large retaining walls would be required to maintain existing drainage course
  - Results in inefficient and costly development of the lands (Less affordable housing for future buyers)
  - Still requires disturbance of the drainage course for installation of culvert crossing on Street B
  - Still require bank modifications to the drainage course as the lands in this area need to be filled ~2m in order to accommodate servicing of the subdivision lands

22

RED-LINE PLAN

- The proposed plan provides:
  - Creation of riparian areas (native grasses, shrubs, forbs and trees) to provide terrestrial habitat, shade, and bank stability
  - Temperature benefits – maintaining cool water to contribute to downstream tributary via longer piped section
  - Reduction in urban sprawl through efficient use of land
  - Provision of prominent centralized park block with unsegregated use-able area
  - Permits efficient and affordable development of the lands
  - Efficient management of drainage

JEWELL ENGINEERING

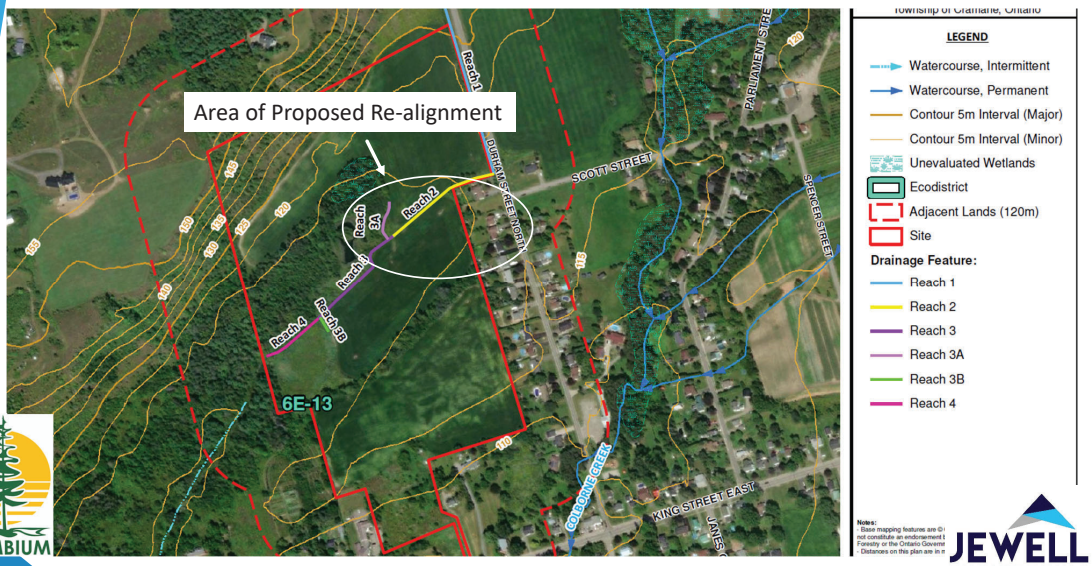
SUMMARY

The existing watercourse being modified/removed is:

- Man-made
- A Dug Channel
- Has limited substrates/habitat features
- 1.5” - 4.0” flow depth
- Primarily receives roadside drainage

JEWELL ENGINEERING

SUMMARY

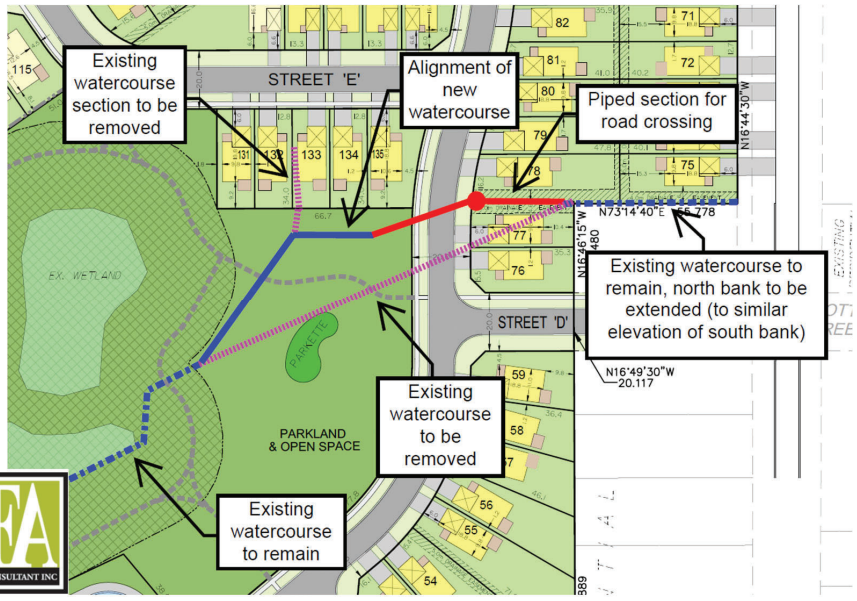


CAMBIUM

JEWELL ENGINEERING

25

PROPOSED MODIFICATIONS – REACH 2 & 3A



RFA PLANNING CONSULTANT INC

JEWELL ENGINEERING

26

SUMMARY

- The proposed re-alignment provides:
  - Creation of riparian areas (native grasses, shrubs, forbs and trees) to provide terrestrial habitat, shade, and bank stability
  - Temperature benefits – maintaining cool water to contribute to downstream tributary via longer piped section
  - Reduction in urban sprawl through efficient use of land
  - Provision of prominent centralized park block with unsegregated use-able area
  - Permits efficient and affordable development of the lands (no unnecessary retaining walls needed for lots 131-135)
  - Efficient management of drainage
  - DFO reviewed the plan and supported it

JEWELL ENGINEERING

27

CONSULTATION SERVICES PROVIDED BY

RFA PLANNING CONSULTANT INC

Ruth Ferguson-Aulthouse, MCIP RPP

President

CAMBIUM

Jeremy Prahl, B.Sc., EP, CAN-CISEC - Senior Ecologist

Kristina Domsic, B.E.S - Ecologist

JEWELL ENGINEERING

28

LOWER TRENT CONSERVATION

STAFF REPORT

Date: June 23, 2023
To: Lower Trent Conservation Hearing Board
Re: Ontario Regulation 163/06 application for permission RP-23-108 to develop within the Shelter Valley Creek floodplain
Prepared by: Gage Comeau, Manager, Watershed Management, Planning and Regulations

---

DATE

June 23, 2023

DATE RECEIVED

Permit application received April 27, 2023
Permit application submission deemed complete – May 19, 2023
Request for Hearing received May 29, 2023

APPLICANT

Tom Trumble (Property Owner)
Elliott Fledderus, P. Eng. with Jewell Engineering Inc. (Agent)

(Copy of application, Elevations and Conceptual plan and Jewell Engineering Inc. Floodplain Opinion Letter Report ***Appendices 1-3***)

LOCATION

2420 Shelter Valley Road
Township of Alnwick/Haldimand, Northumberland County
Geographic Township of Haldimand, Concession 3, Part of Lot 12
(Map attached, see **Appendix 4**)

OVERVIEW

Lower Trent Region Conservation Authority (LTC) received an application to undergo the placement of fill material (600 m3) within the regulated area associated with the Shelter Valley Creek floodplain. The proposed development is considered major development within the floodplain and does not comply with LTC's Ontario Regulation 163/06 Policy Document (February 2022) and therefore, a permit cannot be issued by staff.

PROPOSAL

The proponent is seeking approval from LTC to undergo site preparation and alterations including fill placement associated with future development (i.e., construction of a single-family dwelling) in the Shelter Valley Creek floodplain on the subject property. The site plan and elevation survey (***Appendix 2***) shows the structure fully within the floodplain (167.00 metres CGVD1928).

SUMMARY

LTC is responsible for the administration of Ontario Regulation 163/06 – *Lower Trent Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*. In order to guide the implementation of Ontario Regulation 163/06 made pursuant to Section 28 of the *Conservation Authorities Act*, the LTC Board of Directors has approved policies, most recently updated in February 2022. Where a proposal for development or alteration follows the approved policies or is not a significant deviation from the approved policies, designated authority staff may grant permission.

The vacant property is located within the Shelter Valley Creek floodplain and the current proposal is to undergo site preparation and alterations including fill placement associated with future development of the lot.

The proposed works involves the placement of approximately 600 m^3 of engineered fill material and triggers the below noted policies with respect to development in the One Zone Regulatory Floodplain for Shelter Valley Creek. Designated staff are not in a position to grant approval of the Ontario Regulation 163/06 permit application as it does not conform with the policies.

From the information available to LTC, the Shelter Valley and Barnum House Creeks Floodplain Study (1978) by Crysler & Lanthem Ltd., illustrates that the subject property is in the floodplain for Shelter Valley Creek. A topographic base plan provided to LTC for review confirmed the property was within the regulatory floodplain of Shelter Valley Creek (See **Appendix 2**).

Key issue: A permit from LTC is required for the proposed development as they are to take place within a regulated area as described in Ontario Regulation 163/06. Specifically, within the Shelter Valley Creek floodplain (Section 2 (1) (c) of the Regulation, refer to ***Appendix 5*** for a copy of O. Reg. 163/06).

Lower Trent Region Conservation Authority
Ontario Regulation 163/06 Policy Document (February 2022)

Below are the applicable policies that are relevant to this permit application:

5.2.1.1 Development within One-Zone Regulatory Floodplain of River or Stream Valleys

1) Development within the Regulatory floodplain shall not be permitted.
2) Placement of fill, flood hazard protection and/or bank stabilization works to allow for future/proposed development or an increase in development envelope within the Regulatory floodplain shall not be permitted.

(LTC's 2022 Policies attached, see ***Appendix 6*** – Relevant sections only).

The applicant was notified that staff could not approve the permit application and of their right to a Hearing before the Authority's Board of Directors (see LTC Letter of Denial, May 26, 2023– ***Appendix 7***).

The proponent requested LTC staff to proceed with the necessary arrangements for a Hearing (June 6, 2023 Notice of Hearing scheduled for July 13, 2023 – ***Appendix 8***).

The proponent was provided the Hearing Guidelines.
(LTC's 2022 Hearing Guidelines attached, see ***Appendix 9***).

DEVELOPMENT WITHIN HAZARD LANDS

The proposed works would involve the placement of fill to allow for future/proposed development within hazard lands, specifically the Shelter Valley Creek floodplain. This development activity is considered "development" pursuant to the *Conservation Authorities Act*. Section 2 (1) c. of Ontario Regulation 163/06, made under the authority of Section 28 of the *Conservation Authorities Act* states that no person shall undertake development or permit another person to undertake development in or on the areas within the jurisdiction of the Authority that are hazard lands. The Authority may grant permission for development in or on the areas described in subsection 2 (1) (c) if, in its opinion, the control of flooding, erosion, dynamic beaches, pollution or the conservation of land will not be affected by the development.

This development proposal shows site alterations and the placement of engineered fill material in the Shelter Valley Creek floodplain.

The applicant has submitted the requested documentation for a complete application and the submission has been deemed complete.

Based on a review of the relevant policies that are applicable to this proposal, staff are not in a position to support the application as it does not conform with the policies. Please be advised, a peer-review of the engineering letter report was completed by JKN Consulting for LTC to provide comments related to this submission and the relevant general policies (refer to **Appendix 10**). Specifically, that the development activities would have limited or low potential impact to adjacent properties (i.e., will not increase the existing hazard or create new hazards,

and the control of flooding is not adversely affected during and post development.

STAFF CONCLUSION

Hazard land management was delegated by the Province to LTC through the administration of Ontario Regulation 163/06 made pursuant to the *Conservation Authorities Act*. Through the administration of this Regulation, LTC staff review development proposals in an effort to limit development and protect people and property in flood susceptible areas. Overall, it is the goal of the Regulation Policy document and staff to minimize or prevent the impact of flooding. Deviation from the policies represents a risk that requires careful consideration.

The proposal requires a permit from LTC pursuant to Ontario Regulation 163/06 and does not conform to LTC's Ontario Regulation 163/06 Regulation Policy Document (see ***Appendix 6***). Limiting development proposals such as this is intended to minimize the risk of property damage/loss and investment in an area that is susceptible to natural hazards. Therefore, staff are recommending denial of the Ontario Regulation 163/06 permit.

LOWER TRENT
CONSERVATION

714 Murray Street, R.R. 1, Trenton, Ontario K8V 0N1
Tel: 613-394-4829 Fax: 613-394-5226 Website: www.ltc.on.ca Email: information@ltc.on.ca
Registered Charitable Organization No. 107646598RR0001

Application

Development, Interference with Wetlands & Alterations to Shorelines & Watercourses
(Pursuant to Ontario Regulation 163/06)

Please read, complete each section as required, date and sign this application

Project Description

Project Location (Civic Address): 2420 Shelter Valley Road		
Municipality: Alnwick Haldimand		
Nearest Intersection: Shelter Valley Road and Cooney Lane		
Assessment Roll Number*: 1450116040071000		
Lot: Part Lot 12	Concession: 3	Ward: Haldimand

*Note: The Roll Number can be found from your Property Assessment Notice, real estate agent, or online Map Viewer at www.ltc.on.ca (click on Planning & Permits)

Project Details

Description of Proposed Works:
Placement of fill within ineffective flow area of existing floodplain.

Amount & type of fill (m^3) to be added/removed/moved:
Approximately 600 cubic metres of engineered fill material.

Note: Fill is defined as earth, sand, gravel, topsoil, building materials, rubble, rubbish, garbage or any other material whether similar to or different from any of the aforementioned materials, whether originating on the site or elsewhere, used or capable of being used to raise, lower, or in any way affect or alter the contours of the ground.

Proposed Start date (YYYY/MM/DD):	Anticipated Date of Completion:
2023/07/01	2023/09/15

Has a previous application to Lower Trent Conservation been filed on this property? If yes, please provide previous permit number.

☐ Yes
☒ No

Property Owner	
Name: Marion Trumble Estate (represented by Mr. Tom Trumble)	
Mailing Address: [redacted]	
City: [redacted]	Postal Code: [redacted]
Phone #: [redacted]	Cell #:
Email: [redacted]	Fax #:

Agent	
☐ Same as Property Owner	
Name: Elliott Fledderus, P. Eng.	
Company/Organization: Jewell Engineering Inc.	
Mailing Address: 1-71 Millennium Pkwy	
City: Belleville, ON	Postal Code: K8N 4Z5
Phone #: (613) - 969 - 1111	Cell #:
Email: elliott@jewelleng.ca	Fax #:

Note: Correspondence will be sent to agent, when applicable.

Approved Permit Circulation

☒ email pdf copy ONLY ☐ mail hardcopy ONLY ☐ Pickup at LTC office ***appointment required***

Pre-application Consultation

A pre-application consultation may be in the form of a phone conversation, a meeting, email message, and/or site visit.

Have you conducted any pre-application consultation with a Lower Trent Conservation staff member to determine site issues and technical requirements for a "complete" application?

☒ **Yes (please indicate method below)** LTC File Number:

☒ by phone ☐ by meeting ☒ by email ☐ by site visit

☐ **No**

Further Considerations

Is there a violation on this property under Ontario Regulation 163/06?

☒ No ☐ Yes (provide details below) ☐ Don't know

If yes, please provide file # - ENF-

Are *Planning Act* or Municipal approvals required?

☐ No ☐ Don't know

☒ Yes (check all that apply)

☐ Official Plan Amendment ☐ Minor Variance ☐ Zoning ☐ Consent

☐ Draft Plan of Subdivision ☒ Building Permit ☐ Site Plan ☒ Septic ☐ Other

Do you authorize LTC to circulate approved permit to Municipal Planning & Building Officials? ☐ No ☒ Yes

Are there any other required Approvals? (e.g. MNRF, Fisheries and Oceans Canada)

☒ No ☐ Yes (please select below) ☐ Don't know

☐ MNRF ☐ Parks Canada ☐ DFO

Notice of Collection

Pursuant to the *Municipal Freedom of Information and Protection of Privacy Act*, the personal information contained on this form is collected under the authority of the *Conservation Authorities Act*. This information is used to assess applications and, where approved, issue the Development, Interference with Wetlands & Alterations to Shorelines and Watercourses permit. Information on this form may be disclosed to Government and Municipal agencies for review and comment, or to members of the public through the Freedom of Information process. Questions about the collection of information should be directed to the Chief Administrative Officer, Lower Trent Conservation, 714 Murray Street, Trenton, ON, K8V 0N1, 613-394-4829.

Any false or misleading statement made on this application will render null and void any permission granted.

I, the owner, Tom Trumble (Name) of _____ (Organization (if any))

solemnly declare that to my best knowledge and belief, all of the above information, plans and submissions to be true, valid and current. I further accept the aforementioned inclusions, terms, and conditions to be binding upon the registered owner(s) of the property and all assigned agents, contractors, and/or constructors acting on my behalf. My signature acknowledges the right to exercise binding authority.

*Signature of Owner: [redacted]	Date: Apr. 25, 2023

* Signature or written authorization from the property owner is mandatory

Signature of Agent:	Date: Apr. 25, 2023

GENERAL CONDITIONS

1. By signing this application, consent is given to Lower Trent Conservation (herein referred to as LTC), its employees and other persons as required by LTC, to access the property for the purpose of inspection, obtaining information, and/or monitoring any and all works, activities, and/or construction pertaining to the property in addition to the works as approved under cover of any permit issued by LTC.

2. The owner and agent agree:
   a. To indemnify and save harmless LTC and its officers, employees, or agents, from and against all damages, loss, costs, claims, demands, actions and proceedings, arising out of or resulting from any act or omission of the owner and/or agent or any of their employees or contractors relating to any of the particulars, terms, or conditions of this permission;
   b. This permission shall not release the owner/agent from any legal liability or obligation and remains in force subject to all limitations, requirements, and liabilities imposed by law; and,
   c. All complaints arising from the execution of the works authorized under this permission shall be reported immediately by the owner/agent to LTC. The owner/agent shall indicate any action which has been taken, or is planned to be taken, if any, with regard to each complaint.

3. Permits granted by LTC are not transferrable and are issued to the current owner of the property only.

4. The owner/agent agrees that, should the works be carried out contrary to the terms of this permission, LTC may enter onto the property and cause the terms to be satisfied at the expense of the owner.

5. The works shall be carried out as per the approved plans and specifications submitted in support of the application and as amended by the approval of this permission.

6. The owner/agent agrees to install and maintain all sediment controls as directed by LTC staff, until all disturbed areas have been stabilized.

7. All disturbed areas shall be seeded, sodded, or stabilized in a manner acceptable to LTC as soon as possible, and prior to the expiry of this permission.

8. The owner/agent agrees to maintain all existing drainage patterns, and not to obstruct external drainage from other adjacent private or municipal lands.

9. The owner/agent agrees to contact LTC once the development has commenced so an inspection of the development can be undertaken.

10. Permits granted by LTC do not replace building permits or any other permits or approvals issued through Municipal offices and/or other levels of Government. A permit under Ontario Regulation 163/06 does not constitute LTC approval of any related *Planning Act* applications. Separate approval of all related applications must be obtained from their respective agency and LTC.

11. Permits issued by LTC are valid for a period of two (2) years from the date of issue. After a permit has expired, a new application must be submitted. The current fee schedule during submission applies.

12. It is the responsibility of the owner/agent to ensure that a valid permit is in effect at the time the work is occurring.

LANDOWNER AUTHORIZATION FORM

Subject Property		
Civic Address: 2420 Shelter Valley Road		
Municipality: Alnwick Haldimand		
Assessment Roll Number: 1450116040071000		
Lot: Part Lot 12	Concession: 3	Ward: Haldimand

If an application is to be submitted by a solicitor or agent on behalf of the owner(s), this Landowner Authorization must be completed and signed by the owner(s). If the owner is a corporation acting without agent or solicitor, the application must be signed by an officer of the corporation and the corporation's seal (if any) must be affixed.

If the application is to be prepared by a solicitor or agent, authorization should not be given until the application and its attachments have been examined and approved by you, the owner(s).

I/we Tom Trumble

hereby authorize Jewell Engineering Inc.

to provide as my agent any required authorization or consents, to submit the enclosed application to Lower Trent Conservation, and to appear on my behalf at any hearing(s) of the application and to provide any information or material required by the Lower Trent Conservation Board of Directors relevant to the application for purposes of obtaining a permit to develop, interfere with a wetland or alter a shoreline or watercourse, in accordance with the requirements of Ontario Regulation 163/06 as amended.

