PUSLINCH

Comment Summary – 2nd Submission - Zoning By-law Amendment Application – WDD Main St. Inc.

Consultant	**Comments**
GM BluePlan - Engineers	See letter attached
County of Wellington Planning	See letter attached
Township Ecologist	See letter attached
Township Hydrogeologist	See letter attached
Township of Puslinch Fire Department – Brent Smith	Puslinch Fire and Rescue Services reviewed the above referenced subdivision proposal on Jan 12, 2024. The department has the following concern: Please ensure that fire storage tanks are spaced a maximum of 150 meters apart. Additional tank(s) could be required for this subdivision. Tank/ fitting requirements are attached.
Township of Puslinch Building Department – Andrew Hartholt	I would like to see the septic system and well types identified and located for adjacent existing lots around Lot 1 and Lot 15. Other than the above, I have no concerns or comments from a building code perspective.
Township of Puslinch Public Works – Mike Fowler	With concerns that have been raised over safe access to County Road 36 and the proof in pictures supplied to the Township's traffic consultant, Julia Salvini, Puslinch Public

PUSLINCH

	works will not be endorsing or approving the identified access as safe or complete.
Township of Puslinch By-law – Jacob Normore	By-law has no comments or concerns at this time.
Source Water	Since this property is **not** located in a vulnerable area (wellhead protection area, issues contributing area, intake protection zone etc.), the application can be screened out and it does not require a Section 59 notice under the *Clean Water Act*.
GRCA Comments	Please note that this application is for land completely outside the limits of the GRCA watershed
Halton Conservation	See letter attached
MTO	Comments Pending
Township Traffic Consultant	Comments Pending
County of Wellington Transportation	Comments Pending

February 9, 2024
Our File: 122006-002

Township of Puslinch
7404 Wellington Road 34
Guelph, ON N0B 2J0

Attention: Ms. Lynne Banks

Re: Zoning By-law Amendment – 2nd Submission
11 Main Street, Morriston
Township of Puslinch

Dear Ms. Banks,

Following our review of second submission documents for Zoning By-law Amendment (ZBA) application received on January 10, 2024, we are providing comments in support of the proposed residential subdivision on the subject lands located at 11 Main Street in Morriston. The Draft Plan of Subdivision submitted identifies twenty-one (21) residential lots. Twenty (20) of the lots front a proposed right-of-way, connected to an extension of Ochs Street, while one (1) lot fronts Main Street.

The first ZBA application was received on March 23, 2023, per our review letter dated April 24, 2023. The Draft Plan of Subdivision submitted at that time proposed twenty-three (23) residential lots.

The following second submission documents were reviewed by GM BluePlan Engineering in support of the ZBA:

- Second Submission Cover Letter, prepared by Weston Consulting, dated January 10, 2024.
- Comments Response Matrix, prepared by Weston Consulting, dated January 2024.
- Draft Plan of Subdivision, prepared by Weston Consulting, dated December 20, 2023.
- Meander Belt Width Delineation Cover Letter, prepared by Geo Morphix, dated December 21, 2023.
- Fluvial Geomorphological and Meander Belt Assessment, prepared by Geo Morphix, dated February 17, 2023.
- Functional Servicing and Preliminary Stormwater Management Report, prepared by Crozier Consulting, dated December 2023.
- Engineering Plans (Rev. 1), prepared by Crozier Consulting, dated December 20, 2023, including:
  - Fig. 1 - Preliminary Site Servicing Plan (East)
  - Fig. 2 - Preliminary Site Servicing Plan (West)
  - Fig. 3 - Site Grading Plan (East)
  - Fig. 4 - Site Grading Plan (West)
  - Fig. 5 - External Grading Plan (Ochs Street)
  - Fig. 6 - Pre-Development Drainage Plan
  - Fig. 7 - Post-Development Drainage Plan
- Traffic Impact Study, prepared by GHD, dated December 22, 2023.

We defer review of the following to Township Planning and Development:

- Planning Justification Addendum, prepared by Weston Consulting, December 21, 2023.