Signature of Owner: [redacted] Date: Apr. 25 2023

Signature of Agent: Date: Apr. 25, 2023

SUBMISSION REQUIREMENTS

Permit applications may be submitted by email to permits@ltc.on.ca. Application fees will be invoiced by email. If no email address is available, other payment options will be discussed. Current application fees can be found on our fee schedule at www.ltc.on.ca or contact Lower Trent Conservation at 613-394-4829. Applications will not be processed until the fee is paid in full. **The application fee is non-refundable.**

FOR OFFICE USE ONLY	
Application File Number:	Permit File Number:
Subwatershed:	Regulated Feature:
Permit application rec'd:	Application complete:
Deposit Required: Ontario Land Surveyor ($500) ☐ Yes ☐ No	Coastal Engineer ($1,000) ☐ Yes ☐ No
Amendment request rec'd:	Amended application complete:

Fee Required:

☐ Routine	$100
☐ Minor	$220
☐ Standard	$550
☐ Complex (require review of 1 technical study)	$825
☐ Complex (require review of 2 or more technical studies)	$1,100
☐ Permit amendment (administrative)	$100
☐ Permit amendment (significant) - 1/2 original application fee	_____
☐ Compliance permit - double the application fee	_____
☐ Restoration agreement - double the application Fee	_____
☐ Deposit	_____

Amount Received: _____ Date Received: _____

Method of Payment: ☐ Cheque ☐ Credit Card ☐ Cash

Deposit Returned: _____ Date Returned: _____

☐ **Permission for Minor Works:**

- ☐ Undertake minor landscaping involving the placement, removal or re-grading of material up to 20m^3 (minor fill)
- ☐ Minor shoreline protection up to 20m^3
- ☐ Undertake watercourse or shoreline alteration involving less than 20m^2 (minor alteration)
- ☐ Construct a non-habitable accessory structure up to 10m^2
- ☐ Construct a habitable addition up to 10m^2
- ☐ Construct a deck up to 23m^2
- ☐ Install a pool up to 10m^2

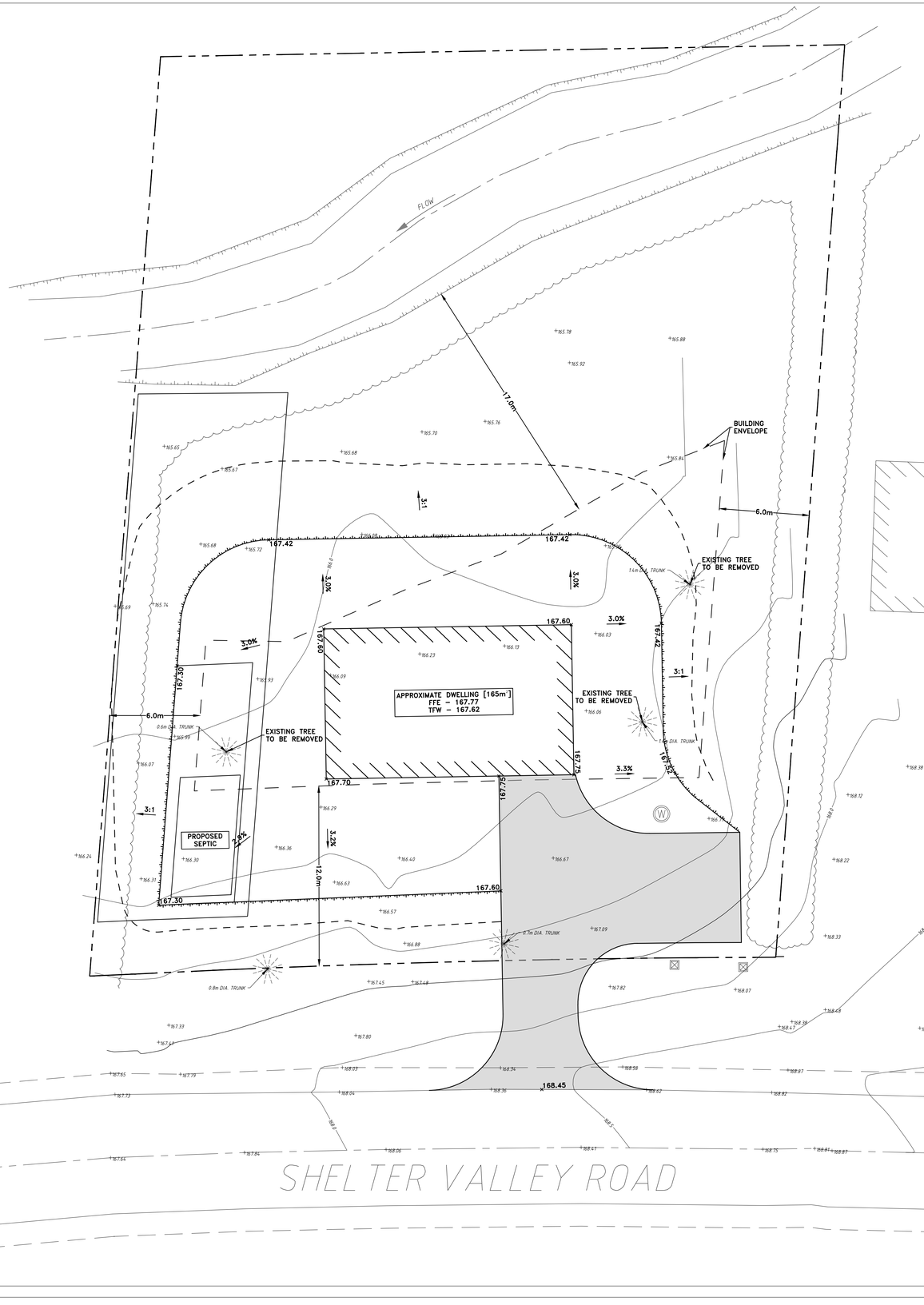
☐ **Permission for Standard or Complex Permit:**

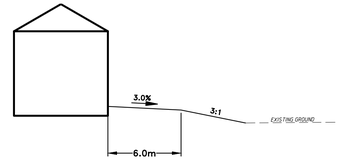
- ☐ Construct, reconstruct, erect or place a building or structure (greater than 10m^2)
- ☐ Change building/structure so that it increases its size by 10m^2 or more, or increases the number of dwelling units
- ☐ Temporary or permanent placing, dumping or removal of any material originating on the site or elsewhere greater than 20m^3
- ☐ Change or interfere with a wetland
- ☐ Change or interfere with a watercourse
- ☐ Shoreline protection work
- ☐ Construct a deck greater than 23m^2
- ☐ Install a pool greater than 10m^2

Permit Approval:

Amendment:

04/19/2023





TYPICAL BUILDING ENVELOPE DETAIL
N.T.S.

GENERAL NOTES:

- ALL INFORMATION TO BE VERIFIED ON SITE PRIOR TO COMMENCING ANY WORK. ANY DISCREPANCIES ARE TO BE REPORTED TO THE CONSULTANT IMMEDIATELY.
- ALL UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL CONFIRM THE LOCATION ON SITE AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL UTILITIES
- EXCLUDING THE BENCHMARK AND DESCRIPTION PROVIDED FOR THIS PROJECT, NO OTHER ELEVATIONS ARE TO BE USED AS A REFERENCE ELEVATION FOR ANY PURPOSE.

METRIC NOTE:

- ALL DIMENSIONS SHOWN ARE IN METRES OR MILLIMETRES, UNLESS OTHERWISE NOTED.

GEOMETRIC NOTE:

- ALL SURVEY DATA SHOWN ON THIS DRAWING WAS RECORDED USING REAL-TIME KINETIC (RTK) GPS OBSERVATIONS IN REFERENCE TO UTM 18 NORTH COORDINATE SYSTEM.
- ALL ELEVATIONS ARE IN REFERENCE TO LOCAL DATUM NAD83 - GEODETIC MODEL HT2_0, UNLESS DESCRIBED OTHERWISE.

* * DRAWINGS ARE NOT TO BE SCALED * *

REVISIONS

NO.	DATE	DESCRIPTION	BY

LEGEND

EXISTING	DESCRIPTION	PROPOSED
	PROPERTY LINE	
× 166.03	SPOT ELEVATION	×167.75
	GRADIENT	3.0%
	DIRECTION OF DRAINAGE	→
	TOP OF SLOPE	
	TOE OF SLOPE	

FFE - FINISHED FLOOR ELEVATION
TFW - TOP FOUNDATION WALL ELEVATION

0 15 30 Feet

0 5 10 Metres

JEWELL ENGINEERING

TOM TRUMBLE
2420 SHELTER VALLEY ROAD

GRAFTON, ONTARIO

CONCEPT PLAN

DRAWN BY: MB	PROJECT NO: 220-5224	
DESIGNED BY:	DATE: April 2023	
CHECKED BY: NG	SCALE: HORIZONTAL - 1:150 VERTICAL - N/A	
APPROVED BY:	CONTRACT NO:	DRAWING NO: CP-1

F:\FTP\PROJECT FILES\TRUMBLE, TOM\CAD\3 - SHEETS\220524 - LG-1

JEWELL ENGINEERING

April 11, 2023

Attn: Tom Trumble

RE: Flood Assessment Opinion Letter
Jewell Engineering File No. 220-5224

Mr. Trumble,

Jewell Engineering Inc. (JE) has completed this opinion letter to provide recommendations regarding potential flood concerns as it relates to your lot at 2420 Shelter Valley Road. It is understood that your objective is to build a residential dwelling on the property for your future retirement home.

Per LTC correspondence, the lot currently has elevations below the regulatory flood limit. For a dwelling to be placed on the subject lot, it must:

1. present no negative impacts to adjacent properties, and
2. have floodproofing measures to ensure the home is protected from the flood hazard in the regulatory storm event.

The objective of this *Flood Assessment Opinion Letter* is to discuss whether a dwelling on the subject property meets these requirements.

As part of our assessment, we reviewed the following information:

- a site-specific survey using GPS and a total station,
- LTC's regulatory flood elevation and correspondence,
- ineffective flow areas due to adjacent dwellings, and
- septic and well locations for the subject lot.

For a complete application, LTC requested a concept plan identifying a building footprint area, septic and well locations with relevant setbacks, and an entrance location. The concept plan is attached for your reference.

BELLEVILLE
(HEAD OFFICE)
1–71 Millennium Pkwy.
Belleville ON K8N 4Z5
Tel: 613-969-1111
info@jewelleng.ca

TOLL FREE
1-800-966-4338

KINGSTON
208–4 Cataraqui St.
Kingston ON K7K 1Z7
Tel: 613-389-7250
kingston@jewelleng.ca

OAKVILLE
214-231 Oak Park Boulevard
Oakville, ON L6H 7S8
Tel: 905-257-2880
oakville@jewelleng.ca

www.jewelleng.ca

Floodproofing Measures

The 1st objective is to ensure the proposed dwelling can be floodproofed in the regulatory storm event. A reliable floodproofing measure is engineered fill. This engineered fill material supports the slab on grade foundation for the dwelling (as discussed there will be no basement). The engineered fill will be placed to have the final floor of the building a minimum of 0.3m above the regulatory flood elevation that was provided by LTC.

The regulatory flood elevation provided by LTC is 167.0m. The proposed dwelling has a final floor elevation of 167.77m. This is more than 2 ft above the regulatory water surface elevation (WSEL). Similarly, the driveway elevation is also above the regulatory WSEL. Therefore, the building will be outside of the flood hazard, and will have safe access in all return period events as well as the regulatory storm.

With the above mitigation measures, Objective #1 is satisfied.

It is noted that Carolle Gauthier was hired for the septic design. It is understood that the lot will have a raised septic bed with an elevation 0.3m above the regulatory flood level.

Assessment of Potential Impacts on Adjacent Properties

LTC provided the flood elevation along the property, and JE used this elevation in conjunction with the topographic data to determine the depth of flooding at the location of the proposed addition. This data was used in combination with the floodline elevation provided by LTC to determine if the structure has any significant impact on the floodplain.

LTC policies do not allow placement of fill within the floodplain unless it can be demonstrated that there will be no negative impacts to the subject property or any other properties. Their policies will also trigger a board hearing, as it is our understanding that their staff do not have the authority to apply discretion on these types of applications.

The theory behind the policy is that lost storage volume within the flood system may increase nearby water surface elevations if excessive amounts of fill are placed in the overbank areas. Based on an understanding of engineering principles, similar past experience, and the reasons described below, JE has no concerns with the relatively small amount of fill needed to floodproof your proposed dwelling.

Ineffective Flow Areas:

One approach to assess potential impacts on the floodplain is to consider the cross-sectional area of the creek and its overbanks. In practice, this approach can utilize a hydraulic modeling program. In hydraulic models, the user is responsible for adding ineffective flow areas. Ineffective flow areas represent areas that offer little to no flow conveyance.

For the lot at 2420 Shelter Valley Road, there are existing buildings immediately upstream and downstream of the lot. This would require the user to establish the lot at 2420 Shelter Valley Road as an ineffective flow area. The bounding buildings would prevent water from flowing in a direct upstream to downstream flow path; rather, the water in the regulatory flood event would only spill laterally from the creek to the subject lot, and with low flow velocities.

With the subject lot functioning as an ineffective flow area in existing conditions, the proposed dwelling would have no effect on flood behavior since it does not contribute to the conveyance of the creek or its overbank flood flows.

Flood System Storage:

For the overall flood system, increases in WSELs only occur when there is a significant loss of storage relative to the size of the overall system. Hence, JE investigated the amount of proposed fill versus the flood storage available within the system.

The subject watercourse is a tributary to Shelter Valley Creek. This tributary has an 18.0 km^2 catchment area and the length of the main channel is 10.5 km. The average creek width is estimated to be 4.5m with an average channel flow depth of 1.5m in the regulatory storm event. With these characteristics, the creek channel would offer more than 70,000 m^3 of storage. Majority of storage in a regulatory storm event occurs within the overbank areas since channels typically can only contain the 2-yr flood flows. It is estimated that another 200,000 m^3 would be available in the overbanks. Therefore, the flood storage for this tributary is expected to be a minimum of 270,000 m^3. This conservatively does not include many smaller tributaries or the swamp and marsh areas that comprise roughly 8% of the watershed and would significantly increase the system storage.

The proposed dwelling would be within the southern half of the lot. The existing average elevation within the area of proposed fill is 166.25m. The average depth of fill needed to raise this land outside of the floodplain is 0.75m. With a footprint area of 750 m^2, the fill placed within the existing floodplain is 570 m^3.

For comparison, the proposed fill is 0.2% of the flood storage of the tributary, not including its sub-tributaries or swamp and marsh areas. Evidently, the proposed fill is negligible relative to the size of the creek system and would have no appreciable impact on the flood system storage.

In a similar project completed in 2022, JE completed a detailed hydraulic model for Glen Miller Creek with the objective of determining the potential impacts of fill within the floodplain. The proposed fill was much larger at 3,000 m^3 since the study was completed for a future commercial development. While the fill amount was larger, the creek system was smaller, with a contributing area of 12.2 km^2 and a main channel length of 9.9 km^2. The results of this

detailed hydraulic model showed no change in water levels in the regulatory storm event, and subsequently no negative impacts on adjacent property owners.

With larger fill and a smaller creek system for the Glen Miller Creek project relative to the subject lot at 2420 Shelter Valley Road, this similar project further supports JE's opinion that a dwelling on the subject lot would present no negative impacts to adjacent property owners. It is our opinion that Objective #2 is satisfied.

Conclusion and Recommendations

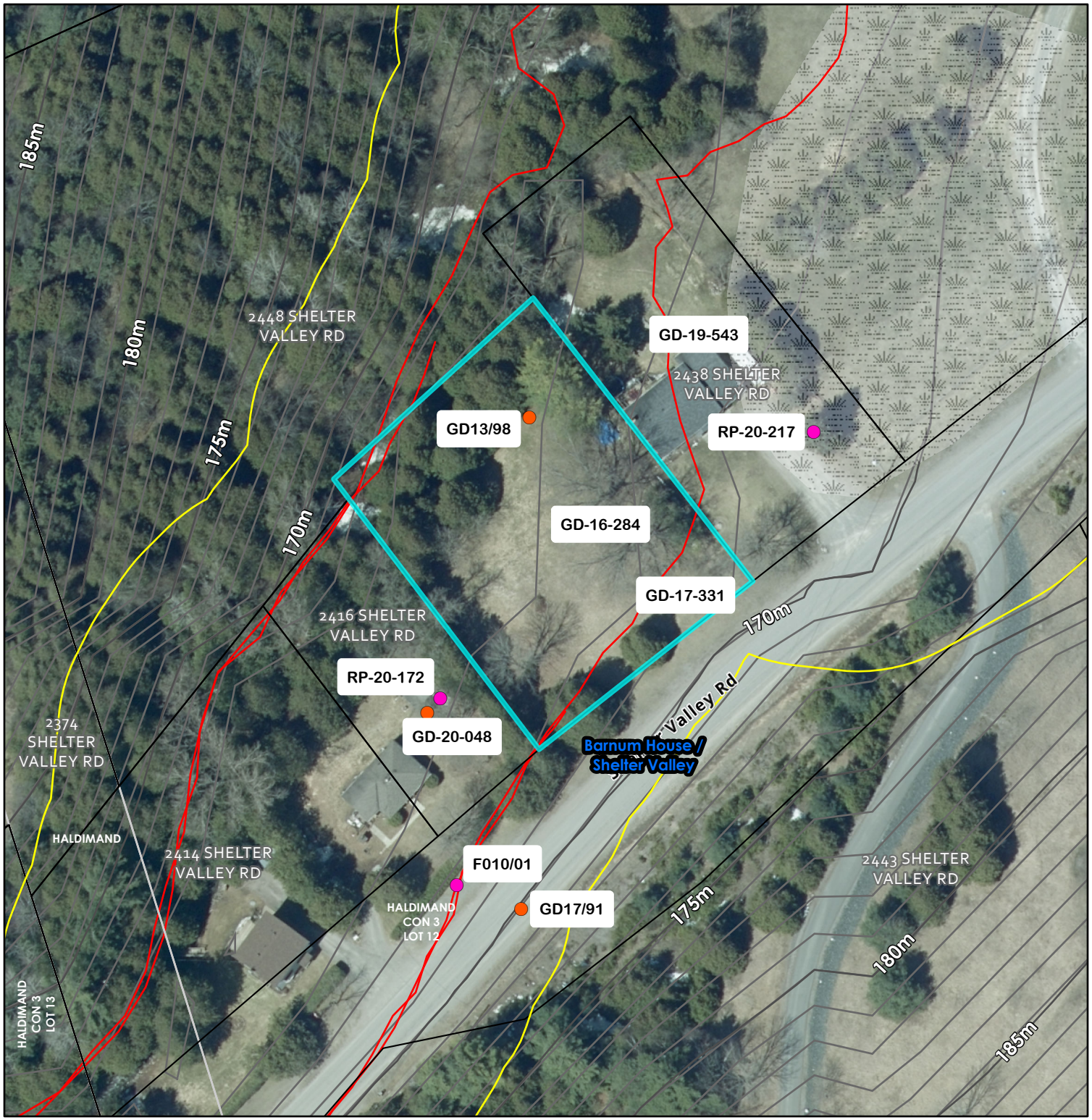
It is our engineering opinion that the proposed dwelling on the subject lot at 2420 Shelter Valley Road can be floodproofed and constructed without any negative impacts to other property owners. It is recommended that engineered fill be placed to support a slab on grade foundation (no basement) to establish a finished floor elevation that is a minimum of 0.3m above the regulatory flood elevation of 167.0 that was provided from LTC.

It is recommended that the setbacks and building envelope shown in the attached concept plan be followed during construction.

Based on an understanding of engineering principles, similar past projects, and the reasons described herein, we have no flood concerns for the lot at 2420 at Shelter Valley Road assuming that our concept plan and recommended floodproofing measures are followed.

Sincerely,

Elliott Fledderus, P. Eng.
Jewell Engineering Inc.



RP-23-108

2420 Shelter Valley Road
AH, Haldimand
Con 3, Lot 12

Legend

- O.Reg. 163/06 Screening Area
- Parcels

Water

- Stream
- Virtual Flow Connector

Wetlands (MNRF)

- Unevaluated wetland
- Evaluated wetland (PSW)
- Evaluated wetland (non-PSW)

Field Verified Wetland

- Yes (Present)
- No (Not Present)

Flood & Erosion Lines

- Floodlines

0 12.5 25 50
Metres

Map produced by Lower Trent Conservation

Note: Property lines shown on this map are approximate only and may be an inaccurate representation of the legal property limits. A legal survey is required to define the legal property limits.

LOWER TRENT CONSERVATION

User: technicaladmin May 1, 2023 2:55 PM

Conservation Authorities Act
Loi sur les offices de protection de la nature

ONTARIO REGULATION 163/06

LOWER TRENT REGION CONSERVATION AUTHORITY: REGULATION OF DEVELOPMENT, INTERFERENCE WITH WETLANDS AND ALTERATIONS TO SHORELINES AND WATERCOURSES

Consolidation Period: From February 8, 2013 to the e-Laws currency date.

Last amendment: O. Reg. 67/13.

This Regulation is made in English only.

Definition

1. In this Regulation,

"Authority" means the Lower Trent Region Conservation Authority. O. Reg. 163/06, s. 1.

Development prohibited

2. (1) Subject to section 3, no person shall undertake development or permit another person to undertake development in or on the areas within the jurisdiction of the Authority that are,

(a) adjacent or close to the shoreline of the Great Lakes-St. Lawrence River System or to inland lakes that may be affected by flooding, erosion or dynamic beaches, including the area from the furthest offshore extent of the Authority's boundary to the furthest landward extent of the aggregate of the following distances:

(i) the 100 year flood level, plus the appropriate allowance for wave uprush shown in the most recent document entitled "Lake Ontario Shoreline Management Plan", or as identified in the most recent document entitled "Cramahe Shorelands Project" for the Township of Cramahe or in the most recent document entitled "Alnwick/Haldimand Lake Ontario Shorelands Project" for the Township of Alnwick/Haldimand, available at the head office of the Authority,

(ii) the predicted long term stable slope projected from the existing stable toe of the slope or from the predicted location of the toe of the slope as that location may have shifted as a result of shoreline erosion over a 100-year period shown in the most recent document entitled "Lake Ontario Shoreline Management Plan", or as identified in the most recent document entitled "Cramahe Shorelands Project" for the Township of Cramahe or in the most recent document entitled "Alnwick/Haldimand Lake Ontario Shorelands Project" for the Township of Alnwick/Haldimand, available at the head office of the Authority,

(iii) where a dynamic beach is associated with the waterfront lands, the appropriate allowance inland to accommodate dynamic beach movement shown in the most recent document entitled "Lake Ontario Shoreline Management Plan", or as identified in the most recent document entitled "Cramahe Shorelands Project" for the Township of Cramahe or in the most recent document entitled "Alnwick/Haldimand Lake Ontario Shorelands Project" for the Township of Alnwick/Haldimand, available at the head office of the Authority, and

(iv) an allowance of 15 metres inland;

(b) river or stream valleys that have depressional features associated with a river or stream, whether or not they contain a watercourse, the limits of which are determined in accordance with the following rules:

(i) where the river or stream valley is apparent and has stable slopes, the valley extends from the stable top of bank, plus 15 metres, to a similar point on the opposite side,

(ii) where the river or stream valley is apparent and has unstable slopes, the valley extends from the predicted long term stable slope projected from the existing stable slope or, if the toe of the slope is unstable, from the predicted location of the toe of the slope as a result of stream erosion over a projected 100-year period, plus 15 metres, to a similar point on the opposite side,

(iii) where the river or stream valley is not apparent, the valley extends the greater of,

(A) the distance from a point outside the edge of the maximum extent of the flood plain under the applicable flood event standard, plus 15 metres, to a similar point on the opposite side, and

(B) the distance from the predicted meander belt of a watercourse, expanded as required to convey the flood flows under the applicable flood event standard, plus 15 metres, to a similar point on the opposite side;

(c) hazardous lands;

(d) wetlands; or

(e) other areas where development could interfere with the hydrologic function of a wetland, including areas within 120 metres of all provincially significant wetlands and areas within 30 metres of all other wetlands. O. Reg. 163/06, s. 2 (1); O. Reg. 67/13, s. 1 (1, 2).

(2) All areas within the jurisdiction of the Authority that are described in subsection (1) are delineated as the "Regulation Limit" shown on a series of maps filed at the head office of the Authority under the map title "Ontario Regulation 97/04: Regulation for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses". O. Reg. 67/13, s. 1 (3).

(3) If there is a conflict between the description of areas in subsection (1) and the areas as shown on the series of maps referred to in subsection (2), the description of areas in subsection (1) prevails. O. Reg. 67/13, s. 1 (3).

Permission to develop

3. (1) The Authority may grant permission for development in or on the areas described in subsection 2 (1) if, in its opinion, the control of flooding, erosion, dynamic beaches, pollution or the conservation of land will not be affected by the development. O. Reg. 163/06, s. 3 (1).

(2) The permission of the Authority shall be given in writing, with or without conditions. O. Reg. 163/06, s. 3 (2).

(3) Subject to subsection (4), the Authority's executive committee, or one or more employees of the Authority that have been designated by the Authority for the purposes of this section, may exercise the powers and duties of the Authority under subsections (1) and (2) with respect to the granting of permissions for development in or on the areas described in subsection 2 (1). O. Reg. 67/13, s. 2.

(4) A designate under subsection (3) shall not grant a permission for development with a maximum period of validity of more than 24 months. O. Reg. 67/13, s. 2.

Application for permission

4. A signed application for permission to undertake development shall be filed with the Authority and shall contain the following information:

1. Four copies of a plan of the area showing the type and location of the proposed development.
2. The proposed use of the buildings and structures following completion of the development.
3. The start and completion dates of the development.
4. The elevations of existing buildings, if any, and grades and the proposed elevations of buildings and grades after the development.
5. Drainage details before and after the development.
6. A complete description of the type of fill proposed to be placed or dumped.
7. Such other technical studies or plans as the Authority may request. O. Reg. 163/06, s. 4; O. Reg. 67/13, s. 3.

Alterations prohibited

5. Subject to section 6, no person shall straighten, change, divert or interfere in any way with the existing channel of a river, creek, stream or watercourse or change or interfere in any way with a wetland. O. Reg. 163/06, s. 5.

Permission to alter

6. (1) The Authority may grant permission to straighten, change, divert or interfere with the existing channel of a river, creek, stream or watercourse or to change or interfere with a wetland. O. Reg. 163/06, s. 6 (1); O. Reg. 67/13, s. 4 (1).

(2) The permission of the Authority shall be given in writing, with or without conditions. O. Reg. 163/06, s. 6 (2).

(3) Subject to subsection (4), the Authority's executive committee, or one or more employees of the Authority that have been designated by the Authority for the purposes of this section, may exercise the powers and duties of the Authority under subsections (1) and (2) with respect to the granting of permissions for alteration. O. Reg. 67/13, s. 4 (2).

(4) A designate under subsection (3) shall not grant a permission for alteration with a maximum period of validity of more than 24 months. O. Reg. 67/13, s. 4 (2).

Application for permission

7. A signed application for permission to straighten, change, divert or interfere with the existing channel of a river, creek, stream or watercourse or change or interfere with a wetland shall be filed with the Authority and shall contain the following information:

1. Four copies of a plan of the area showing plan view and cross-section details of the proposed alteration.
2. A description of the methods to be used in carrying out the alteration.
3. The start and completion dates of the alteration.
4. A statement of the purpose of the alteration.
5. Such other technical studies or plans as the Authority may request. O. Reg. 163/06, s. 7; O. Reg. 67/13, s. 5.

Cancellation of permission

8. (1) The Authority may cancel a permission granted under section 3 or 6 if it is of the opinion that the conditions of the permission have not been met. O. Reg. 163/06, s. 8 (1); O. Reg. 67/13, s. 6 (1).

(2) Before cancelling a permission, the Authority shall give a notice of intent to cancel to the holder of the permission indicating that the permission will be cancelled unless the holder shows cause at a hearing why the permission should not be cancelled. O. Reg. 163/06, s. 8 (2).

(3) Following the giving of the notice under subsection (2), the Authority shall give the holder at least five days notice of the date of the hearing. O. Reg. 163/06, s. 8 (3); O. Reg. 67/13, s. 6 (2).

Period of validity of permissions and extensions

9. (1) The maximum period, including an extension, for which a permission granted under section 3 or 6 may be valid is,

(a) 24 months, in the case of a permission granted for projects other than projects described in clause (b); and

(b) 60 months, in the case of a permission granted for,

(i) projects that, in the opinion of the Authority or its executive committee, cannot reasonably be completed within 24 months from the day the permission is granted, or

(ii) projects that require permits or approvals from other regulatory bodies that, in the opinion of the Authority or its executive committee, cannot reasonably be obtained within 24 months from the day permission is granted. O. Reg. 67/13, s. 7.

(2) The Authority or its executive committee may grant a permission for an initial period that is less than the applicable maximum period specified in subsection (1) if, in the opinion of the Authority or its executive committee, the project can be completed in a period that is less than the maximum period. O. Reg. 67/13, s. 7.

(3) If the Authority or its executive committee grants a permission under subsection (2) for an initial period that is less than the applicable maximum period of validity specified in subsection (1), the Authority or its executive committee may grant an extension of the permission if,

(a) the holder of the permission submits a written application for an extension to the Authority at least 60 days before the expiry of the permission;

(b) no extension of the permission has previously been granted; and

(c) the application sets out the reasons for which an extension is required and, in the opinion of the Authority or its executive committee, demonstrates that circumstances beyond the control of the holder of the permission will prevent completion of the project before the expiry of the permission. O. Reg. 67/13, s. 7.

(4) When granting an extension of a permission under subsection (3), the Authority or its executive committee may grant the extension for the period of time requested by the holder in the application or for such period of time as the Authority or its executive committee deems appropriate, as long as the total period of validity of the permission does not exceed the applicable maximum period specified in subsection (1). O. Reg. 67/13, s. 7.

(5) For the purposes of this section, the granting of an extension for a different period of time than the period of time requested does not constitute a refusal of an extension. O. Reg. 67/13, s. 7.

(6) The Authority or its executive committee may refuse an extension of a permission if it is of the opinion that the requirements of subsection (3) have not been met. O. Reg. 67/13, s. 7.

(7) Before refusing an extension of a permission, the Authority or its executive committee shall give notice of intent to refuse to the holder of the permission, indicating that the extension will be refused unless,

(a) the holder requires a hearing, which may be before the Authority or its executive committee, as the Authority directs; and

(b) at the hearing, the holder satisfies the Authority, or the Authority's executive committee, as the case may be,

(i) that the requirements of clauses (3) (a) and (b) have been met, and

(ii) that circumstances beyond the control of the holder will prevent completion of the project before the expiry of the permission. O. Reg. 67/13, s. 7.

(8) If the holder of the permission requires a hearing under subsection (7), the Authority or its executive committee shall give the holder at least five days notice of the date of the hearing. O. Reg. 67/13, s. 7.

(9) After holding a hearing under subsection (7), the Authority or its executive committee shall,

(a) refuse the extension; or

(b) grant an extension for such period of time as it deems appropriate, as long as the total period of validity of the permission does not exceed the applicable maximum period specified in subsection (1). O. Reg. 67/13, s. 7.

(10) Subject to subsection (11), one or more employees of the Authority that have been designated by the Authority for the purposes of this section may exercise the powers and duties of the Authority under subsections (2), (3) and (4), but not those under subsections (6), (7), (8) and (9). O. Reg. 67/13, s. 7.

(11) A designate under subsection (10) shall not grant an extension of a permission for any period that would result in the permission having a period of validity greater than 24 months. O. Reg. 67/13, s. 7.

Appointment of officers

10. The Authority may appoint officers to enforce this Regulation. O. Reg. 163/06, s. 10.

Flood event standards

11. (1) The applicable flood event standards used to determine the maximum susceptibility to flooding of lands or areas within the watersheds in the area of jurisdiction of the Authority are the Timmins Flood Event Standard and the 100 year flood level plus wave uprush, described in Schedule 1. O. Reg. 163/06, s. 11 (1).

(2) The Timmins Flood Event Standard applies to all watersheds within the area of jurisdiction of the Authority except for,

(a) the main channels of Rice Lake and Trent River, where the applicable standard is rainfall or snowmelt, or a combination of rainfall and snowmelt, that would produce the water surface elevations above Canadian Geodetic Datum described in Table 1;

(b) Lake Ontario in the Great Lakes-St. Lawrence River System where the 100 year flood level plus wave uprush applies.

TABLE 1
WATER SURFACE ELEVATIONS

Location	Elevation
Rice Lake	187.9 metres
Trent River:	
Below Dam #1 (Trenton)	77.2 metres
Below Dam #2 (Sidney)	81.3 metres
Below Dam #3 (Glen Miller)	87.7 metres
Below Dam #4 (Batawa)	95.7 metres
Below Dam #5 (Trent)	101.7 metres
Below Dam #6 (Frankford)	107.9 metres
Below Dam #7 (Glen Ross)	113.5 metres
Below Dam #8 (Meyers)	117.9 metres
Below Dam #9 (Hagues Reach)	128.1 metres
Below Dam # 10 (Ranney Falls)	143.4 metres
Below Dam #11 (Campbellford)	148.3 metres
Below Dam #12 (Crowe Bay)	154.3 metres
Below Dam #13 (Healy Falls)	175.5 metres
Below Dam #14 (Hastings)	186.7 metres

O. Reg. 163/06, s. 11 (2).

12. REVOKED: O. Reg. 67/13, s. 8.

13. OMITTED (REVOKES OTHER REGULATIONS). O. Reg. 163/06, s. 13.

SCHEDULE 1

1. The Timmins Flood Event Standard means a storm that produces over a 12-hour period,

(a) in a drainage area of 25 square kilometres or less, rainfall that has the distribution set out in Table 2; or

(b) in a drainage area of more than 25 square kilometres, rainfall such that the number of millimetres of rain referred to in each case in Table 2 shall be modified by the percentage amount shown in Column 2 of Table 3 opposite the size of the drainage area set out opposite thereto in Column 1 of Table 3.

TABLE 2

15 millimetres of rain in the first hour
20 millimetres of rain in the second hour
10 millimetres of rain in the third hour
3 millimetres of rain in the fourth hour
5 millimetres of rain in the fifth hour
20 millimetres of rain in the sixth hour
43 millimetres of rain in the seventh hour
20 millimetres of rain in the eighth hour
23 millimetres of rain in the ninth hour
13 millimetres of rain in the tenth hour
13 millimetres of rain in the eleventh hour
8 millimetres of rain in the twelfth hour

TABLE 3

Column 1	Column 2
Drainage Area (Square Kilometres)	Percentage
26 to 50 both inclusive	97
51 to 75 both inclusive	94
76 to 100 both inclusive	90
101 to 150 both inclusive	87
151 to 200 both inclusive	84
201 to 250 both inclusive	82
251 to 375 both inclusive	79
376 to 500 both inclusive	76
501 to 750 both inclusive	74
751 to 1000 both inclusive	70
1001 to 1250 both inclusive	68
1251 to 1500 both inclusive	66
1501 to 1800 both inclusive	65
1801 to 2100 both inclusive	64
2101 to 2300 both inclusive	63
2301 to 2600 both inclusive	62
2601 to 3900 both inclusive	58
3901 to 5200 both inclusive	56
5201 to 6500 both inclusive	53
6501 to 8000 both inclusive	50

2. The 100 year flood level means the peak instantaneous still water level plus an allowance for wave uprush and other water-related hazards that has a probability of occurrence of one per cent during any given year.

O. Reg. 163/06, Sched. 1.

Back to top

Lower Trent Region

Conservation Authority

Ontario Regulation 163/06

Policy Document

Approved by

Lower Trent Region Conservation Authority

Board of Directors

February 10, 2022

1.9 Flood, Erosion and Dynamic Beach Hazard Applications in the Lower Trent Conservation Watershed

The regulatory standard for the Lower Trent watershed is:

- Lake Ontario: 1:100-year event
- Trent River: 1:100-year event
- All other watercourses: Timmins event

In the LTC watershed, the following flood, erosion and dynamic beach hazards are applied and the reference documents are listed here for each delineated floodplain.

1.9.1 Lake Ontario

The flood hazard for Lake Ontario is based on the 100-year flood limit that is comprised of the 100-year flood level plus wave uprush. The erosion hazard is based on the potential for erosion in a 100-year time frame. These hazards along with dynamic beach hazards for Lake Ontario were first identified in the following report:

- Lake Ontario Shoreline Management Plan (LOSMP), 1990, by Sandwell, Swan & Wooster.

Final flood hazard elevations were provided in an update, dated December 1992. Subsequent shoreline studies for the Township of Alnwick/Haldimand and Township of Cramahe were undertaken to build on the information provided in the "Sandwell Report". The updated studies were:

- *Cramahe Shorelands Project*, 1997
- *Alnwick/Haldimand Township Lake Ontario Shorelands Project*, 2002.

In 2018 to 2020, LTC undertook an update to the Shoreline Management Reports in partnership with the Ganaraska Region Conservation Authority (GRCA) and Central Lake Ontario Conservation Authority (CLOCA). The resulting report provided much needed updates to flood, erosion and dynamic beach hazards along the Lower Trent Conservation portion of the Lake Ontario Shoreline. This study extended from Wellers Bay in the City of Quinte West in the east to the western boundary of the Township of Alnwick/Haldimand. The current Lake Ontario hazard report is:

- *Lake Ontario Shoreline Management Plan, November 5, 2020 (Zuzek)*

The resulting 100-year combined (still water and wind setup) flood level for the LTC Lake Ontario shoreline is 75.97 metres CGVD28 (Canadian Geodetic Vertical Datum 1928) with varying wave uprush considerations that determine the entire Flood Hazard delineation.

There were no detailed technical studies for the Bay of Quinte portion of Lake Ontario but a Memorandum by the MNR (February 21, 1991–see **Appendix I**) identified the 100-year water level for the Lower Trent Conservation portion of the Bay of Quinte as 75.8 metres CGVD28.

During the 2019-2020 Lake Ontario Shoreline Update, LTC contracted SJL Engineering to provide an update on the Combined 100-year Flood Level for the Bay of Quinte based on statistical

analyses completed with the Lake Ontario Study. The resulting memorandum provides an update for the flood level for the Bay of Quinte and is found in **Appendix I**. The resulting flood level for the Bay of Quinte is 76.05 metres CGVD28:

- *Bay of Quinte 100-Year Combined Flood Level, February 29, 2020 (SJL Engineering)*

There are communications in the historic memos about wave uprush to be used on the Bay of Quinte in the communications between MNR and the Bay of Quinte Conservation Authorities and three acceptable methods to calculate wave uprush were documented. Lower Trent Conservation applies a 0.2 metre uprush to the 100-year flood limit on the Bay of Quinte, resulting in a Flood Hazard elevation of 76.25 metres CGVD28.

There are no dynamic beach hazards identified on the Bay of Quinte and the standard erosion hazard of 15 metres from the 100-year flood elevation has been applied as per NDMNRF Technical Guidelines for Large Inland Lakes, 1996.

1.9.2 Other Lakes

Both Little Lake in the Township of Cramahe and Oak Lake in the City of Quinte West originally had mapped flood lines that had not been delineated through engineered studies. These lines were identified as a horizontally measured 15 metre zone around the average lake water level to delineate a potential high-water level. A 15-metre regulation limit was applied to these floodlines for a regulated area of 30 metres beyond the typical water's edge.

In 2021 LTC staff conducted a preliminary hydrology assessment of Little Lake and used LiDAR mapping provided through OMAFRA to better identify the actual flood hazard for Little Lake. This mapping has now been incorporated into the LTC mapping. Flood Hazard elevations for Little Lake are 171.93 metres CGVD2013 or **172.28 metres CGVD1928**. Calculations for this assessment are provided in **Appendix K**.

The preliminary hydrology to calculate flood depths for Oak Lake has been undertaken but there is not accurate topographic information to determine the flood hazard mapping for Oak Lake at this time. Therefore, the 15-metre setback is still in effect without confirmed flood hazard elevation.

Oak Lake is identified as Area Specific Policy 3 in the City of Quinte West Official Plan and the LTC regulated area is still defined as stated above. Planning studies may be required before Lower Trent Conservation can issue permits. These policies should be reviewed in consultation with City of Quinte West planning staff, prior to approval of any LTC permits.

Policies specific to flood hazards on Little Lake and Oak Lake are found in Section 5.2.1.1. regarding One-Zone Floodplain mapping.

1.9.3 Trent River and Rice Lake

The regulatory event for the Trent River is the 100-year event. The floodplain delineations were completed in two studies and both are treated as one-zone areas. The first study defined the floodplain from the Bay of Quinte to Highway 401 and the second study defined the floodplain from Highway 401 to Rice Lake.