We defer review of the following to the Township Ecologist:

- Environmental Impact Study, prepared by Colville Consulting, dated December 2023.
- Tree Preservation Plan, prepared by Colville Consulting, dated January 8, 2024.

We defer detailed review of the following to the Township Hydrogeologist and Wellington Source Water Protection:

- Hydrogeological Assessment Addendum, prepared by Terraprobe, dated December 21, 2023.

Based on our first submission comments and review of second submission documents identified above, we provide the following comments for ZBA:

Deficiencies / Outstanding Matters

Item No.	Matter / Requirement	Document Reference	Date Issue Identified	Comment
3.	Quality Control	Functional Servicing & Preliminary SWM Report	April 20, 2023	GMBP Comment (April 20, 2023) The FSR needs to demonstrate how Enhanced quality control is met (i.e. 80% total suspended solid removal). It appears that a treatment train is not created as grassed swales are the only method of quality control for the runoff being infiltrated. An additional mechanism such as but not limited to an oil/grit separator would be required to have a treatment train. Crozier Response (January 2024) Enhanced quality control will be met through the implementation of an oil grit separator upstream of the proposed stormwater management facility. The stormwater management facility will provide additional settling to meet the enhanced quality control requirements. GMBP Comment (February 9, 2024) The Functional Servicing & Preliminary SWM Report states that quality control will be provided by an oil grit separator in series with dry pond settling. However, the MOE SWMPD Manual states that dry ponds should not be used for combined quantity and quality control unless a forebay is included. Table 4.8 lists the forebay requirement for dry ponds. Conversely, Puslinch Municipal Development Standards support the use of oil-grit separators as part of a treatment train, not the only method of treatment. Please provide additional discussion on the treatment train proposed.
4.	Infiltration Water Quality	Functional Servicing & Preliminary SWM Report	April 20, 2023	GMBP Comment (April 20, 2023) The proponent should be cognizant of any potential impacts of infiltrating road runoff which contains chlorides and other pollutants. There could be a potential for contaminant spills or oils to be infiltrated in the ground via the proposed infiltration trenches (no oil/grit separator is proposed in the FSR). We recommend infiltration of ‘clean’ runoff only (i.e. infiltration of building rooftop runoff and/or grassed areas only).

Item No.	Matter / Requirement	Document Reference	Date Issue Identified	Comment
				In addition, the proposed drinking water wells are located at the front of the lot in close proximity to the infiltration trenches which introduces further concerns regarding infiltration of possible roadway contaminants. We defer to the Township Hydrogeologist and Wellington Source Water Protection for comments on the infiltration water quality and the effect on drinking water wells. <u>Crozier Response (January 2024)</u> Based on the Hydrogeological Report the soils on-site are not conducive to infiltration (10 mm/hr infiltration rates); therefore, lot level infiltration has not been proposed. All infiltration trenches have been removed and replace with storm sewer and an end of pipe stormwater management facility. <u>GMBP Comment (February 9, 2024)</u> The response to this comment states that infiltration is not proposed while the Hydrogeological Report recommends lot level soakaway pits for roof runoff. Please coordinate and revise reports accordingly.
7.	Roadway Grade	Grading Plan	April 20, 2023	<u>GMBP Comment (April 20, 2023)</u> Please note that the maximum allowable roadway grade is 6% in the Township of Puslinch. <u>Crozier Response (January 2024)</u> Maximum allowable roadway grades have been maintained everywhere possible. There are a few minor locations where the maximum grade exceeds 6%. <u>GMBP Comment (February 9, 2024)</u> The proposed “Street B” contains a grade of 7.6%. Please revise. Ochs Street contains grades of 8%. Please revise or provide cross-sections to justify deviation from the Township standard (see comment #19).
10.	Quantity Control of Stormwater	FSR	April 20, 2023	<u>GMBP Comment (April 20, 2023)</u> The post-development 2-year storm event does not appear to match pre-development flow rates. Please revise. <u>Crozier Response (January 2024)</u> The stormwater management modelling has been revised to incorporate the quantity controls within the proposed stormwater management facility. Based on the modelling