- Trent River Floodplain Mapping Report, 1975. M.M. Dillon Limited.
  (Associated Mapping TR-T-1 to TR-T-4).
- Floodplain Mapping Study of the Trent River, 1983. Cumming-Cockburn & Associates.
  1:5000 mapping TR-1 to TR-45
  1:2000 mapping of Flood Damage Areas:
  Hastings: (TR-H-1 to TR-H-5)
  Campbellford: (TR-C-1 to TR-C-5)
  Percy Boom: TR-PB-1 to TR-PB-3)
  Frankford: (TR-F-1 to TR-F-4)

Note that Rice Lake is listed as the smallest of the Large Inland Lakes in the MNR Technical Guide with an area of 100 km2. There are no technical studies assessing erosion or dynamic beach hazards on Rice Lake and therefore the flood elevation for Rice Lake identified in the Trent River mapping is the only hazard delineated for Rice Lake at this time (187.9 metres CGVD28). This is covered in Trent River maps (TR-46 to TR-62). Also note that there are some steep shorelines along Rice Lake that would require erosion hazard assessment for steep slopes, similar to a riverine system.

1.9.4 One-Zone Riverine Areas

Not all streams have delineated floodplains in the Lower Trent Conservation watershed. However, the following reports have floodplain delineations associated with them. The creek name and associated reports are listed below. All of these floodplains have been delineated with the Timmins Storm Regulatory event.

- **Shelter Valley & Barnum House Creeks:** Shelter Valley and Barnum House Creeks Floodplain Study, 1978. Crysler & Lathem Ltd.
- **Colborne Creek (Colborne):** Floodplain Mapping Colborne Creek, Village of Colborne, 1982. Kilborn Limited (Note: 2-Zone study undertaken but results did not support creation of a 2-Zone policy).
- **Dead & York Creeks (Murray Ward):** Dead & York Creek Subwatershed Plan, 1998. Totten Sims Hubicki Associates.
- **DND Creek (Trenton):** DND Creek Floodline Mapping Study, 2002. PSR Group Ltd.
- **Glen Miller Creek (Trenton & Sidney Ward):** Floodplain Mapping and Preliminary Engineering Study, Glen Miller Creek, 1983. Cumming-Cockburn & Associates Limited (CCA); and the Spill Analysis of the Glen Miller Creek by CCA dated April 1984.
- **Killoran Creek (Hastings):** Killoran Creek Flood Reduction Study, 1985. Totten Sims Hubicki Associates.
- **Mill/Burnley Creek (Warkworth):** Mill Creek Preliminary Engineering Study, 1983. Cumming-Cockburn & Associates Limited.
- **Rawdon Creek (Stirling other than SPA):** Flood Damage Reduction Study, Rawdon Creek, Village of Stirling, 1985. Kilborn Limited.
- **Meyers, Massey and other South Sidney Creeks (Sidney Ward):** South Sidney Watershed Plan, 1985. Totten Sims Hubicki Associates.

1.9.5 Two-Zone Areas

Two zone concepts recognize that floodplains can be divided into two zones: the floodway, where the majority of the flood is conveyed, and flood fringes, which exist on both sides of the floodway. They can be established by a Municipality in conjunction with the Conservation Authority and MNRF, following recommendations of a detailed engineering study.

There are four two-zone policy areas located within the Lower Trent Watershed: Butler Creek in Brighton, Cold Creek in Frankford; Mayhew Creek in Trenton and Trout Creek in Campbellford. The studies and maps associated with these areas are as follows:

- **Butler Creek 2-Zone (Brighton):** Butler Creek Flood Reduction Study, 1988. Totten Sims Hubicki Associates.
- **Cold Creek 2-Zone (Frankford)**: Floodplain Assessment & Policy Formulation for a Two Zone Concept Application in the Village of Frankford, July 1983. Totten Sims Hubicki Associates.
- **Mayhew Creek 2-Zone (Trenton):** Mayhew Creek Two-Zone Concept, City of Trenton and Township of Murray, 1983. Totten Sims Hubicki Associates. – Note that the 2-Zone was only implemented in Trenton and not Murray Township.
- **Trout Creek 2-Zone (Campbellford)**: Final Report Trout Creek Floodplain Management Study, 1982. MacLaren Plansearch Inc.

Note that a two-zone study was completed for Colborne Creek in the Township of Cramahe (Ecos Garatech Associates - November 1991) but the report concluded that Colborne Creek was NOT a suitable candidate for implementation of a Two-Zone Concept. Floodplain mapping was updated during this study in several areas so this mapping should be used for regulatory purposes.

1.9.6 Special Policy Area

A Special Policy Area is an area within a community that has historically existed in the floodplain where site specific policies apply. Only the MNRF and MMAH have the authority to establish Special Policy Areas; this authority cannot be delegated to municipalities and other planning bodies.

Rawdon Creek - Downtown Stirling: One Special Policy Area with respect to floodplains exists in the Lower Trent Conservation watershed within the downtown core of the Village of Stirling in the Township of Stirling-Rawdon. This area is bounded by Front Street and Mill Street in the south, Victoria Street in the north, North Street in the west and Edward Street in the east. The property of the Stirling Creamery located on the south side of Front Street is also considered in this zone although not included in the descriptions. This is because the Special Policy Area is intended to ensure the long-term economic viability of the area and the creamery is an integral component of the economy of Stirling. In this area, the 1:100-year flood elevations are to be used for floodproofing requirements rather than the Timmins event. Lands above the 1:100-year elevation may be developed without the need for floodproofing measures. Lands south of Rawdon Creek within this zone that are below the 1:100-year elevation may be developed with floodproofing and causing no impediment to flow to Rawdon Creek. The associated report for

the flood elevations identified for this Special Policy Area is Flood Damage Reduction Study, Rawdon Creek, Village of Stirling, 1985, by Kilborn Limited.

2 GENERAL POLICIES

Background:

Lower Trent Region Conservation Authority (LTC) will be guided by the following general administrative guidance with respect to the implementation of its regulatory responsibilities:

- Development, interference and/or alteration activities shall not be undertaken in a regulated area without written permission from LTC.
- Where a regulated area pertains to more than one water-related hazard (e.g., lands susceptible to flooding that are part of a wetland), policies will be applied jointly, and where applicable, the more restrictive policies will apply.
- Technical studies and/or assessments, site plans and/or other plans submitted as part of an application for permission to undertake development, interference and/or alteration in a regulated area must be completed by a qualified professional to the satisfaction of LTC in conformity with the most current provincial technical guidelines or guidelines accepted by LTC through a Board Resolution.

Note: Information regarding technical standards and guidelines is contained within the Appendices.

Similar to the MNR recommended 6-metre erosion access allowance (Section 3.4, Technical Guide for River and Stream Systems: Erosion Hazard Limit, MNR), LTC recommends that a 6-metre access allowance is applied to all hazard lands. Note that emergency access is required along the hazard as well as between the buildings and the lot line to allow for heavy equipment access to the hazard area.

The guidelines for development within the 15 metre adjacent lands to a hazard include an access setback. Three main principles support the inclusion of an access setback:

- providing for emergency access to hazard areas;
- providing for construction access for regular maintenance and access to the site in the event of a natural hazard or failure of a structure; and
- providing protection against unforeseen or predicted external conditions which could have an adverse effect on the natural conditions or processes acting on or within a hazard prone area.

Activities in regulated areas that are carried out by other provincial ministries or the federal government do not require a permit. Activities conducted on provincial crown land by third-party proponents in a regulated area may require a permit, unless acting as an agent of the Crown.

Works for which permission is required under the Regulation may also be subject to other legislation, policies and standards that are administered by other agencies and municipalities, such as the Planning Act, Public Lands Act, Nutrient Management Act, Drainage Act, Environmental Assessment Act (EA Act) or the federal Fisheries Act, etc. It is the responsibility of the applicant (or applicant's agent) to ensure that all necessary approvals are obtained prior to undertaking any works for which a permit under this Regulation has been obtained.

LTC Policies – General Policies:

Within areas defined by the regulation (i.e., regulated areas), including Lake Ontario shoreline hazard lands and an allowance, river or stream valleys and an allowance, wetlands or other areas where

development could interfere with the hydrologic function of a wetland (areas of interference), watercourses, or hazardous lands, the following general policies will apply:

1) Development, interference and/or alteration will not be permitted within a regulated area, except in accordance with the policies contained in this document.
2) Notwithstanding Policy 2. (1), the LTC Board of Directors, sitting as the Hearing Board, may grant permission for development, interference and/or alteration where the applicant provides evidence acceptable to the Board that documents that the development and/or activity will have no adverse effect on the control of flooding, erosion, dynamic beaches, pollution or the conservation of land with respect to Lake Ontario shoreline, river or stream valleys, hazardous land, wetlands, and areas of interference or will not result in an unacceptable interference with a watercourse or wetland.
3) In addition to specific conditions outlined through this document, development, interference and/or alteration within a regulated area may be permitted only where:
    a) risk to public safety is not increased;
    b) there is no increase in habitation in the hazard area with the exception of allowable flood fringes or wave uprush hazard areas;
    c) susceptibility to natural hazards is not increased nor new hazards created (e.g., there will be no impacts on adjacent properties with respect to natural hazards);
    d) safe ingress/egress is available for proposed development that increases habitation outside of hazard lands;
    e) pollution, sedimentation and erosion during construction and post construction is minimized using best management practices including site, landscape, infrastructure and/or facility design, construction controls, and appropriate remedial measures;
    f) access for emergency works and maintenance of flood or erosion control works is available;
    g) proposed development is constructed, repaired and/or maintained in accordance with accepted engineering principles and approved engineering standards or to the satisfaction of LTC, whichever is applicable based on the structural scale and scope, and purpose of the project;
    h) there are no adverse hydraulic or fluvial effects on rivers, creeks, streams, or watercourses;
    i) there are no adverse sedimentation or littoral effects on the Lake Ontario shoreline;
    j) there are no adverse effects on the hydrologic function of wetlands; and,
    k) the control of flooding, erosion, dynamic beaches, pollution and/or the conservation of land is not adversely affected during and post development.

Prohibited Uses:

4) Notwithstanding the General Policies referenced above, in accordance with Section 3.1 of the Provincial Policy Statement, development will not be permitted within hazardous lands as defined in the Conservation Authorities Act, where the use is:
    - an institutional use associated with hospitals, nursing homes, pre-school, school nurseries, day care and schools, where there is a threat to the safe evacuation of the sick, the elderly, persons with disabilities or the young during an emergency as a result of flooding, failure of floodproofing and/or protection works, and/or erosion;
    - an essential emergency service such as that provided by fire, police and ambulance stations and electrical substations, which would be impaired during an emergency as result of flooding, failure of flood-proofing measures and/or protection works, and/or erosion; or,
    - uses associated with the disposal, manufacture, treatment or storage of hazardous substances.

5 HAZARDOUS LANDS

5.1 Ontario Regulation 163/06

The updated definition of hazardous lands referenced in Section 25 of the Conservation Authorities Act is as follows: *"hazardous land"* means property or lands that could be unsafe for development due to naturally occurring processes. Along the shorelines of the Great Lakes - St. Lawrence River System, this means the land, including that covered by water, between the international boundary, where applicable, and the furthest landward limit of the flooding hazard, erosion hazard or dynamic beach hazard limits. Along the shorelines of large inland lakes, this means the land, including that covered by water, between a defined offshore distance or depth and the furthest landward limit of the flooding hazard, erosion hazard or dynamic beach hazard limits. Along river, stream and small inland lake systems, this means the land, including that covered by water, to the furthest landward limit of the flooding hazard or erosion hazard limits.

Lower Trent Conservation's Regulation contains the following sections dealing with hazardous lands.

The LTC Regulation contains the following sections dealing with hazardous lands:

Development prohibited

2.(1) Subject to section 3, no person shall undertake development or permit another person to undertake development in or on areas within the jurisdiction of the Authority that are:

(C) hazardous lands;

Permission to develop

3. (1) The Authority may grant permission for development in or on the areas described in subsection 2(1) if, in its opinion, the control of flooding, erosion, dynamic beaches, pollution or the conservation of land will not be affected by the development.

(2) The permission of the Authority shall be given in writing, with or without conditions.

Therefore, the following policies have been developed to deal with flooding and erosion. The dynamic beach hazards were identified in the Great Lakes section along with the flooding and erosion hazards for Great Lakes and Large Inland Lakes.

Also note that with the updated definitions declared in O.Reg. 686/21, *Hazardous Sites* have been separated from *Hazardous Lands*. Although LTC's Regulation O.Reg. 163/06 only refers to *Hazardous Lands*, O.Reg. 686/21 does note that an authority shall provide the programs and services for a list of natural hazards that includes *Hazardous Sites* and Section 28 Regulations are included in the list of programs and services. Therefore, *Hazardous Sites* are included as regulated features in this policy document. *Hazardous Sites* means property or lands that could be unsafe for development and site alteration due to naturally occurring hazards. These may include unstable soils (sensitive marine clays [leda], organic soils) or unstable bedrock (karst topography).

5.2 Policy Standards

The following sections outline the policy standards for implementing the LTC Regulation with respect to hazardous lands including flood hazard lands, erosion hazard lands and hazardous sites with unstable soil and/or unstable bedrock. LTC, in their role through the planning process, should review planning applications to ensure that, in general, all development occurs outside the unstable soil and bedrock boundaries.

LTC may require technical studies be undertaken to demonstrate the suitability of development proposals. Technical studies should be carried out by a qualified professional, with recognized expertise in the appropriate discipline, and should be prepared using established procedures and recognized methodologies to the satisfaction of LTC.

5.2.1 Development within Flood Hazard Lands

5.2.1.1 Development within One-Zone Regulatory Floodplain of River or Stream Valleys (including inland lakes)

Background

The following policies are focused on development within the One-Zone Regulatory floodplain. These policies do not apply to development within the allowance adjacent to the One-Zone Regulatory floodplain and the reader should refer to Section 4.2.2 for policies that apply to these areas.

LTC Policies

1) Development within the Regulatory floodplain shall not be permitted.
2) Placement of fill, flood hazard protection and/or bank stabilization works to allow for future/proposed development or an increase in development envelope within the Regulatory floodplain shall not be permitted.
3) Development associated with new and/or the expansion of existing trailer parks / campgrounds in the Regulatory floodplain shall not be permitted.
4) *Major development* within the Regulatory floodplain shall not be permitted.
5) Redevelopment of derelict and abandoned buildings within the Regulatory floodplain shall not be permitted.
6) Stormwater management facilities within the 100-year floodplain shall not be permitted.
7) Basements within the Regulatory floodplain shall not be permitted.
8) Underground parking within the Regulatory floodplain shall not be permitted.
9) Cut and fill operations will not be permitted within the One-Zone Regulatory floodplain.
10) Notwithstanding Section 5.2.1.1 1), public infrastructure (e.g. roads, sewers, flood and erosion control works) and various utilities (e.g. pipelines) may be permitted within the Regulatory floodplain subject to the activity being approved through a satisfactory Environmental Assessment process and/or if it has been demonstrated to the satisfaction of

LTC that the control of flooding, erosion, pollution, or the conservation of land will not be affected.

11) Notwithstanding Section 5.2.1.1 1), development associated with public parks (e.g. passive or low intensity outdoor recreation, education, or trail systems) may be permitted within the Regulatory floodplain if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution, or the conservation of land will not be affected.

12) Notwithstanding Section 5.2.1.1 1), stream bank slope and valley stabilization to protect existing development and conservation or restoration projects may be permitted within the Regulatory floodplain subject to the activity being approved through a satisfactory Environmental Assessment process and/or if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution, or the conservation of land will not be affected.

13) Notwithstanding Section 5.2.1.1 1), *moderate development and* structural repairs may be permitted within the Regulatory floodplain if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution, or the conservation of land will not be affected. The submitted plans must demonstrate that:

    a) there is no feasible alternative site outside of the Regulatory floodplain for the proposed development or in the event that there is no feasible alternative site, that the proposed development is located in an area of least (and acceptable) risk;

    b) the proposed works do not create new hazards or aggravate flooding on adjacent or other properties and there are no negative upstream and downstream hydraulic impacts;

    c) the development is protected from the flood hazard in accordance with established floodproofing and protection techniques. Habitable development must be dry floodproofed to 0.3 metres above the Regulatory flood elevation and non-habitable development must be floodproofed to the Regulatory flood elevation;

    d) the proposed development will not prevent access for emergency works, maintenance, and evacuation;

    e) the potential for surficial erosion has been addressed through the submission of proper drainage, erosion and sediment control and site stabilization/restoration plans;

    f) natural features and/or ecological functions associated with conservation of land are protected, pollution is prevented and erosion and flooding hazards have been adequately addressed; and,

    g) for any building where the depth of flooding exceeds 0.8 metres (2.5 ft) an engineering assessment and design carried out by a qualified professional with recognized expertise in the appropriate discipline must be prepared using established procedures and recognized methodologies to the satisfaction of LTC.

14) Notwithstanding Section 5.2.1.1 4), detached non-habitable accessory structures greater than 46 m2 (500 ft2) may be permitted within the Regulatory floodplain if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution, or the conservation of land will not be affected. The submitted plans must demonstrate that:

    a) there is no feasible alternative site outside of the Regulatory floodplain for the proposed development or in the event that there is no feasible alternative site, that the proposed development is located in an area of least (and acceptable) risk;

    b) the proposed works do not create new hazards or aggravate flooding on adjacent or other properties and there are no negative upstream and downstream hydraulic impacts;

    c) the development is protected from the flood hazard in accordance with established floodproofing and protection techniques;

    d) the proposed development will not prevent access for emergency works, maintenance, and evacuation;

    e) the potential for surficial erosion has been addressed through the submission of proper drainage, erosion and sediment control and site stabilization/restoration plans;

    f) natural features and/or ecological functions associated with conservation of land are protected, pollution is prevented and erosion and flooding hazards have been adequately addressed; and,

    g) an engineering assessment and design carried out by a qualified professional with recognized expertise in the appropriate discipline must be prepared using established procedures and recognized methodologies to the satisfaction of LTC.

15) Notwithstanding Section 5.2.1.1 4), construction of a second storey addition to a habitable building greater than 46 m2 (500 ft2) may be permitted within the Regulatory floodplain if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution, or the conservation of land will not be affected. The submitted plans must demonstrate that:

    a) The original footprint of the building is not increased;

    b) Habitation is not increased for the entire building;

    c) the entire building is protected from the flood hazard in accordance with established floodproofing and protection techniques with dry floodproofing to 0.3 metres above the Regulatory flood elevation;

    d) the potential for surficial erosion has been addressed through the submission of proper drainage, erosion and sediment control and site stabilization/restoration plans;

    e) for any building where the depth of flooding exceeds 0.8 metres (2.5 ft) an engineering assessment and design carried out by a qualified professional with recognized expertise in the appropriate discipline must be prepared using established procedures and recognized methodologies to the satisfaction of LTC.

16) Notwithstanding Section 5.2.1.1 1), development associated with existing uses located within the Regulatory floodplain such as marine facilities, in-ground (at existing grade) pools, *minor development*, landscaping retaining walls, grading, etc., may be permitted if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution, or the conservation of land will not be affected.

17) Notwithstanding Section 5.2.1.1 1), development may be permitted for the reconstruction or relocation of a building within the Regulatory floodplain, provided that it has not been damaged or destroyed by flooding and if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution, or conservation of land will not be affected. The submitted plans must demonstrate that:

    a) the building or structure meets the criteria described in Policy 13) above;

    b) the building or structure must not be located closer to the hazard than the original building; and,

    c) the building or structure does not exceed the original floor space plus the allowable floor space for a *minor addition*. If the building or structure is enlarged, a future *minor addition* to the building or structure will not be considered.

18) Notwithstanding Section 5.2.1.1 1), development associated with the construction of a driveway or access way through the Regulatory floodplain in order to provide access to lands outside of the Regulatory floodplain may be permitted subject to the provision of safe access as identified in Section 1.7.3 and if it has been demonstrated to the satisfaction of LTC that there is no viable alternative outside of the regulated area and that the control of flooding, erosion, pollution, or the conservation of land will not be affected.

19) Notwithstanding Section 5.2.1.1 1), removal or placement of *minor fill* and associated site grading may be permitted within the Regulatory floodplain if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution or the conservation of land will not be affected.

20) Notwithstanding Section 5.2.1.1 1), the replacement of sewage disposal systems may be permitted within the Regulatory floodplain if it does not require greater than 1 metre depth of *fill* and has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution or the conservation of land will not be affected. The replacement system should be located outside of the floodplain where possible, and only permitted within the floodplain subject to being located in the area of lowest risk.

21) Notwithstanding Section 5.2.1.1 1), parking areas may be permitted within the Regulatory floodplain if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution or the conservation of land will not be affected, and that safe pedestrian and vehicular access is achieved.