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				the post-development flows have been reduced to the pre-development flows for all storm events. Details of the outlet control structure will be included during the detailed design stage. GMBP Comment (February 9, 2024) The design of the outlet control structure will impact volume of storage required. Please provide preliminary design of the structure or provide discussion on the volume of storage provided versus storage required.
11.	External Areas	Functional Servicing & Preliminary SWM Report	April 20, 2023	GMBP Comment (April 20, 2023) Please confirm if the external catchments are to be conveyed through the site in the proposed development. In the Visual OTTHYMO (VO) model, the external catchments are added in at the end of the model while the report text it states that the catchments will drain through the site to Bronte Creek. If these areas are conveyed through the site, the stormwater management calculations (quality and quantity control) need to demonstrate that the proposed stormwater management system can handle the conveyance of the two external areas without surcharging the system. Crozier Response (January 2024) The VO model and Functional Servicing and Stormwater Management Report have been updated to discuss the external catchment flows in greater detail. All storm events from Catchment EX1 are directed to a low-lying depression area located in the eastern corner of the Old Morriston Baseball Diamond. An earth berm along the south and east property limits of the baseball diamond allows stormwater to pond within the park limits. If the storage limits are reached, stormwater will drain southwest between the Lot 1 and Lot 2 towards the Bronte Creek tributary via sheet flow, consistent with predevelopment conditions. Note, a figure has been prepared and included in Appendix D of the revised report outlining this scenario. All storm events from Catchment EX2 are to be conveyed through the site by the proposed storm sewer infrastructure and internal roadway towards the proposed stormwater management facility, ultimately outletting to the Bronte Creek tributary. The stormwater modelling has been updated to reflect this scenario. Storm sewer design sheets will be completed at the detailed design stage to ensure the proposed storm sewer network can accept the additional external flows.

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				GMBP Comment (February 9, 2024) Based on the grades shown in the Site Grading Plan at the property line along external catchment EX1, stormwater ponding at the corner of this external catchment will flow onto the site and enter the proposed storm sewer network. Additionally, Ochs Street in external catchment EX2 appears to be draining towards the existing Badenoch Street right-of-way rather than the proposed site. Please review and account for in stormwater management calculations. For clarity, add overland flow arrows to both external catchments in the drainage area plans (Figures 6 and 7).
15.	External Area Topography	Engineering Plans	February 9, 2024	GMBP Comment (February 9, 2024) The FSR states that, based on existing LiDAR contour mapping, runoff from external catchment EX1 ponds along existing berms and then drains southwest towards Bronte Creek. Please show these existing contours and berms on the Engineering Plans to confirm that this flow route will be maintained. Additional topographic survey may be required on the adjacent lands.
16.	Drainage Easement	Engineering Plans	February 9, 2024	GMBP Comment (February 9, 2024) Please confirm ownership of the small rectangular parcel in the south corner of catchment EX1. Please note that a drainage easement will be required between Lots 1 and 2 for the overland flow route from EX1 to the Bronte Creek tributary.
17.	Ponding at Catchbasin	Engineering Plans	February 9, 2024	GMBP Comment (February 9, 2024) The Site Grading Plan shows that proposed catchbasin CB 36 has a T/G elevation of 316.89, which is 1.5m lower than the adjacent curb elevation proposed. Considering the proximity of CB 36 to the property line, there is concern that stormwater will pond onto the neighbouring property at catchment EX2. Please show that the storm sewer leaving CB 36 will have the capacity to convey the flow generated by EX2 with ponding contained to the subject property up to and including the 100yr storm event. Additional topographic survey may be required on the adjacent lands.
18.	Proposed Sidewalk	Engineering Plans	February 9, 2024	GMBP Comment (February 9, 2024) The Badenoch Street right-of-way includes an existing sidewalk that should be continued into the proposed development. Sidewalk is required on one side of local residential streets per Township of Puslinch Municipal Development standards. Please indicate proposed sidewalk on the Engineering Plans, including Ochs Street.

Item No.	Matter / Requirement	Document Reference	Date Issue Identified	Comment
19.	Ochs Street Cross-Section	Engineering Plans	February 9, 2024	GMBP Comment (February 9, 2024) Please provide cross-sections for the proposed Ochs Street right-of-way, including proposed retaining walls and swales due to their close proximity to existing buildings.
20.	Well Setback	Engineering Plans	February 9, 2024	GMBP Comment (February 9, 2024) The well location shown in Lot 21 does not appear to meet the 15m minimum setback from the septic bed in Lot 17. Additionally, OBC 8.2.1.6.A specifies a 5m setback from structures and 3m setback from property lines. Please revise.
21.	Conservation Regulation Limit	Engineering Plans	February 9, 2024	GMBP Comment (February 9, 2024) Please show the approximate regulation limit of Conservation Halton on the Engineering Plans.
22.	Storm Parameters	Functional Servicing & Preliminary SWM Report	February 9, 2024	GMBP Comment (February 9, 2024) The IDF curve parameters are outdated. Please revise stormwater quantity control calculations using the latest City of Guelph Development Engineering Manual.
23.	Qualified Professional	Engineering Plans	February 9, 2024	GMBP Comment (February 9, 2024) All reports and drawings are to be signed and sealed by a qualified professional for future submissions.
24.	Sight Distance Figure	Traffic Impact Study	February 9, 2024	GMBP Comment (February 9, 2024) In Section 9 of the Traffic Impact Study (TIS), please include an additional figure that is similar to Figure 15 but enlarged to illustrate the extent of the sight distances described in Table 9.
25.	Internal Road Geometry Figure	Traffic Impact Study	February 9, 2024	GMBP Comment (February 9, 2024) Section 10 of the TIS needs to be revised using the Township of Puslinch 20m wide urban road cross-section. Additionally, the TIS states that the proposed right-of-way is 18m wide. Please revise to 20m to be consistent with the engineering reports and drawings.

Additional Commentary

Item No.	Additional Commentary
1.	Please provide a copy of the review comments as received by Conservation Halton.

Completed / Approved

Item No.	Matter / Requirement	Document Reference	Date Issue Identified	Date Issue Cleared	Comment
1.	Right-of-way Profiles	Grading Plans	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) The proposed development proposes an 18m wide rural cross section complete with roadside ditches and reduced pavement widths. A 20m wide urban cross-section complete with curb and gutter, storm sewer system and sidewalk is required per Township of Puslinch Municipal Development Standards and Township of Puslinch Standard Drawing 102 (STD-102). Please revise for the next submission. Crozier Response (January 2024) All drawings have been updated with a 20 m urban right-of-way per Standard Drawing 102 (STD-102). Storm sewer has been incorporated to direct stormwater runoff to the proposed stormwater management facility. GMBP Comment (February 9, 2024) Accepted, no further comment.
2.	Cul-de-sac Radius	Grading Plans	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) As per Township of Puslinch Municipal Development Standards, the cul-de-sac bulb right-of-way radius shall be revised from 18m to 20m. Crozier Response (January 2024) The cul-de-sac radius has been revised from 18m to 20m. GMBP Comment (February 9, 2024) Accepted, no further comment.
5.	Infiltration Trenches / Galleries	Servicing Plans / FSR	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) The FSR proposes surface ponding up to 0.3m in the roadside ditches and subsurface storage/infiltration in a series of longitudinal infiltration galleries located below the proposed roadside ditches. While this concept could work in principle for a flat area, we express concerns in the ability to capture and store the runoff when some of the roads are graded at close to an 8% slope. The stormwater management calculations assume that 0.3m ponding is available throughout the roadside ditches and that the sub-surface galleries can fill up with water. Even with the construction of check dams, terracing or elevated culverts as mentioned in the FSR, due to the steepness of the roads, the volume potential outlined in the stormwater management calculations would be extremely challenging to achieve.