22) Notwithstanding Section 5.2.1.1 1), boathouses may be permitted within the Regulatory floodplain if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution or the conservation of land will not be affected, and an engineered design may be required for wet flood proofing.

9 GLOSSARY

100 Year Flood Event Standard: That flood, based on an analysis of precipitation, snow melt, or a combination thereof, having a return period of 100 years on average, or having a 1% chance of occurring or being exceeded in any given year.

Alteration to a Waterway: the act whereby the channel of a watercourse is altered in some manner. Examples of an alteration include, but are not limited to, the following: channelization, full or partial diversions, retaining walls, revetments, bridges, culverts, pipeline crossings erosion protection measures, construction of storm sewer outlets and agricultural tile drain outlets.

Apparent (confined) river and stream valley: Ones in which the physical presence of a valley corridor containing a river or stream channel, which may or may not contain flowing water, is visibly discernible (i.e., valley walls are clearly definable) from the surrounding landscape by either field investigations, aerial photography and/or map interpretation. The location of the river or stream channel may be located at the base of the valley slope, in close proximity to the toe of the valley slope (i.e., within 15 metres), or removed from the toe of the valley slope (i.e., greater than 15 metres)."

Area of interference: Those lands where development could interfere with the hydrologic function of a wetland.

Armour: Artificial surfacing of bed, banks, shores, or embankments to resist scour or erosion.

Authority: The Lower Trent Region Conservation Authority, a corporate body established under the *Conservation Authorities Act* (RSO 1990).

Basement: One or more storeys of a building located below the first storey (Building Code).

Breakwall/Breakwater: An object (especially a groyne or pier) resisting force of waves.

Boathouse: Structure meant for storage of water craft and associated boating equipment located on or within 6 metres of a navigable waterway. The boathouse must be anchored and is to be constructed as a single storey with no habitable space. The boathouse is considered a detached accessory structure and it must be wet floodproofed with openings on two sides to allow the flow of water through and no electrical services to be located less than 0.3 metres above the flood elevation.

Channel: The area of a watercourse carrying normal flows within the banks.

Conservation of Land (CO Interpretation)**:** The protection, management, or restoration of lands within the watershed ecosystem for the purpose of maintaining or enhancing the natural features and hydrologic and ecological functions within the watershed.

Crawl Space: A Crawl space must be:

(a) less than 1500 mm high between the lowest part of the floor assembly and the ground or other surface below, and

(b) not used for any occupancy.

Development: a) the construction, reconstruction, erection or placing of a building or structure of any kind, b) any change to a building or structure that would have the effect of altering the use or potential

use of the building or structure, increasing the size of the building or structure or increasing the number of dwelling units in the building or structure, c) site grading, or d) the temporary or permanent placing, dumping or removal of any material, originating on the site or elsewhere.

Diversion: The process whereby streamflow is directed from the original channel of the watercourse and returned to the original channel at another point on the watercourse. Diversions may be full or partial re-direction of the streamflow. A diversion may also be the redirecting of flow from the channel of one watercourse to the channel of another watercourse.

Dwelling unit: One or more habitable rooms, occupied or capable of being occupied as an independent and separate housekeeping establishment, in which separate kitchen and sanitary facilities are provided for the exclusive use of the occupants.

Dyke (dike): An embankment or wall, usually along a watercourse or floodplain, to prevent overflow on to adjacent land.

Dynamic Beach: That portion of the shoreline where accumulated unconsolidated sediment continuously moves as a result of naturally occurring processes associated with wind and water and changes in the rate of sediment supply.

Dynamic Beach Hazard: Areas of inherently unstable accumulations of shoreline sediments along the Great Lakes – St. Lawrence River System and large inland lakes, as identified by provincial standards, as amended from time to time. The dynamic beach hazard limit consists of the flooding hazard limit plus a dynamic beach allowance.

Erosion: Continual loss of earth material (i.e., soil or sediment) over time as a result of the influence of water or wind.

Erosion Hazard: The loss of land, due to human or natural processes, that poses a threat to life and property. The erosion hazard limit is determined using considerations that include the 100-year erosion rate (the average annual rate of recession extended over a one-hundred-year time span) and an allowance for slope stability and an erosion/erosion access allowance.

Fill: Earth, sand, gravel, topsoil, building materials, rubble, rubbish, garbage, or any other material whether similar to or different from any of the aforementioned materials, whether originating on the site or elsewhere, used or capable of being used to raise, lower or in any way affect or alter the contours of the ground.

Flooding Hazard: The inundation, under the conditions specified below, of areas adjacent to a shoreline or a river or stream system and not ordinarily covered by water:

a) along the shorelines of the Great Lakes - St. Lawrence River System and large inland lakes, the flooding hazard limit is based on the one-hundred-year flood level plus an allowance for wave uprush and other water related hazards;
b) along river, stream and small inland lake systems, the flooding hazard limit is the greater of:
    a. the flood resulting from the rainfall actually experienced during a major storm such as the Hurricane Hazel storm (1954) or the Timmins storm (1961), transposed over a specific watershed and combined with the local conditions, where evidence suggests

that the storm event could have potentially occurred over watersheds in the general area;

b. the one-hundred-year flood; and

c. a flood which is greater than 1. or 2. which was actually experienced in a particular watershed or portion thereof as a result of ice jams and which has been approved as the standard for that specific area by the Minister of Natural Resources and Forestry;

except where the use of the one-hundred-year flood or the actually experienced event has been approved by the Minister of Natural Resources and Forestry as the standard for a specific watershed (where the past history of flooding supports the lowering of the standard).

Flood Line: An engineered line delineating the potential extent of flooding.

Floodplain: The area, usually low lands, adjoining a watercourse which has been or may be covered by water.

Floodproofing: A combination of structural changes and/or adjustments incorporated into the basic design and/or construction or alteration of individual buildings, structures, or properties subject to flooding so as to reduce or eliminate flood damages.

Floodway: The channel of a watercourse and the inner portion of the floodplain where flood depths and velocities are generally higher than those experienced in the flood fringe. The floodway represents that area required for the safe passage of flood flow and/or that area where flood depths and/or velocities are considered to be such that they pose a potential threat to life and/or property damage.

Groyne: A structure extending from the shore to prevent erosion and arrest sand movement along a shoreline.

Habitable: Suitable to live in or on; that can be inhabited. Inhabit means to dwell in, occupy.

Habitation: is measured by the number of bedrooms within a dwelling unit**.**

Hazardous Land: Property or lands that could be unsafe for development due to naturally occurring processes. Along the shorelines of the Great Lakes - St. Lawrence River System, this means the land, including that covered by water, between the international boundary, where applicable, and the furthest landward limit of the flooding hazard, erosion hazard or dynamic beach hazard limits. Along the shorelines of large inland lakes, this means the land, including that covered by water, between a defined offshore distance or depth and the furthest landward limit of the flooding hazard, erosion hazard or dynamic beach hazard limits. Along river, stream and small inland lake systems, this means the land, including that covered by water, to the furthest landward limit of the flooding hazard or erosion hazard limits.

Hazardous Sites: Property or lands that could be unsafe for development and site alteration due to naturally occurring hazards. These may include unstable soils (sensitive marine clays [leda], organic soils) or unstable bedrock (karst topography).

Hydric Soil: Soil that, in its undrained condition, is saturated, flooded, or ponded long enough during the growing season to develop an anaerobic condition that supports the growth and regeneration of hydrophytic vegetation.

Hydrologic Function: The functions of the hydrological cycle that include the occurrence, circulation, distribution, and chemical and physical properties of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere, and water's interaction with the environment including its relation to living things.

Inert Fill: Earth or rock fill, or material of a similar nature that contains no putrescible materials or soluble or decomposable chemical substances.

Ingress/egress: The ability to access a property or residence by land.

Interference in any way (CO Interpretation)**:** Any anthropogenic act or instance which hinders, disrupts, degrades, or impedes in any way the natural features or hydrologic and ecologic functions of a wetland or watercourse.

Jetty: A structure that projects from the land out into water.

Large Inland Lakes: Waterbody that has a surface area equal to or greater than 100 square kilometers where there is no measurable or predictable response to a single runoff event.

Major Development: New structures, additions, or restorations greater than 46 square metres (500 square feet).

Major Stabilization Work: stabilization works that have been approved through a satisfactory Environmental Assessment process and/or if it has been demonstrated to the satisfaction of LTC through a detailed engineering design that the control of flooding, erosion, pollution, dynamic beaches or the conservation of land will not be affected.

Minor Addition: An addition to an existing structure that does not exceed 46 square metres (500 square feet) and shall not result in an increase in the number of dwelling units. Attached covered structures including decks and garages will be considered habitable space. All new floor space shall be considered when determining the additional floor space including all storeys.

Minor Alteration: Alteration of a watercourse not exceeding 20 square metres (215 square feet).

Minor Development: A small addition to an existing building, a detached accessory building or above-ground pool that does not exceed 10 square metres (108 square feet) and does not increase number of dwelling units in a hazard land. Uncovered decks less than 23 square metres (250 square feet) are also considered minor development.

Minor Fill: A volumetric amount of fill not exceeding 20 cubic metres (26 cubic yards).

Moderate Development: *Minor additions*, detached accessory buildings and above ground pools that do not exceed 46 square metres (500 square feet). Uncovered decks larger than 23 square metres (250 square feet) are also considered moderate development. All moderate development (excluding uncovered decks) will be considered cumulative and will not exceed the 46 square metres (500 square feet). If cumulative moderate development exceeds 46 square metres (500 square feet) *major development* definitions apply.

Moderate Stabilization Work: stabilization works for banks/bluffs two metres or less in height and placement of appropriately sized stone a volumetric amount equivalent of up to one cubic metre per

one linear metre of shoreline or stream bank if it has been demonstrated to the satisfaction of LTC that the control of flooding, erosion, pollution, dynamic beaches or the conservation of land will not be affected.

Non-Habitable: Detached structure not intended for dwelling in (i.e. garage, uncovered deck, picnic shelter, sun shelter, gazebo, pergola, boathouse)

Not Apparent (unconfined) river and stream valleys: Valleys in which a river or stream is present but there is no discernible valley slope or bank that can be detected from the surrounding landscape. For the most part, unconfined systems are found in fairly flat or gently rolling landscapes and may be located within the headwater areas of drainage basins. The river or stream channels contain either perennial (i.e., year round) or ephemeral (i.e., seasonal or intermittent) flow and range in channel configuration from seepage and natural channels to detectable channels.

Offsetting: Measures that are undertaken to counterbalance unavoidable impacts to the ecosystem. Offsetting should be identified through an Environmental Impact Study and considered only when all other options have been deemed not feasible.

One Zone Concept: An approach whereby the entire floodplain, as defined by the regulatory flood, is treated a one unit, and all development is prohibited or restricted.

Pollution: Any deleterious physical substance or other contaminant that has the potential to be generated by development in an area.

Regulated Lands: The area within which development, interference and alteration activities are regulated by the Conservation Authority.

Regulatory floodplain: See definition of flooding hazard

Retaining Wall: A vertical structure designed to resist the lateral pressure of soil and water behind it.

Revetment: A vertical or inclined facing of rip-rap or other material protecting a soil surface from erosion.

Rip-rap: A layer of stone to prevent the erosion of soil.

Routine permit applications: are activities that are documented through another approval process (DART Protocol) or are determined to have limited impacts on the control of flooding, erosion, dynamic beaches, pollution or the conservation of land (i.e. non-habitable buildings and structures that are less than 10 m2 in size).

Rubble: Waste fragments of stone, brick etc. from old houses; pieces of undressed stone used especially as backfill for walls; loose angular stones; water worn stones.

Scour: Local lowering of a streambed by the erosive action of flowing water.

Sedimentation: The deposition of detached soil particles.

Sewage Disposal System: A system which contains the entire sewage envelope, including both primary and secondary beds, mantle, septic tanks, and reserve areas, as per the requirements of the Ontario *Building Code Act* or the Ministry of the Environment and Climate Change.

LOWER TRENT CONSERVATION
714 Murray Street, R.R. 1, Trenton, Ontario K8V 0N1
Tel: 613-394-4829 Fax: 613-394-5226 Website: www.ltc.on.ca Email: information@ltc.on.ca
Registered Charitable Organization No. 107646598RR0001

May 26, 2023 LTC File: **RP-23-108**

Property Owner: Tom Trumble
Email to: [redacted]

Agent: Elliott Fledderus, P. Eng.
Jewell Engineering Inc.
Email to: elliott@jewelleng.ca

Re: 2420 Shelter Valley Road, Township of Alnwick/Haldimand, Northumberland County, Geographic Township of Haldimand, Concession 3, Part of Lot 12

Application for Permission under Ontario Regulation 163/06 – *Lower Trent Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*

LTC Staff Cannot Grant Approval

Dear Applicants,

Lower Trent Region Conservation Authority (LTRCA) received the above noted application to undergo site preparation and alterations including fill placement associated with future development on the subject lands within an area that is regulated by LTRCA under Ontario Regulation 163/06. Staff have reviewed the applications and the property information available on record including, but not limited to provincial mapping, aerial and satellite imagery and supplementary documents provided as part of the permit submission (i.e., engineering report completed by Jewell Engineering Inc., dated April 11, 2023).

In 2022, LTRCA updated the Regulation Policy Document with respect to Ontario Regulation 163/06. The entire Ontario Regulation 163/06 Policy Document, with all appendices, can be viewed on the LTRCA website at this link: http://www.ltc.on.ca/planning/pag/. Please note that Sections *5.2.1 Development within Flood* Hazards is the applicable section of the Policy Document for the proposed development on this property.

According to our review of the development proposal with consideration for the policies contained within the applicable sections noted above, we can confirm that the proposed development is in direct conflict with the following policies:

5.2.1 Development within Flood Hazard Lands

5.2.1.1 Development within One-Zone Regulatory Floodplain of River or Stream Valleys (including inland lakes)

1) Development within the Regulatory floodplain shall not be permitted.

2) Placement of fill, flood hazard protection and/or bank stabilization works to allow for future/proposed development or an increase in development envelope within the Regulatory floodplain shall not be permitted.

The policies contained in the document represent thresholds and guidelines that have been approved by the LTRCA Board of Directors to enable designated staff to approve permit applications. It is our opinion that the proposed development does not comply with the above noted policies and therefore, staff approval cannot be granted.

Based on the above noted information, there are three options available for you to proceed with your application:

- You may review the information above and withdraw your application for permission under Ontario Regulation 163/06;
- You may modify your development proposal to comply with the LTC Board-approved policies; or,
- You may request a Hearing before the Board as you have a right to a hearing where staff are recommending refusal of the application.

If you intend to proceed with the third bulleted option above the next available date for a Hearing is **July 13, 2023** as our Board Meetings are held on the second Thursday of the month. Please confirm **in writing** by **June 7, 2023** which of the above-noted options you would prefer so that the necessary arrangements can be made. Please note that the LTC Hearing Guidelines have been attached with this letter for your information.

We look forward to hearing back from you on your chosen option. If you require further assistance, please do not hesitate to contact me at 613-394-3915 ext. 224.

Sincerely,

Gage Comeau

Gage Comeau, M. Sc. Provincial Offences Officer
Manager, Watershed Management, Planning and Regulations
Lower Trent Conservation

Encl: Appendix G – Hearing Guidelines

LOWER TRENT
CONSERVATION

714 Murray Street, R.R. 1, Trenton, Ontario K8V 0N1
Tel: 613-394-4829 Fax: 613-394-5226 Website: www.ltc.on.ca Email: information@ltc.on.ca
Registered Charitable Organization No. 107646598RR0001

June 6, 2023

LTC File #: RP-23-108

Owner: Tom Trumble
Email to: [redacted]

Agent: Elliott Fledderus, P. Eng.
Jewell Engineering Inc.
Email to: elliott@jewelleng.ca

NOTICE OF HEARING

IN THE MATTER OF

The Conservation Authorities Act,

R.S.O. 1990, Chapter 27

AND IN THE MATTER OF an application by **JEWELL ENGINEERING INC. for TRUMBLE**

FOR THE PERMISSION OF THE CONSERVATION AUTHORITY

Pursuant to Regulations made under

Section 28, Subsection 12 of the said Act

TAKE NOTICE THAT a Hearing before the Hearing Board of the Lower Trent Region Conservation Authority will be held under Section 28, Subsection 12 of the *Conservation Authorities Act* at the offices of the said Authority located at 714 Murray Street, RR #1 Trenton, Ontario K8V 0N1 at the hour of **1:00 p.m., on the 13th day of July, 2023** with respect to the application by **JEWELL ENGINEERING INC. for TRUMBLE** to permit development within an area regulated by the Authority in order to ensure there are no adverse effects on the control of flooding or erosion as a result of the proposed development in the Shelter Valley Creek floodplain. Specifically, this Hearing is to request permission to undergo site preparation and alterations including fill placement associated with future development in the Township of Alnwick/Haldimand, Geographic Township of Haldimand, Concession 3, Part of Lot 12, on the property known as 2420 Shelter Valley Road in Northumberland County.

TAKE NOTICE THAT you are invited to make a delegation and submit supporting written material to the Hearing Board for the meeting of July 13, 2023. If you intend to appear, please contact Gage Comeau, Manager, Watershed Management, Planning & Regulations. **Written material will be required by July 4, 2023, to enable the Hearing Board members to review the material prior to the meeting.**

TAKE NOTICE THAT this hearing is governed by the provisions of the *Statutory Powers Procedure Act*.

Under the Act, a witness is automatically afforded a protection that is similar to the protection of the *Ontario Evidence Act*. This means that the evidence that a witness gives may not be used in subsequent civil proceedings or in prosecutions against the witness under a Provincial Statute. It does not relieve the witness of the obligation of this oath since matters of perjury are not affected by the automatic affording of the protection. The significance is that the legislation is Provincial and cannot affect Federal matters. If a witness requires the protection of the *Canada Evidence Act* that protection must be obtained in the usual manner. The Ontario Statute requires the tribunal to draw this matter to the attention of the witness, as this tribunal has no knowledge of the effect of any evidence that a witness may give.

AND FURTHER TAKE NOTICE that if you do not attend at this Hearing, the Hearing Board of the Conservation Authority may proceed in your absence, and you will not be entitled to any further notice in the proceedings.

DATED the 6th day of June, 2023.

The Board of Directors of the Lower Trent Region Conservation Authority

Per: Rhonda Bateman

CAO/ Secretary Treasurer: Rhonda J. Bateman

LOWER TRENT
CONSERVATION

APPENDIX G

HEARING GUIDELINES

February 10, 2022

TABLE OF CONTENTS

Appendices:

Appendix G-1: Notice of Hearing – Section 28 (12)

Appendix G-2: Hearing Procedures

Appendix G-3: Chair's Remarks When Dealing with Hearing with respect to Ontario Regulation 163/06.

Appendix G-4: Notice of Decision – Hearing Pursuant to Section 28(12)

Appendix G-5: Notice of Decision – Hearing Pursuant to Section 28(12) (with permit)

Appendix G-6: Notice of Hearing - Section 28.0.1 (7)

Appendix G-7: Chair's Remarks When Dealing with Section 28.0.1 (7)

Revision Notes:

May 12, 2016 – Original Hearing Guidelines – Approved by Board (Resolution G67/16)

Revision 1: April 13, 2017 – Clarifications and Consistency Updates (Resolution G44/17)

Revision 2: November 16, 2018 – Admin Updates

Revision 3: March 26, 2021 – Include Electronic Hearings (Resolution G51/21)

Revision 4: February 10, 2022 – MZO Hearings and OLT Reference (Resolution G20/22)

G-1. PURPOSE OF HEARING GUIDELINES:

The Conservation Authorities Act requires that the applicant be provided with an opportunity for a hearing by the local Conservation Authority Board, or Executive Committee (sitting as a Hearing Board) as the case may be, for an application to be refused or approved with contentious conditions. Further, a permit may be refused if, in the opinion of the Authority, the proposal adversely affects the control of flooding, erosion, dynamic beaches, pollution or the conservation of land. The Hearing Board is empowered by law to make a decision, governed by the *Statutory Powers Procedures Act (SPPA*).

The Hearing Rules are adopted under the authority of Section 25.1 of the *Statutory Powers Procedures Act (SPPA)*. The SPPA applies to the exercise of a statutory power of decision where there is a requirement to hold or to afford the parties to the proceeding an opportunity for a hearing before making a decision. The SPPA sets out minimum procedural requirements governing such hearings and provides rule-making authority for to establish rules to govern such proceedings.

The Hearing Board shall hear and decide whether the application will be approved with or without conditions or refused. In the case of hearings related to applications submitted purposed to Section 28.0.1, the Hearing Board shall determine what conditions, if any, will be attached to the permission. See Section G-6 for further details.

These guidelines have been prepared as an update to previous hearing guidelines and are intended to provide a step-by-step process to conducting hearings required under Section 28 (12), (13), (14) of the Conservation Authorities Act. It is expected that hearings meet the legal requirements of the *Statutory Powers Procedures Act* without being unduly legalistic or intimidating to the participants. Additional considerations have been included related to hearings under Section 28.0.1 (7) in Section G-6 of this document.

G-1.1 Hearing Guideline Updates

Note that these Guidelines have been revised based on changes in legislation to incorporate various considerations as noted below:

- Revised in May 2018 - Housekeeping amendments made reflecting changes to appeal process as a result of the *Building Better Communities and Conserving Watersheds Act, 2017* and subsequent *Order in Council*. Note: changes to appeal process are no longer valid.
- Revised in March 2021 - Amendments made to incorporate the use of electronic hearings.
- Revised in February 2022 - Amendments made to incorporate hearings under 28.0.1 and update references to the Ontario Land Tribunal (OLT).

G-1.2 Additional Hearing Considerations – 2021

With the passage of *Bill 229, Protect, Support and Recover from COVID-19 Act (Budget Measures), 2020*, a new section of the Conservation Authorities Act came into force. Section 28.0.1 (Permission for development, zoning order) applies to applications for permission submitted to an Authority where a zoning order has been made by the Minister of Municipal Affairs and Housing authorizing the proposed development project. While the Act outlines that the Authority must issue these permissions, an Authority has the ability to attach conditions to the permission. In the case of these applications for

permission, applicants must be given the opportunity for a hearing before the Authority, prior to conditions being attached.

As such, hearings under section 28.0.1 of the Act differ from those under section 28, in that the intent of the hearing is not to determine whether or not to issue a permission, but rather, to finalize the conditions of a permission. The purpose of the interim update to the Hearing Guidelines is to incorporate direction for hearings under section 28.0.1 of the Conservation Authorities Act in Section G-6 of this document.

Further, with the passage of Bill 245, Accelerating Access to Justice Act, 2021, on June 1st, 2021 the Local Planning Appeal Tribunal, Environmental Review Tribunal, Board of Negotiation, Conservation Review Board and Mining and Lands Tribunal were merged into a new single tribunal called the Ontario Land Tribunal (OLT). Amendments have been throughout the Hearing Guidelines to update references to the Mining and Lands Tribunal to now reference the Ontario Land Tribunal.

G-2. PRE-HEARING PROCEDURES

G-2.1 Role of the Hearing Board

In considering the application, the Hearing Board is acting as a decision-making tribunal. The tribunal is to act fairly. Under general principles of administrative law relating to the duty of fairness, the tribunal is obliged not only to avoid any bias but also to avoid the appearance or reasonable apprehension of bias. The following are three examples of steps to be taken to avoid apprehension of bias where it is likely to arise.

a) No member of the Authority taking part in the hearing should have prior involvement with the application that could lead to a reasonable apprehension of bias on the part of that member. Where a member has a personal interest, the test is whether a reasonable well-informed person would consider that the interest might have an influence on the exercise of the official's public duty. Where a member is a municipal councillor, the *Municipal Conflict of Interest Act* applies. In the case of preciously expressed opinion, the test is that of an open mind, i.e. is the member capable of persuasion in participating in the decision making.
b) If material relating to the merits of an application that is the subject of a Hearing is distributed to Board members before the Hearing, the material should be distributed to the applicant. The applicant may be afforded an opportunity to distribute similar pre-hearing material. These materials can be distributed to the applicable parties electronically.
c) The applicant will be given an opportunity to attend the Hearing before a decision is made; however, the applicant does not have to be present for a decision to be made.

G-2.2 Application

An applicant has the right to a hearing when:

- staff are recommending refusal of an application because it doesn't comply with the approved policies;
- Staff are unable to approve the permit application because the application does not comply with approved policies; or

- the applicant objects to the conditions of approval.

The applicant is entitled to reasonable notice of the hearing pursuant to the *Statutory Powers Procedures Act.*

G-2.3 Notice of Hearing

The Notice of Hearing shall be sent to the applicant within sufficient time to allow the applicant to prepare for the hearing. To ensure that reasonable notice is given, it is recommended that prior to sending the Notice of Hearing, the applicant be consulted to determine an agreeable date and time based on the local Conservation Authority's regular meeting schedule.

The Notice of Hearing must contain the following:

a) Reference to the applicable legislation under which the hearing is to be held (i.e., the Conservation Authorities Act)
b) The date, time, place and the purpose of the hearing, or for electronic hearings: the time, purpose of the hearing, and details about the manner in which the hearing will be held. Note: for electronic hearings the Notice must also contain a statement that the applicant should notify the Authority if they believe holding the hearing electronically is likely to cause them significant prejudice. The Authority shall assume the applicant has no objection to the electronic hearing if no such notification is received.
c) Particulars to identify the applicant, property and the nature of the application which are the subject of the hearing. Note: If the applicant is not the landowner but the prospective owner, the applicant must have written authorization from the registered landowner.
d) The reasons for the proposed refusal or conditions of approval shall be specifically stated. This should contain sufficient detail to enable the applicant to understand the issues so they can be adequately prepared for the hearing. It is sufficient to reference in the Notice of Hearing that the recommendation for refusal or conditions of approval is based on the reasons outlined in previous correspondence or a hearing report that will follow.
e) A statement notifying the applicant that the hearing may proceed in the applicant's absence and that the applicant will not be entitled to any further notice of the proceedings. Except in extreme circumstances, it is recommended that the hearing not proceed in the absence of the applicant.
f) Reminder that the applicant is entitled to be represented at the hearing by a representative such as legal counsel, if desired. The Conservation Authority may be represented at the Hearing by counsel and/or staff.
g) A copy of the Authority's Hearing Guidelines.

It is recommended that the Notice of Hearing be directed to the applicant and/or landowner by registered mail or other method where confirmation of delivery can be verified.

Refer to **Appendix G-1** for an example **Notice of Hearing**.

G-2.4 Pre-submission of Reports

It is the practice of the Lower Trent Region Conservation Authority to submit reports to the Board members in advance of the hearing (i.e., inclusion on an Authority Agenda) and the applicant will be

provided with the same opportunity. The applicant will be given reasonable time to prepare a report once the reasons for the staff recommendations have been received. Subsequently, this may affect the timing and scheduling of the staff hearing reports. The applicant will be required to provide sufficient copies of this report for inclusion in the Agenda.

G-2.5 Hearing Information

Prior to the hearing, the applicant should be advised of the local Conservation Authority's hearing procedures. (a copy of this document should be provided with the staff report).

G-3. HEARING

G-3.1 Public Hearing

Pursuant to the *Statutory Powers Procedure Act*, hearings, including electronic hearings, are required to be held in public. For electronic hearings, public attendance should be synchronous with the hearing. The exception is in very rare cases where public interest in public hearings is outweighed by the fact that intimate financial, personal or other matters would be disclosed at hearings.

G-3.2 Hearing Participants

The Conservation Authorities Act does not provide for third party status at the Hearing. The Hearing however is open to the public. Any information provided by third parties should be incorporated within the presentation of information by, or on behalf of, the applicant or Authority staff as appropriate.

G-3.3 Attendance of Hearing Board Members

In accordance with case law relating to the conduct of hearings, those members of the Authority who will decide whether to grant or refuse the application must be present during the full course of the hearing. If it is necessary for a member to leave, the remaining members can continue with the Hearing and render a decision.

G-3.4 Adjournments

The Board may adjourn a hearing on its own motion or that of the applicant or Authority staff where it is satisfied that an adjournment is necessary for an adequate hearing to be held. Any adjournments form part of the hearing record.

G-3.5 Orders and Directions

The Authority is entitled to make orders or directions to maintain order and prevent the abuse of its hearing processes. A hearing procedures example has been included as **Appendix G-2.**

G-3.6 Information Presented at Hearings

a) The *Statutory Powers Procedure Act* requires that a witness be informed of their right to object pursuant to the *Canada Evidence Act*. The *Canada Evidence Act* indicates that a witness shall not

be excused from answering questions on the basis that the answer may be incriminating. Further, answers provided during the hearing are not admissible against the witness in any criminal trial or proceeding. This information should be provided to the applicant as part of the Notice of Hearing.

b) It is the decision of the hearing members as to whether information is presented under oath or affirmation. It is not a legal requirement. The applicant must be informed of the above, prior to or at the start of the hearing.
c) The Board may authorize receiving a copy rather than the original document. However, the Board can request certified copies of the document if required.
d) Privileged information, such as solicitor/client correspondence, cannot be heard.
e) Information that is not directly within the knowledge of the speaker (hearsay), if relevant to the issues of the hearing, can be heard.
f) The Board may take into account matters of common knowledge such as geographic or historic facts, times measures, weights, etc. or generally recognized scientific or technical facts, information or opinions within its specialized knowledge without hearing specific information to establish their truth.

G-3.7 Conduct of Hearing

G-3.7.1 Record of Attending Hearing Board Members

A record should be made of the members of the Hearing Board.

G-3.7.2 Opening Remarks

The Hearing Board Chair should convene the hearing with opening remarks which; identify the applicant, the nature of the application, and the property location; outline the hearing procedures; and advise on requirements of the *Canada Evidence Act*. Please reference **Appendix G-3** for the Opening Remarks Template. In an electronic hearing, all the parties and members of the Hearing Board must be able to clearly hear one another and any witnesses throughout the hearing.

G-3.7.3 Presentation of Authority Staff Information

Staff of the Authority presents the reasons supporting the recommendation for the refusal or conditions of approval of the application. Any reports, documents or plans that form part of the presentation should be properly indexed and received.

Staff of the Authority should not submit new technical information at the Hearing as the applicant will not have had time to review and provide a professional opinion to the Hearing Board.

Consideration should be given to the designation of one staff member or legal counsel who coordinates the presentation of information on behalf of Authority staff and who asks questions on behalf of Authority staff.

G-3.7.4 Presentation of Applicant Information

The applicant has the opportunity to present information at the conclusion of the Authority staff presentation. Any reports, documents or plans which form part of the submission should be properly indexed and received.

The applicant shall present information as it applies to the permit application in question. For instance, does the requested activity affect the control of flooding, erosion, dynamic beaches, pollution or conservation of land? The hearing does not address the merits of the activity or appropriateness of such a use in terms of planning.

- The applicant may be represented by legal counsel or agent, if desired.
- The applicant may present information to the Board and/or have invited advisors to present information to the Board.
- The applicant's presentation may include technical witnesses, such as an engineer, ecologist, hydro-geologist etc.

The applicant should not submit new technical information at the hearing as the Staff of the Authority will not have had time to review and provide a professional opinion to the Hearing Board.

G-3.7.5 Questions

Members of the Hearing Board may direct questions to each speaker as the information is being heard. The applicant and/or agent can make any comments or questions on the staff report. Staff will be given an opportunity to respond to questions posed by either the Board or the applicant. Staff may also rebut comments or pose questions to the applicant at this time.

Pursuant to the *Statutory Powers Procedure Act*, the Board can limit questioning where it is satisfied that there has been full and fair disclosure of the facts presented. Please note that the courts have been particularly sensitive to the issue of limiting questions and there is a tendency to allow limiting of questions only where it has clearly gone beyond reasonable or proper bounds.

G-3.7.6 Deliberation

After all the information is presented, the Board may adjourn the hearing and retire in private to confer. The Board may reconvene on the same date or at some later date to advise the applicant of the Board's decision. The Board members should not discuss the hearing with others prior to the decision of the Board being finalized.

G-4. DECISION

The applicant must receive written notice of the decision. The applicant should be informed of the right to appeal the decision within 30 days upon receipt of the written decision to the Ontario Land Tribunal.

It is important that the hearing participants have a clear understanding of why the application was refused or approved. The Board should itemize and record information of particular significance which

led to their decision.

G-4.1 Notice of Decision

The decision notice should include the following information:

a) The identification of the applicant, property and the nature of the application that was the subject of the hearing.
b) The decision to refuse or approve the application. A copy of the Hearing Board resolution should be attached.

It is recommended that the written Notice of Decision be forwarded to the applicant by registered mail or other method where confirmation of delivery can be verified.

A sample Notice of Decision and cover letter has been included as **Appendix G-4**. Note that if the decision of the Board is to approve the application, the written notice of decision can be included as part of the Permit Cover Letter. An example of Permission Granted through Hearing has been included as **Appendix G-5**.

G-4.2 Adoption

A resolution advising of the Board's decision and particulars of the decision should be adopted.

G-5. RECORD

The Authority shall compile a record of the hearing. In the event of an appeal, a copy of the record should be forwarded to the Ontario Land Tribunal. The record must include the following:

a) The application for the permit.
b) The Notice of Hearing.
c) Any orders made by the Board (e.g. for adjournments).
d) All information received by the Board.
e) Attendance of Hearing Board members.
f) The transcript/minutes, if one exists, of the oral presentations made at the hearing.
g) The decision and reasons for decision of the Board.
h) The Notice of Decision sent to the applicant.

G-6. HEARINGS UNDER SECTION 28.0.1 CAA

Section 28.0.1 of the Conservation Authorities Act came into force with the Royal Assent of *Bill 229, Protect, Support and Recover from COVID-19 Act (Budget Measures), 2020*. This section applies to any application submitted to an authority under a regulation made under Section 28 of the Act for permission to carry out all or part of a development project associated with an approved Minister's Zoning Order (MZO). For such applications, an Authority must grant permission to the applicant to carry out the activity, provided an MZO has been made by the Minister of Municipal Affairs and Housing, and provided that the authority's regulated area in which the development activity is proposed to take place

is not located in the Greenbelt Area designated under section 2 of the Greenbelt Act. A permission which is granted under s.28.0.1 may be subject to conditions as prescribed by the issuing Authority.

Understanding that an Authority must grant permission for applications submitted pursuant to an approved MZO (pending the above-noted conditions are met), hearings for these applications differ from those under Section 28(12) of the Act, in that a hearing cannot be held to determine if a permission should be refused. The Authority may refuse to grant a permit only if i) a zoning order has not been made to authorize the development project, ii) the project is proposed to be carried out in the Greenbelt Area, and iii) if all other prescribed requirements have not been satisfied. Per s.28.0.1 (7) of the Act, the applicant for a permission will be given the opportunity to be heard by the Authority prior to any conditions being attached to the granted permission.

The following table is intended to provide a step-by-step process to conducting hearings required under Section 28.0.1 (7) of the Conservation Authorities Act. It is recognized that much of the guidance provided in the body of the Section 28 Hearing Guidelines will be applicable to the s. 28.0.1 (7) hearing process. Where processes differ, the table outlines the necessary considerations for the s. 28.0.1 (7) processes. Where the processes are the same, the table refers to the appropriate sections of the Section 28(3) hearing guidelines.

Sections of the *Section 28 Conservation Authorities Act Hearing Guidelines*	**Specific Guidance and/or Processes for S. 28.0.1 (7) Hearings**
1.0 Purpose of Hearing Guidelines	The *Conservation Authorities Act* requires that the applicant be provided with an opportunity for a hearing by the local Conservation Authority Board, or Executive Committee (sitting as a Hearing Board) as the case may be, for an application to be refused or approved with contentious conditions. In the case of hearings related to applications submitted pursuant to s. 28.0.1 of the *Conservation Authorities Act*, the Authority must grant permission to the applicant, provided the requirements set out under this section are met. In this scenario, a hearing will only be held to determine conditions which will be attached to a permission. Further, a permit may be refused if in the opinion of the Authority the proposal adversely affects the control of flooding, pollution or conservation of land, and additional erosion and dynamic beaches. In the case of applications submitted pursuant to s. 28.0.1 of the *Conservation Authorities Act*, the Authority may refuse to grant a permit only if i) a zoning order has not been made to authorize the development project, ii) the project is proposed to be carried out in the Greenbelt Area, and iii) if all other prescribed requirements have not been satisfied. The Hearing Board is empowered by law to make a decision, governed by the *Statutory Powers Procedures Act*.

	The Hearing Rules are adopted under the authority of Section 25.1 of the *Statutory Powers Procedures Act* (SPPA). The SPPA applies to the exercise of a statutory power of decision where there is a requirement to hold or to afford the parties to the proceeding an opportunity for a hearing before making a decision. The SPPA sets out minimum procedural requirements governing such hearings and provides rule-making authority for to establish rules to govern such proceedings. The Hearing Board shall hear and decide whether the application will be approved with or without conditions or refused. In the case of hearings related to applications submitted purposed to Section 28.0.1, the Hearing Board shall determine what conditions, if any, will be attached to the permission. See Section G-6 for further details. These guidelines have been prepared as an update to the October 1992 hearing guidelines and are intended to provide a step-by-step process to conducting hearings required under Section 28 (12), (13), (14) of the *Conservation Authorities Act*. It is hoped that the guidelines will ensure that hearings meet the legal requirements of the *Statutory Powers Procedures Act* without being unduly legalistic or intimidating to the participants. Additional considerations have been included related to hearings under Section 28.0.1 (7) in Section G-6
2.0 Prehearing Procedures	Not applicable to S.28.0.1(7) hearings
2.1 Role of the Hearing Board	In considering the application, the Hearing Board is acting as a decision-making tribunal. The tribunal is to act fairly. Under general principles of administrative law relating to the duty of fairness, the tribunal is obliged not only to avoid any bias but also to avoid the appearance or reasonable apprehension of bias. The following are three examples of steps to be taken to avoid apprehension of bias where it is likely to arise. (a) No member of the Authority taking part in the hearing should have prior involvement with the application that could lead to a reasonable apprehension of bias on the part of that member. Where a member has a personal interest, the test is whether a reasonably well-informed person would consider that the interest might have an influence on the exercise of the official's public duty. Where a member is a municipal councillor, the *Municipal Conflict of Interest Act* applies. In the case of a previously expressed opinion, the test is that of an

	open mind, i.e. is the member capable of persuasion in participating in the decision making (b) If material relating to the merits of an application that is the subject of a hearing is distributed to Board members before the hearing, the material shall be distributed to the applicant at the same time. The applicant may be afforded an opportunity to distribute similar pre-hearing material. These materials can be distributed electronically. (c) The applicant will be given an opportunity to attend the hearing before a decision is made; however, the applicant does not have to be present for a decision to be made. (d) Where a hearing is required for applications submitted pursuant to s. 28.0.1 of the *Conservation Authorities Act* (e.g., to determine the conditions of the permission), final decisions on the conditions shall not be made until such a time as the applicant has been given the opportunity to attend a hearing.
2.2 Application	The right to a hearing arises where staff is recommending refusal of an application or is recommending conditions to the approval of an application. Additionally, in the case of applications submitted pursuant to s. 28.0.1 of the CA Act, the authority shall not attach conditions to a permission unless the applicant has been given an opportunity to be heard by the authority. The applicant is entitled to reasonable notice of the hearing pursuant to the *Statutory Powers Procedures Act*.
2.3 Notice of Hearing	*Refer to Section 2.3*
2.4 Presubmission of Reports	*Refer to Section 2.4*
3.0 Hearing	Not applicable to S.28.0.1(7) hearings
3.1 Public Hearing	*Refer to Section 3.1*
3.2 Hearing participants	*Refer to Section 3.2*
3.3 Attendance of Hearing Board Members	*Refer to Section 3.3*
3.4 Adjournments	*Refer to Section 3.4*
3.5 Orders and Directions	*Refer to Section 3.5*
3.6 Information Presented at Hearings	*Refer to Section 3.6*
3.7 Conduct of Hearing	N/A
3.7.1 Record of Attending Hearing Board Members	*Refer to Section 3.7.1*
3.7.2 Opening Remarks	*Refer to Section 3.7.2*
3.7.3 Presentation of Authority Staff Information	*Refer to Section 3.7.3*
3.7.4 Presentation of Applicant Information	*Refer to Section 3.7.4*
3.7.5 Questions	*Refer to Section 3.7.5*

3.7.6 Deliberation	*Refer to Section 3.7.6*
4.0 Decision	*Refer to Section 4.0*
4.1 Notice of Decision	The decision notice should include the following information: (a) The identification of the applicant, property and the nature of the application that was the subject of the hearing. (b) The decision to refuse or approve the application, and in the case of applications under s. 28.0.1 of the CA Act, the decision to approve the application with or without conditions. A copy of the Hearing Board resolution should be attached. It is recommended that the written Notice of Decision be forwarded to the applicant by registered mail. A sample Notice of Decision and cover letter has been included as **Appendix G-4**.
4.2 Adoption	*Refer to section 4.2*
5.0 Record	*Refer to Section 5.0*
Appendix G-6	A new Appendix G-6 has been prepared which provides an example "Notice of Hearing" for hearings under Section 28.0.1 (7) of the *Conservation Authorities Act*
Appendix G-7	A new Appendix G-7 has been prepared which provides an example "Notice of Decision" for hearings under Section 28.0.1 (7) of the *Conservation Authorities Act*

Appendix G-1

NOTICE OF HEARING

IN THE MATTER OF

The Conservation Authorities Act, R.S.O. 1990, Chapter 27

AND IN THE MATTER OF an application by **XXXXXX**

FOR THE PERMISSION OF THE CONSERVATION AUTHORITY

Pursuant to Regulations made under Section 28, Subsection 12 of the said Act

TAKE NOTICE THAT a Hearing before the Full Board of the Lower Trent Region Conservation Authority will be held under Section 28, Subsection 12 of the Conservation Authorities Act at the offices of the said Authority located at 714 Murray Street, RR #1 Trenton, Ontario K8V 5P4 at the hour of **, on the day of , 20**___, [for electronic hearings, include details about the manner in which the hearing will be held] with respect to the application by ***(NAM*E)** to permit development within an area regulated by the Authority in order to ensure no adverse effect on ***(the control of flooding, erosion, dynamic beaches or pollution or, conservation of land./alter or interfere with a watercourse or wetland*)** on Lot , Plan/Lot , Concession, ***(Stree*t) in the City of , Regional Municipality of , River Watershed.