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					Furthermore, it is unclear how the 0.3m ponding in the ditch is proposed to work with driveway culverts. The Town is not in support of a roadside ditch system in urban centers and hamlets, let alone a roadside ditch system that has the potential to pond water for prolonged periods of time. Additional concerns with the location of infiltration galleries and utility infrastructure – this will introduce a maintenance concern for the Township. Crozier Response (January 2024) Acknowledged. All infiltration trenches have been removed and replace with storm sewer and an end of pipe stormwater management facility. GMBP Comment (February 9, 2024) Accepted, no further comment.
6.	Post-Development Drainage Plan	FSR	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) Please label the imperviousness of the external areas on the Post-Development plan for consistency. Crozier Response (January 2024) The Post-development Drainage Plan has been revised to include the imperviousness of the external drainage catchments. GMBP Comment (February 9, 2024) Accepted, no further comment.
8.	Ochs Street Labels	Plans	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) Please label Ochs Street on all plans. Crozier Response (January 2024) Ochs Street has been labelled on all plans. GMBP Comment (February 9, 2024) Accepted, no further comment.
9.	Infiltration Gallery Detail	Grading Plan	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) The function of the 150mm diameter perforated pipe and surface ponding capability of the system is questionable. It appears that the 150mm diameter perforated pipe would convey the drainage prior to the ability of the system to pond on the surface or use the last 150mm of storage in the gallery.

Item No.	Matter / Requirement	Document Reference	Date Issue Identified	Date Issue Cleared	Comment
					Inconsistencies between the FSR and infiltration gallery detail with respect to gallery and overflow pipe dimensions. (i.e. FSR states 1.0m deep gallery with 100mm diameter overflow pipe, detail shows 0.9m deep gallery with 150mm diameter overflow pipe). The notes regarding placing sod on top of geotextile wrapped media need further clarification as the topsoil is not proposed to be wrapped in geotextile. Crozier Response (January 2024) Acknowledged. All infiltration trenches have been removed and replace with storm sewer and an end of pipe stormwater management facility. GMBP Comment (February 9, 2024) Accepted, no further comment.
12.	Stormwater Model – Visual OTTHYMO	FSR – VO Schematics	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) Please replace the wording of the “Post-Development” schematic title to reflect a post-development uncontrolled scenario. Please replace the wording of the “Post-Development w/ Mitigation” to be “Post Development Controlled”. This will make it consistent with Table 8 in the report and will make ultimate conditions clear. Crozier Response (January 2024) The Visual OTTHYMO and schematics has been updated to reflected Table 8. GMBP Comment (February 9, 2024) Accepted, no further comment.
13.	Fire Storage Tank	Servicing Plans	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) Please give representation to the location of the fire storage tank on the Servicing Plans. Crozier Response (January 2024) The location of the fire storage tank has been represented on the Site Servicing Plans (Figure 1). GMBP Comment (February 9, 2024) Accepted, no further comment.
14.	FSR Text	FSR	April 20, 2023	February 9, 2024	GMBP Comment (April 20, 2023) Please review the text presented in Section 7.3 paragraph four describing imperviousness.

Item No.	Matter / Requirement	Document Reference	Date Issue Identified	Date Issue Cleared	Comment
					Crozier Response (January 2024) Section 7.3 has been reviewed and revised to account for the removal of the infiltration trenches and the implementation of the end of pipe stormwater management facility. GMBP Comment (February 9, 2024) Accepted, no further comment.

If you have any questions or require additional information, please do not hesitate to contact us.

Yours truly,

GM BLUEPLAN ENGINEERING
Per:

[redacted]

Parth Lad, E.I.T.
Technical Specialist

[redacted]

Steve Conway, C.E.T., rcsi, PMP
Construction Services Lead, Vice President

COUNTY OF WELLINGTON

PLANNING AND DEVELOPMENT DEPARTMENT
MEAGAN FERRIS, RPP MCIP MANAGER OF PLANNING AND ENVIRONMENT
TEL: (519) 837-2600 EXT. 2120
FAX: (519) 823-1694
1-800-663-0750

ADMINISTRATION CENTRE
74 WOOLWICH STREET
GUELPH, ONTARIO
N1H 3T9

February 16th, 2024

Lynne Banks
Development and Legislative Coordinator
Township of Puslinch
7404 Wellington County Rd 34
Puslinch, On
N0B 2J0

Dear Ms. Banks:

Re: ZONING BY-LAW AMMENDMENT – 2nd submission, 2nd Phase Pre-consultation
WDD Main Street Inc. c/o Faisal Hamadi
No Municipal Address, Morriston
Township of Puslinch

Please find the preliminary Planning comments below in reference to the above noted Zoning By-law amendment based on our *preliminary* review of the documents below as part of the 2nd submission through the 2nd phase pre-consultation process. These comments are provided based on an initial review of the following (below) submitted items as they relate specifically to planning and in our capacity as the Township's Planning Consultant.

It is anticipated that many of these studies are being reviewed by the appropriate technical staff/consultants and agencies.

<u>Reports Submitted:</u>

- Cover Letter by Weston Consulting (January 10, 2024)
- Comment Response Matrix by Weston Consulting (January 2024)
- Revised Draft Plan of Subdivision by Weston Consulting (December 20, 2023)
- Planning Justification Report (Addendum) by Weston Consulting (December 21, 2023)
- Hydrogeological Assessment (Addendum) by Terraprobe (December 21, 2023)
- Environmental Impact Study (Revised) by Colville Consulting Inc (December 2023)
- Tree Preservation Plan by Colville Consulting Inc. (January 8, 2024)
- Meander Belt Cover Letter and Report GEO Morphix Ltd. (December 21, 2023 & February 17, 2023)
- Functional Servicing and Preliminary Stormwater Management Report by Cozier Consulting Engineers (December 2023)
- Engineering Plans by Crozier Consulting Engineers (December 20, 2023)
- Traffic Impact Study (Revised) by GHD (December 22, 2023)

It is noted that this proposal was submitted with a concurrent application to the County of Wellington (a

Draft Plan of Subdivision) which included additional submission details such as a draft plan, engineering plans, surveys, and a Stage 2 Archaeological Assessment.

Planning Comments:

General

1. As part of the 2nd submission for the proposed Zoning By-law amendment, the applicant has also submitted all of the supporting materials for the related Draft Plan of Subdivision to both the Township and the County. For clarification for the Township's records, at this time, the Draft Plan of Subdivision has not been deemed completed (or circulated) by the County of Wellington.

   Based on a review of the comments from the 2nd submission, it appears there are several comments that may once again impact the Draft Plan of Subdivision design. It is also understood that comments from the County, Township and MTO have not been provided thus far, which may further impact the design. The applicant may wish to further hold off of formal submission to the County for the Draft Plan of Subdivision until these comments are addressed.

2. Once the Draft Plan of Subdivision is deemed complete and circulated, additional comments and discussion regarding potential appropriate draft plan conditions will be required. Due to this being a review primarily of the Zoning By-law amendment, these types of comments are pending from planning staff.

3. Public Engagement - The applicant is aware that the *Planning Act* no longer requires Draft Plans of Subdivision to go through the Public Meeting process. However, if the Township wishes that the applicant undertakes another form of Public Engagement, although not required under the Planning Act, such as a developer run open house, this should be communicated at the Township's earliest convenience. The timing of when the Zoning By-law amendment is deemed complete may impact the Township's approach to public engagement.

4. The submission has indicated that the natural environment block is proposed to be conveyed to the Township. This will need to be considered by the Township and it is recommended that if the Township is willing to accept this block, that they should consult the Township/County consulting Ecologist to determine if there are certain requirements to be met by the applicant prior to taking ownership of said block. Further, the Township may wish to consider if there is an interest in trail development and if there is a need for certain type of fencing between private property and the natural feature block (if municipally owned) to avoid trespassing and encroachment into the feature.

   If the lands are not intending to be accepted by the Township, this should be communicated to the applicant.

Official Plan

5. Based on the comments from the Township/County consulting Ecologist, conformity with the County Official Plan, with respects to Greenland System, is not yet met. It is anticipated a revised Environmental Impact Study will be required. It is recommended that the lots have specific measure included to avoid encroachment of uses into the natural features.

Comments from the Conservation Halton (CH) will also need to be addressed.

6. As previously commented, the site is also partially within the Paris Galt Moraine Policy Area and staff well need confirmation that the Township's Hydrogeologist is satisfied that Section 4.9.7 Paris and Galt Moraine Policy Area are addressed.