TAKE NOTICE THAT you are invited to make a delegation and submit supporting written material to the Hearing Board for the meeting of ***(meeting numbe*r)**. If you intend to appear, [for electronic hearings: or if you believe holding the hearing is likely to cause significant prejudice], please contact ***(name*)**. Written material will be required by ***(date*)**, to enable the Hearing Board members to review the material prior to the meeting.

TAKE NOTICE THAT this hearing is governed by the provisions of the *Statutory Powers Procedure Act*. Under the Act, a witness is automatically afforded a protection that is similar to the protection of the Ontario Evidence Act. This means that the evidence that a witness gives may not be used in subsequent civil proceedings or in prosecutions against the witness under a Provincial Statute. It does not relieve the witness of the obligation of this oath since matters of perjury are not affected by the automatic affording of the protection. The significance is that the legislation is Provincial and cannot affect Federal matters. If a witness requires the protection of the Canada Evidence Act that protection must be obtained in the usual manner. The Ontario Statute requires the tribunal to draw this matter to the attention of the witness, as this tribunal has no knowledge of the effect of any evidence that a witness may give.

AND FURTHER TAKE NOTICE that if you do not attend at this Hearing, the Hearing Board of the Conservation Authority may proceed in your absence, and you will not be entitled to any further notice in the proceedings.

DATED the ___ day of , _____20__.

APPENDIX G – HEARING GUIDELINES

The Board of Directors of the Lower Trent Region Conservation Authority

Per:

Staff Member, Title: _____

Chief Administration Officer/ Secretary Treasurer: _____

Appendix G-2

HEARING PROCEDURES

1. Motion to sit as Hearing Board.
2. Roll Call followed by the Chair's opening remarks. For electronic hearings, the Chair shall ensure that all parties and the Hearing Board are able to clearly hear one another and any witnesses throughout the hearing.
3. Staff will introduce to the Hearing Board the applicant/owner, his agent and others wishing to speak.
4. Staff will indicate the nature and location of the subject application and the conclusions.
5. Staff will present the staff report included in the Authority agenda.
6. The applicant and/or his agent will speak and also make any comments on the staff report, if he so desires.
7. The Hearing Board will allow others to speak, and, if necessary, the applicant in rebuttal.
8. The Hearing Board will question, if necessary, both the staff and the applicant/agent.
9. The Hearing Board will move into camera. For electronic hearings, the Hearing Board will separate from the other participants.
10. Members of the Hearing Board will move and second a motion.
11. A motion will be carried which will culminate in the decision.
12. The Hearing Board will move out of camera. For electronic meeting, the Hearing Board will reconvene with other participants.
13. The Chair or Acting Chair will advise the owner/applicant of the Hearing Board decision.
14. If decision is "to refuse" or "approve with conditions", the Chair or Acting Chair shall notify the owner/applicant of his/her right to appeal the decision to the Ontario Land Tribunal within 30 days of receipt of the reasons for the decision.
15. Motion to move out of Hearing Board and sit as the Board of Directors.

Appendix G-3

CHAIR'S REMARKS WHEN DEALING WITH HEARINGS WITH RESPECT TO ONTARIO REGULATION 163/06.

Date: Month XX, XXXX
O.Reg. 163/06: Permit Application # RP-XX-XXX
Applicant: Name

We are now going to conduct a hearing under Section 28 of the Conservation Authorities Act in respect of an application by _____: , for permission to:_____

The Authority has adopted regulations under section 28 of the Conservation Authorities Act which requires the permission of the Authority for development within an area regulated by the Authority in order to ensure no adverse effect on the control of flooding, erosion, dynamic beaches, pollution or conservation of land, or to permit alteration to a shoreline or watercourse or interference with a wetland. This Hearing is about granting permission to develop under the Authority regulations; a separate matter from approvals under the *Planning Act*.

The Staff has reviewed this proposed work and a copy of the staff report has been given to the applicant.

The Conservation Authorities Act (Section 28 [12]) provides that:

"Permission required under a regulation made under clause (1) (b) or (c) shall not be refused or granted subject to conditions unless the person requesting permission has been given the opportunity to require a hearing before the authority or, if the authority so directs, before the authority's executive committee."

In holding this hearing, the Hearing Board is to determine whether or not a permit is to be issued, with or without conditions. In doing so, we can only consider the application in the form that is before us, the staff report, such evidence as may be given and the submissions to be made on behalf of the applicant. Only information disclosed prior to the hearing is to be presented at the hearing. It is not our place to suggest alternative development methods.

It is to be noted that if the Hearing Board decision is "to refuse" or not support the proposed work within the permit submission, the Chair or Acting Chair shall notify the owner/applicant of his/her right to appeal the decision to the Ontario Land Tribunals.

The proceedings will be conducted according to the *Statutory Powers Procedure Act*. Under Section 5 of the Canada Evidence Act, a witness may refuse to answer any question. The procedure in general shall be informal without the evidence before it being given under oath or affirmation.

If the applicant has any questions to ask of the Hearing Board or of the Authority representative, they must be directed to the Chair of the Board.

At this time, if any member of this Board has intervened on behalf of the Applicant with regards to this matter, they should recuse themselves so there is no apprehension of bias and that a fair and impartial Hearing may be conducted.

Appendix G-4

(Date) **BY REGISTERED MAIL**

(name) , (address)

Dear:

RE: NOTICE OF DECISION
Hearing Pursuant to Section 28(12) of the Conservation Authorities Act
Proposed Residential Development
Lot , Plan ; ?? Drive, City of
(Application #)

In accordance with the requirements of the Conservation Authorities Act, the Lower Trent Region Conservation Authority provides the following Notice of Decision:

On ***(meeting date and numbe***r), the Hearing Board of the Lower Trent Region Conservation Authority refused/approved your application/approved your application with conditions. A copy the Board's Resolution # _____ has been attached for your records. Please note that this decision is based on the following reasons: ***(the proposed development/alteration to a watercourse adversely affects the control of flooding, erosion, dynamic beaches, pollution or conservation of land***.)

In accordance with Section 28 (15) of the Conservation Authorities Act, an applicant who has been refused permission or who objects to conditions imposed on a permission may, within 30 days of receiving the reasons under subsection (14), appeal to the Minister who may refuse the permission; or grant permission, with or without conditions. Through Order in Council 332/2018 the responsibility for hearing the appeal has been transferred to the Ontario Land Tribunal. For your information, should you wish to exercise your right to appeal the decision, a letter by you or your agent/counsel setting out your appeal must be sent within 30 days of receiving this decision addressed to:

Ontario Land Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario M5G 1E5

A carbon copy of this letter should also be sent to Lower Trent Region Conservation Authority. Should you require any further information, please do not hesitate to contact ***(staff contac***t) or the undersigned.

Yours truly,

Chief Administration Officer/ Secretary Treasurer

Enclosure

Appendix G-5

Date

FILE #: RP-XX-XXX
PERMIT#: P-XX-XXX

Name of Applicant
Address of Applicant

ATTENTION: **It is important that you read and understand the contents of this letter and ensure that all necessary parties (i.e., landowner(s) and anyone conducting site works) are aware of any special mitigation requirements contained herein.**

RE: Location where Permission Applies

Application for permission to (development, interference and/or alteration) pursuant to Ontario Regulation 163/06 – *Lower Trent Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*.

As you are aware, your application to allow for (Proposed development/interference/alteration) on the property noted above was heard and approved by the Lower Trent Region Conservation Authority's (LTC) Hearing Board on Hearing Date. The following resolution was passed (draft resolution for final approval at the upcoming LTC's Board of Directors' meeting – Next Meeting Date):

RES: HC2/17 **Moved by: Board Member** **Seconded by: Board Member**
THAT the permit application RP-XX-XXX by Applicant for permission (development/interference/alteration) in the (Regulated Area) be approved.
Carried

Please accept this letter as formal notice of the decision of the Hearing Board.

The proposed (development/alteration/interference) is situated within regulated areas associated with (Regulated Area). Attached you will find a copy of Permit No. P-XX-XXX issued for the works noted above in accordance with Ontario Regulation 163/06. The permit has been issued based on the information, plans and specifications submitted with the application as well as your acceptance of the general conditions of approval detailed in the application. The plans and specifications are attached as part of the approved documentation.

The following mitigation measures are expected to be implemented as part of the approval from LTC:

1) *Listed Conditions of Permission;*

Should you require any further information, please do not hesitate to contact ***(staff contac***t) or the undersigned.

Appendix G-6

NOTICE OF HEARING

(Subsection 28.0.1 (7) of the Conservation Authorities Act)

IN THE MATTER OF

The Conservation Authorities Act, R.S.O. 1990, Chapter 27

AND IN THE MATTER OF an application by

FOR THE PERMISSION OF THE CONSERVATION AUTHORITY

Pursuant to Regulations made under Section 28.0.1, Subsection 7 of the said Act

TAKE NOTICE THAT a Hearing before the Executive Committee of the Conservation Authority will be held under Section 28.0.1, Subsection 7 of the Conservation Authorities Act at the offices of the said Authority (located at 714 Murray Street, RR #1 Trenton, Ontario K8V 5P4), at the hour of XX:XX, on the XX day of XXX , 20XX, [for electronic hearings, include details about the manner in which the hearing will be held] with respect to the application by (NAME) to permit development within an area regulated by the Authority in association with a Minister's Zoning Order (REGULATION NUMBER) on Lot , Plan/Lot , Concession , (Street) in the City of , Regional Municipality of , River Watershed.

TAKE NOTICE THAT you are invited to make a delegation and submit supporting written material to the Executive Committee for the meeting of (meeting number). If you intend to appear [For electronic hearings: or if you believe that holding the hearing electronically is likely to cause significant prejudice], please contact (name). Written material will be required by (date), to enable the Committee members to review the material prior to the meeting.

TAKE NOTICE THAT pursuant to Section 28.0.1 of the Conservation Authorities Act, a conservation authority is required to grant the permission applied for and may only impose conditions to the permission. The Hearing will therefore focus on the conditions to be imposed to the granting of the permission.

TAKE NOTICE THAT this hearing is governed by the provisions of the *Statutory Powers Procedure Act*. Under the Act, a witness is automatically afforded a protection that is similar to the protection of the *Ontario Evidence Act*. This means that the evidence that a witness gives may not be used in subsequent civil proceedings or in prosecutions against the witness under a Provincial Statute. It does not relieve the witness of the obligation of this oath since matters of perjury are not affected by the automatic affording of the protection. The significance is that the legislation is Provincial and cannot affect Federal matters. If a witness requires the protection of the Canada Evidence Act that protection must be obtained in the usual manner. The Ontario Statute requires the tribunal to draw this matter to the attention of the witness, as this tribunal has no knowledge of the affect of any evidence that a witness may give.

AND FURTHER TAKE NOTICE that if you do not attend at this Hearing, the Executive 24 Committee of the Conservation Authority may proceed in your absence, and you will not be entitled to any

further notice in the proceedings.

DATED the ___ day of , _____202X

The Executive Committee of the Conservation Authority

Per:

Chief Administrative Officer/Secretary-Treasurer

Appendix G-7

HEARING BOARD CHAIR'S REMARKS WHEN DEALING WITH HEARINGS

(Section 28.0.1, Subsection 7 of the Conservation Authorities Act)

WITH RESPECT TO ONTARIO REGULATION 163/06.

We are now going to conduct a hearing under section 28.0.1 of the Conservation Authorities Act in respect of an application by _____: , for permission to:_____

Under Section 28.0.1 of the Conservation Authorities Act, an Authority is required to grant permission for any application submitted under a regulation made under subsection 28(1) for permission to carry out all or part of a development project, in an area regulated by the Authority, associated with a Minister's Zoning Order, provided the criteria listed under subsection 28.0.1 (1) are met. A permission is subject to any conditions as may be prescribed by the Authority.

The Staff has reviewed this proposed work and prepared a staff report, including the proposed conditions of approval for the proposed work, which has been given to the applicant and the Board. The applicant was invited to file material in response to the staff report, a copy of which has also been provided to the Board.

Under Section 28.0.1 (7) of the Conservation Authorities Act, the person requesting permission has the right to a hearing before the Authority/Executive Committee.

In holding this hearing, the Authority Board/Executive Committee is to determine the prescribed conditions to be attached to the approved permission. In doing so, we can only consider the application in the form that is before us, the staff report, such evidence as may be given and the submissions to be made on behalf of the applicant. Only Information disclosed prior to the hearing is to be presented at the hearing.

The proceedings will be conducted according to the *Statutory Powers Procedure Act*. Under Section 5 of the *Canada Evidence Act*, a witness may refuse to answer any question on the ground that the answer may tend to incriminate the person, or may tend to establish his/her liability to a civil proceeding at the instance of the Crown or of any person.

The procedure in general shall be informal without the evidence before it being given under oath or affirmation unless decided by the hearing members.

If the applicant has any questions to ask of the Hearing Board or of the Authority representative, they must be directed to the Chair of the board.

Fwd: Trumble - LTC Permit Application

Janet K Noyes <jknatltc@gmail.com>
Thu 2023-05-18 2:14 PM
To: Gage Comeau <gage.comeau@ltc.on.ca>

1 attachments (13 KB)
image001.png;

Hi Gage

I am happy with this response and note that the floodplain impacts to adjacent properties would be quite limited.

I realize that this application will go to the Board but I would consider this application complete with the opinion letter and detailed explanation below.

LTC File: RP-23-108

Janet Noyes, P.Eng.
JKN Consulting
[redacted]
JKNatLTC@gmail.com

---------- Forwarded message ---------
From: **Elliott Fledderus** <elliott@jewelleng.ca>
Date: Thu., May 18, 2023, 10:26 a.m.
Subject: RE: Trumble - LTC Permit Application
To: Janet K Noyes <jknatltc@gmail.com>
Cc: Gage Comeau <gage.comeau@ltc.on.ca>

Hi Janet,

Thanks for the input. Please see below. Sorry for the length of email.

1. No modeling was completed. We did assess the depth of fill required by taking a full size scaled drawing of the concept plan and taking average fill depths for cross sections throughout the fill area and multiplying by the fill footprint area. We used those calcs to estimate the 600 m^3 of engineered fill material listed on the permit application. The 1.5m depth in some areas is about

right. The grades ended up working well with the raised septic recommended by Carol. The neighbour to the east is raised quite a bit higher than this lot's existing elevations, and is a good reference for what this lot would look like in a built condition.

2. Regarding the concern for *localized* loss of storage: This is where the ineffective flow areas are factored in. If we were to update a traditional HEC-RAS model (LTC did not have the model on file), or produce a traditional (1D) HEC-RAS model of our own, then we already know that properly input ineffective flow areas in existing conditions, compared to the proposed fill location on the lot, both of which would be aligned with immediate upstream and downstream houses in existing conditions, would produce no change in the local WSELs.

Hydraulic models assume flow in one direction. Any cross sections entered on Tom's property in existing conditions would need ineffective flow areas for the same reason that we apply ineffective flow areas to the bounding contraction and expansion cross sections on a bridge. The model computes the flow and subsequent WSEL based on the area of the cross section. Due to the buildings and driveways immediately upstream and downstream of Tom's property, one has to make any portion of his property that is between the bounding buildings (in the direction of flow parallel to the creek) an ineffective flow area (it can also be modeled as an obstruction) in order for the model to know it cannot flow in its singular direction. If you fill within an ineffective flow area, it has no impact on that cross section's flow conveyance since the model already knows not to use that cross sectional area. As a result, the added fill has no impact on localized WSELs.

For reference, we completed this exact scenario last year as a modeling exercise for the Drag River in Haliburton. That project was prepared for a building near the downtown of Haliburton immediately adjacent to the Drag River. There is no CA there, so the Municipality required a flood assessment to determine potential localized flooding impacts to the bounding and adjacent buildings. With a number of buildings nearby in the overbank areas, we added flow obstructions in place of the buildings. Although the existing lot was undeveloped, obstructions/ineffective flow areas were added for the future building in locations where the bounding buildings were parallel to the flow direction. The model results showed no negative impacts, as expected based on the above concept. The peer review was completed by Engage Engineering and there were no concerns with this approach.

In Tom's case, or many other private lot owners, the cost to do a full hydrology and hydraulics study is not feasible. For this particular site, we were able to provide a confident opinion based on hydraulic theory and past experience without the need of a modelling tool.

3. My opinion on scour on the north slope of the engineered fill is that it is low risk for the following reasons:

a. In a site visit of the property, I do not recall any erosion or scour on the adjacent upstream property that has similar grading to Tom's proposed lot grades. I may have Tom go and get some pictures of their slope for me to confirm as I completed that site visit a little while ago.
b. You and I know that in these creek systems the velocities would be higher at the creek and lower in the overbank areas, and lower yet at the flood limit which is where this slope would be located. We see this visually with the 2D hydraulic models. We also see this in 1D models although less detailed and in tabular format.
c. The creek has well defined dimensions based on my site visit. It is reasonable to assume that the 2-yr is contained with the creek. The narrowest point on the concept plan between the top of creek bank and top of fill slope is about 10m, with 5m from the top of creek bank to the toe of slope. This means there will be significant flow capacity in the overbank and that it is reasonable to expect the 5-yr depth at the north slope of the engineered fill to be shallow. With shallow flows and low velocities in the minor return period events, I am not too concerned about erosion in these events, although regular inspections by the lot owner is recommended.
d. For the major and regulatory event, the depth could get in the 1 – 1.5m range based on the flood elevation provided, and there could be noticeable velocities at different depths along the slope. I think a reasonable approach here is to add straw bales to the north slope of the engineered fill during construction. The straw bales would be spread across the face of the slope to act as a mulch to provide some added stability.

Elliott Fledderus P. Eng. | **Municipal Engineer**

Jewell Engineering Inc.

1-71 Millennium Parkway

Belleville ON K8N 4Z5

O 613.969.1111 ex 242

From: Janet K Noyes <jknatltc@gmail.com>
Sent: Friday, May 12, 2023 10:56 AM
To: Elliott Fledderus <elliott@jewelleng.ca>
Cc: Gage Comeau <gage.comeau@ltc.on.ca>
Subject: Trumble - LTC Permit Application

Hello Elliott;

I am reviewing the permit application submission for Mr. Trumble's property at 2420 Shelter Valley Road and I have a few questions about the Floodline Opinion Letter by Jewell Engineering (2023-04-11). The updated survey confirms that almost the entire property (except a portion of the entrance driveway) is located within the flood hazard lands of Shelter Valley Creek.

I note the discussions about ineffective flow areas and loss of storage but I was wondering if you did any modelling in support of these statements? Did you complete a "heat map" as to depth of fill required as it looks like there is a good 1.5 metres required in some areas - especially near the north end of the top of slope area. I realize that your storage calculations are for the entire tributary but note that a more localized loss of storage could have more localized impacts. I'm mostly concerned about impacts to the direct neighbours - specifically the upstream neighbour.

I'm also curious as to your opinion of the velocity scour on the north slope of the engineered fill required for the proposed development. Would the high velocities incurred during a flood event provide significant erosion/scour on the filled slope? If so, should this slope be protected?

Please don't hesitate to respond to the email or give me a call.