7. It is understood that the applicant's comment matrix included comments regarding Section 11.2.3 of the Official Plan, which related to a Servicing Options Assessment. A separate letter from a Hydrogeologist regarding this policy is requested.

Zoning By-law Amendment

8. It is understood that the development proposal has been revised based on technical comments and now indicates that 21 residential lots are proposed with a stormwater management block. Based on the revised design, it appears that the proposed draft Zoning By-law will need to address:
    a. Further reduced lot sizes
    b. Exclusion of uses on the proposed stormwater management pond block.

9. It is unclear if any of the technical assessments submitted have assessed all dwelling types permitted in the Urban Residential (UR) Zone or the permissions for additional residential units. The application has also indicated that the proposed dwelling type if single family dwellings, but requests the full permissions of the UR Zone.

    This should be flagged for the Township's consultants so that this can be confirmed and considered as part of the ongoing review of the subject application.

10. Based on the above comment, the draft zoning by-law should be revised to clearly address:
    a. Dwelling types based on the type proposed and supporting studies.
    b. Remove the following uses such as boarding/lodging/rooming house, semi-detached dwellings, townhouses, long term care facilities, retirement home, and schools.
    c. Clarify permissions for additional residential units.

11. It is recommended that the applicant may wish to complete more detailed assessments of lots 1 and lots 16, 18, and 21 to determine if any reduced setbacks will be required for these lots (i.e. lot 1) and if there is an interest, based on future building designs, to deem lot lines for the corner lots (i.e. 16, 18, and 21).

12. It is requested that the applicant clarify if the Natural Environment (NE) Zone and the Environmental Protection Overlay will also include any accepted setback from the natural features.

Studies

13. Planning Justification Report
    a. It is acknowledged that a PJR addendum has been provided with respects to Provincial Policy Statement policies specific to Natural Heritage (Section 2.1) and Water (Section 2.2).

        However, it does not appear that any discussions regarding the refinement to the Greenland System mapping are included. Additional discussion regarding this matter will be required with the Township/County consulting Ecologist.

14. Environmental Site Assessment
    a. The applicant has prepared a Phase 1 Environmental Site Assessment. This study recommends that a Phase 2 assessment be completed. Confirmation is to be provided by the applicant at what stage this assessment will be completed.

These comments are intended to provide planning comments to the Township and the applicant on the 2nd submission of supporting materials for a Zoning By-law under the Township's 2nd Phase Pre-consultation meeting process. As more information is provided and detailed review of the application is completed more comments may arise.

I trust these initial comments will be of assistance.

Regards,

[redacted]

Meagan Ferris, RPP MCIP
Manager of Planning and Environment

February 6, 2024 2765

Township of Puslinch
7404 Wellington County Rd 34
Puslinch, ON
N0B 2J0

Attention: Ms. Justine Brotherston
Deputy Clerk

RE: 11 Main Street, Morriston, Township of Puslinch
Environmental Impact Study and Tree Preservation Plan Peer Review

Natural Resource Solutions Inc. (NRSI) was retained by the Township of Puslinch to undertake a peer review of an Environmental Impact Study (EIS) and Tree Preservation Plan (TPP) prepared by Colville Consulting Inc. (Colville), as well as additional application materials, for the proposed residential development ("proposed development") at 11 Main Street, Town of Morriston. These materials have been prepared as part of a second submission for a Zoning By-Law Amendment (ZBA) and Draft Plan of Subdivision application (the "Application") prepared by Weston Consulting ("the proponent"). Our comments are set out below.