LTC File: RP-23-108

Regards,

Janet Noyes, P.Eng.

JKN Consulting

[redacted]

[redacted]

JKNatLTC@gmail.com

LOWER TRENT CONSERVATION

HEARING
Ontario Regulation 163/06 Permit Application: RP-23-108

Property Owner: Tom TRUMBLE
Agent: Elliott Fledderus – Jewell Engineering
2420 Shelter Valley Road, Township of Alnwick/Haldimand
Concession 3, Part of Lot 12

Presented to: Lower Trent Region Conservation Authority Hearing Board
Presented by: Gage Comeau, Manager, Watershed Management, Planning & Regulations

Date: July 13, 2023

Contents

- Subject Property
- Floodplain Mapping
- Development Proposal
- O.Reg. 163/06 LTC Policies
- Staff Conclusion
- File Timelines

2

Subject lands

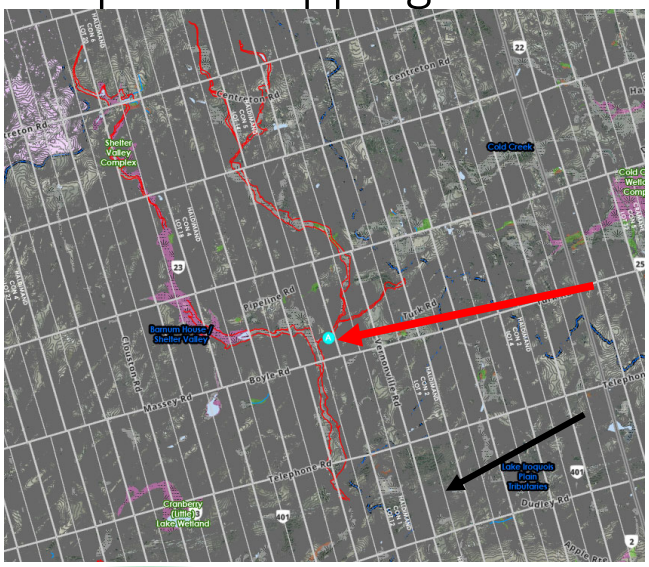
- Property located to the North of Shelter Valley Road
- Shelter Valley Creek runs along the North portion of the property boundary
- Property located within Shelter Valley Creek Regulatory floodplain

3

Subject Property

4

Floodplain Mapping



5

One-Zone Concept

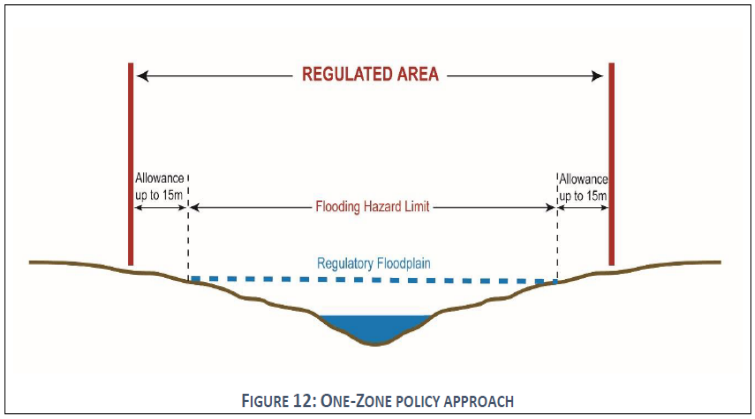


FIGURE 12: ONE-ZONE POLICY APPROACH

One-Zone Concept

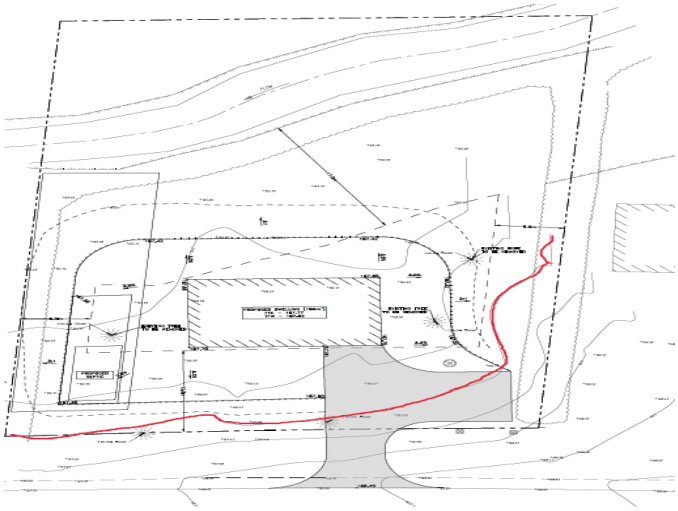
Two-Zone Concept

6

Shelter Valley Creek Floodplain

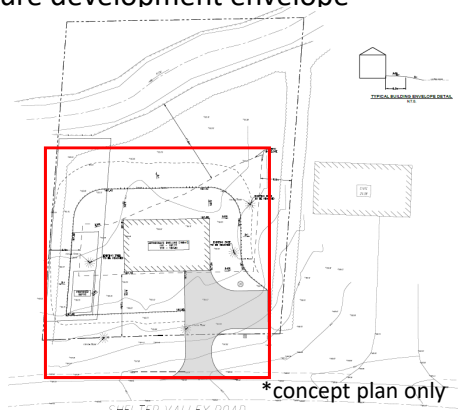
- Information is from the 1978 Shelter Valley & Barnum House Creeks project
- Property is located in floodplain based on the mapping

Shelter Valley Creek Floodplain



Development Proposal

- Permit Application received: April 27, 2023
- Undergo the placement of fill material (600 m^3) to provide a suitable future development envelope



*concept plan only

9

Ontario Regulation 163/06 Policy Document

- **General Policies**
- c) Susceptibility to natural hazards is not increased nor new hazards created (e.g., there will be no impacts on adjacent properties with respect to natural hazards).
- k) the control of flooding, erosion, dynamic beaches, pollution and/or the conservation of land is not adversely affected during and post development.

- **5.2.1.1 Development within One-Zone Regulatory Floodplain of River or Stream Valleys**

1. Development within the Regulatory floodplain shall not be permitted.
2. Placement of fill, flood hazard protection and/or bank stabilization works to allow for future/proposed development or an increase in development envelope within the Regulatory floodplain shall not be permitted.

10

Staff Conclusion

Based on a review of the relevant policies that are applicable to this proposal, staff are not in a position to support the application as it does not conform with the policies.

Permit Application: RP-23-108

- Permit Application received: July 8, 2021
- Complete Application: May 19, 2023
- Denial Letter: May 26, 2023
- Request for Hearing: May 29, 2023
- Notice of Hearing: June 6, 2023
- Hearing Date: July 13, 2023

12

2420 Shelter Valley Rd

Concession 3, Part of Lot 12 of Alnwick/Haldimand Township

(only property between 2416 and 2438)

ENGINEERING OPINION & CONCEPT PLAN

PERMIT APPLICATION HEARING

Prepared by: Elliott Fledderus, P. Eng.

July 13, 2023

JEWELL ENGINEERING

PERMIT APPLICATION & HEARING OBJECTIVE

- Applicant:
  - Mr. Tom Trumble
- Permit Application:
  - To permit development and alteration within an area regulated by the Authority in order to ensure there are no adverse effects on the control of flooding or as a result of the proposed alteration to the placement of fill within the floodplain.
- Objective:
  - To present an engineering opinion based on site observations, recent similar projects, and an understanding of floodplain and hydraulic engineering principles.
  - To present a prudent concept plan that presents no flood risk to the applicant or other property owners
  - Mr. Trumble is **seeking to place fill** on the subject lot with the intent to re-instate a residential dwelling on a family property they have owned for 40+ years.

JEWELL ENGINEERING

2

BACKGROUND

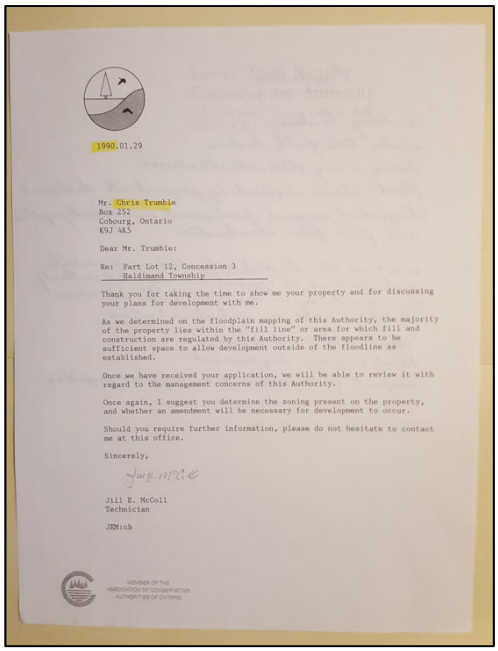
- Property located at 2420 Shelter Valley Road in Grafton, ON.
- Single family dwelling previously existed on the lot but was destroyed by fire in the early 1980s.
- In 1990, the Trumble family received a letter from LTC suggesting sufficient space is available to allow development outside of the floodline.
- In 2022, LTC's records indicate the subject lot would not have sufficient space to accommodate a dwelling in its current state.
- The flood hazard model is not available in LTC files – the 2022 information received from LTC was conservatively used in Jewell Engineering's assessment.

JEWELL ENGINEERING

3

JEWELL ENGINEERING

4



1990.01.29

Mr. Chris Trumble
Box 252
Cobourg, Ontario
K9J 4K5

Dear Mr. Trumble:

Re: Part Lot 12, Concession 3
Haldimand Township

Thank you for taking the time to show me your property and for discussing your plans for development with me.

As we determined on the floodplain mapping of this Authority, the majority of the property lies within the "fill line" or area for which fill and construction are regulated by this Authority. There appears to be sufficient space to allow development outside of the floodline as established.

Once we have received your application, we will be able to review it with regard to the management concerns of this Authority.

Once again, I suggest you determine the zoning present on the property, and whether an amendment will be necessary for development to occur.

Should you require further information, please do not hesitate to contact me at this office.

Sincerely,

Jill E. McColl
Technician

JEM:cb

MEMBER OF THE ASSOCIATION OF CONSERVATION AUTHORITIES OF ONTARIO

5

JEWELL ENGINEERING

6

2023 Engineering Assessment

- Jewell Engineering completed:
  - A site visit and topographic survey at the subject property.
    - The site visit was completed by a licensed Professional Engineer.
  - Correspondence with Gage Comeau to understand LTC's policy concerns.
  - An engineering opinion letter to address LTC's flood hazard concerns.
  - A concept plan to show a floodproofed dwelling that simultaneously presents no negative impacts to adjacent property owners.

JEWELL ENGINEERING

7

Engineering Opinion Letter

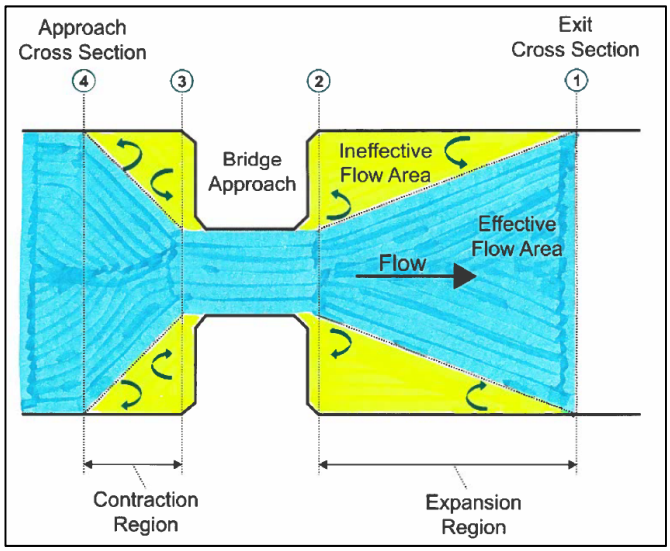
- Our opinion letter concluded that:
  - Engineered fill will be placed to ensure the final floor elevation for the proposed dwelling is a minimum of 0.3m above the regulatory flood elevation that was provided by LTC - the dwelling will be slab-on-grade (i.e. no basement).
  - Majority of the subject lot is an *ineffective flow area* due to the adjacent existing buildings – **ineffective flow areas represent areas that are *not* relied upon to convey flows**, and subsequently have no impact on water levels in a flood hazard storm event. This means that fill placed on the subject lot would not raise water levels or affect any neighbouring property.
  - The proposed fill is **0.002 m^3/m^3** (or 0.2%) of the flood storage within the tributary – meaning the lost flood storage is insignificant and does not present a drainage concern to adjacent property owners.
  - Our topographic survey confirmed the upstream property is >1m **higher** than the local flood elevation – this confirms the upstream property will **act as a barrier and create an ineffective flow area** on the subject site (it also confirms the current LTC floodline delineation is not entirely accurate).

JEWELL ENGINEERING

8

9

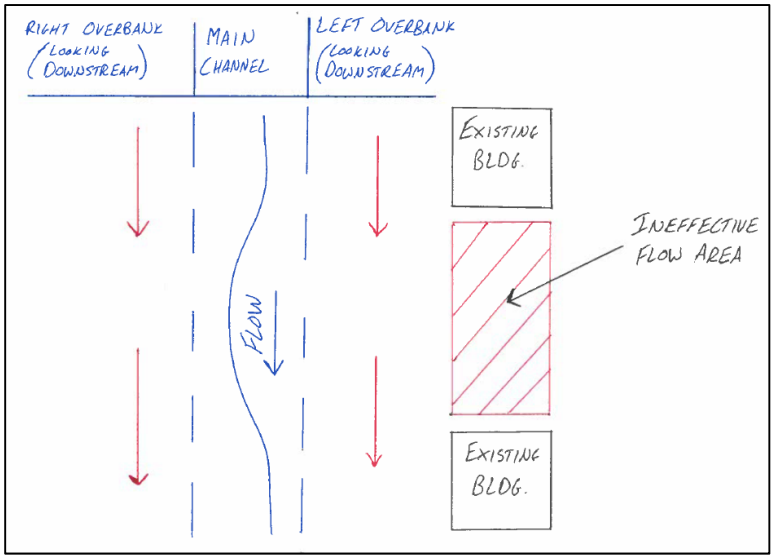
Ineffective Flow Area – Concept 1



JEWELL ENGINEERING

10

Ineffective Flow Area - Concept 2



JEWELL ENGINEERING

11

JEWELL ENGINEERING

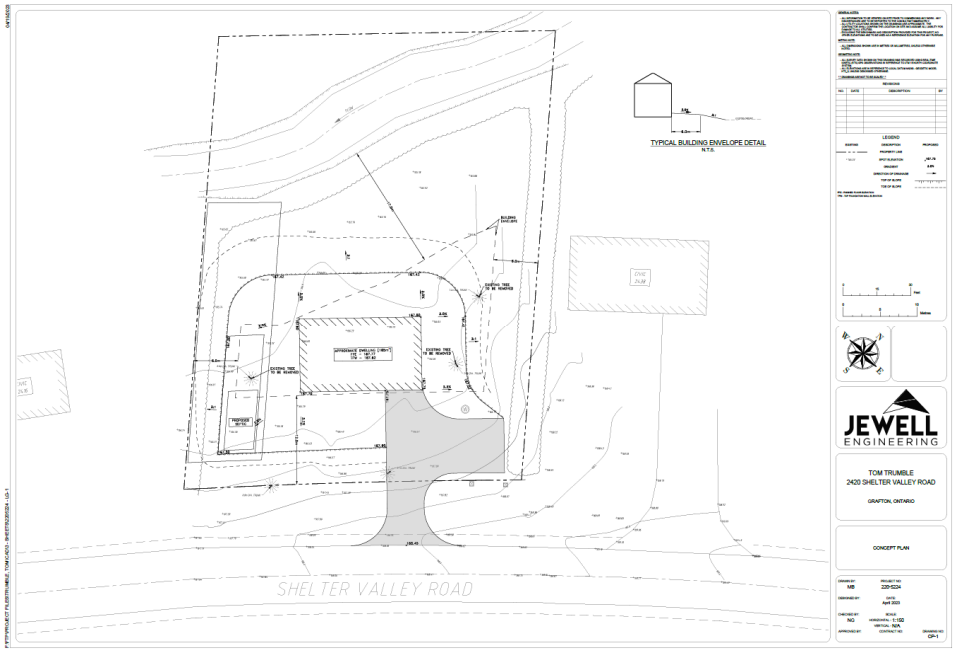
12

Concept Plan

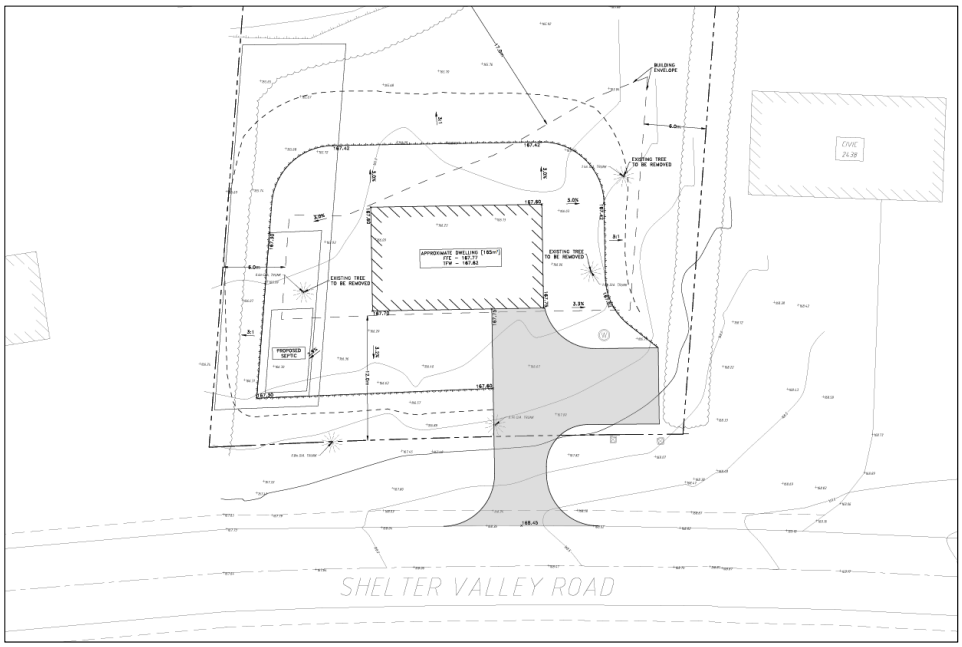
- The concept plan includes:
  - A septic design prepared by Carolle Gauthier.
  - A proposed dwelling location that meets relevant setbacks (i.e. septic, well, frontage, and creek setbacks).
  - A hammerhead driveway commonly requested by municipalities.
  - A grading plan for the house and surrounding grades to ensure all features fit within the site boundaries.
    - Note that the septic bed, dwelling finished floor, driveway, and top of well are all a minimum of 0.3m above the regulatory water surface elevation in the drawing.

JEWELL ENGINEERING

13



14



15

LTC Engineering Review

- Correspondence between LTC's engineering representative and Jewell Engineering after the submission of the opinion letter and concept plan concluded that LTC's engineer has no further concerns with the proposed plan.
- Case study: Drag River, Haliburton
  - A similar project that included detailed modeling. The numerical assessment confirmed the methodology and engineering theory discussed in our opinion letter to be true and accurate.
  - Based on the Drag River project, years of experience, site observations, and our understanding of engineering principles and hydraulic theory, a new hydraulic model was not needed for this particular site. This is primarily due to the scenario presented by the existing buildings that bound either side of the subject lot.

JEWELL ENGINEERING

16

JEWELL ENGINEERING

17

CONCLUSIONS

- Mr. Trumble is seeking to place fill on the subject lot with the intent to re-instate a residential dwelling on his family's property at 2420 Shelter Valley Rd.
- Jewell Engineering completed an inspection of the site and an engineering opinion letter as it relates to LTC's flood concerns. Our investigation concluded that with the proposed concept plan, the issuance of a permit is supportable since the plan presents a floodproofed dwelling *and* no negative impacts to adjacent property owners.
- The detailed concept plan was completed to satisfy LTC's request to show the lot is sufficient to accommodate the necessary grading, septic, well, and driveway.
- We request a permit with a duration of five (5) years to allow sufficient time for other approvals and the placement of fill material.
- The intent is to apply for a follow-up permit from LTC staff following the fill placement; the objective will be to reduce the flood-line setback from 15m to 6m. A reduction to the flood-line setback is not requested as part of this hearing.

JEWELL ENGINEERING

18