Background

The property intended for development is located at 11 Main Street Pt. Lt. 31, Con. 8 and Lots 7 & 8 Plan 135, Morriston, Township of Puslinch ("subject property"). The current development concept consists of 21 single detached residential lots. The subject property is situated southeast of Badenoch Street and northeast of Highway 6/Queen Street. NRSI was previously retained to review pre-consultation documents submitted to the Township of Puslinch in December 2021 and provided pre-consultation review comments on January 17, 2022. An EIS and TPP were prepared and submitted in February 2023, in addition to other application materials. These reports were submitted as part of the 2023 ZBA Application and outlined natural heritage features existing on and adjacent to the subject property, as well as potential direct and indirect impacts the proposed ZBA and associated development may have on these features. NRSI staff subsequently reviewed this submission and provided peer review comments on the EIS and TPP (April 2023), as well as completed a site visit (May 18, 2023) with Ian Barrett and Brett Espensen of Colville. It is understood that the secondary submission and revised EIS and TPP have been prepared to address peer review comments made in April 2023, as well as modifications in the Draft Plan of Subdivision for the proposed development. This letter exclusively addresses remaining natural heritage questions or concerns relevant to the secondary submission, while items that have been appropriately addressed in the revised EIS and TPP have not been discussed further.

Tasks Completed

In order to complete this assignment, NRSI reviewed the following materials:

- Environmental Impact Study: 11 Main Street, Morriston, Township of Puslinch. Prepared by Colville Consulting Inc. for WDD International. December 2023.
- Tree Preservation Plan for 11 Main Street, Village of Morriston. Prepared by Colville Consulting Inc. for WDD International. January 8, 2024.

In addition to the EIS and TPP, NRSI staff also conducted a high-level review of the following documents in order to further understand potential impacts to existing natural heritage features on and adjacent to the subject property. The review comments provided below are primarily focused on the EIS and TPP.

- Second Submission ZBA and Draft Plan Cover Letter, 11 Main St. Morrison. Prepared by Weston Consulting. January 10, 2024.
- Comment Response Matrix, 11 Main St. Morrison. Prepared by Weston Consulting. January 2024.
- Draft Plan of Subdivision, 11 Main St. Morrison. Prepared by Weston Consulting. December 20, 2023.
- Planning Justification Report Addendum, 11 Main St. Morriston. Prepared by Weston Consulting. December 20, 2023.
- Zoning By-Law Amendment Application. Weston Consulting. February 23, 2023.
- Hydrogeological Assessment Addendum: Proposed Residential Development 11 Main Street, Puslinch, Ontario. Prepared by Terraprobe for Weston Consulting. December 21, 2023.
- Meander Belt Width Report and Cover Letter, 11 Main St. Morriston. Prepared by GeoMorphix Ltd. December 21, 2023.
- Functional Servicing & Preliminary Stormwater Management Report, 11 Main St. Morriston Estate Residential Development. Prepared by C.F. Crozier & Associates. December 2023.
- Engineering Plans, 11 Main St. Morriston. Prepared by Crozier Consulting Engineers. December 2023.
- Traffic Impact Study, Part of Lots 7 & 8 North of Queen Street and Part of Lot 31 Concession Road 8. Prepared by GHD. December 22, 2023.

The review comments are based on a desktop review of the above-described materials, aerial imagery, and available natural heritage information for the subject property and surrounding lands, in addition to the site visit completed by Jack Richard and Colville staff in May 2023.

Relevant Policy Framework

Our review considered the adequacy of the Application and the potential impacts of the proposed development on natural heritage features identified within the County of Wellington Natural Heritage System, or “Greenlands System”, and the *Provincial Policy Statement* (“PPS”). Both Greenlands and Core Greenlands, as identified by the *County of Wellington Official Plan* (OP), exist within the subject property (2023). Additionally, our review evaluated the level to which the Application adheres to the requirements of the *Endangered Species Act* (ESA), *2007*, and the *Township of Puslinch Comprehensive Zoning By-Law, 2018.* This analysis was undertaken to identify whether the EIS and TPP sufficiently addressed relevant natural heritage policies, evaluated the potential direct and indirect impacts the proposed development may have on the existing natural features, as well as considered the proposed avoidance and mitigation of these impacts.

Comments on Reviewed Materials

Environmental Impact Study

The author states that the “EIS has been prepared to delineate the extent of natural heritage features on the subject property” and assess the potential impacts of development on natural heritage features on and adjacent to the subject property. Our previous peer review identified that “adjacent lands” had not been defined within the original EIS despite being referenced numerous times, and therefore the actual extent of the study area for this EIS is unclear. The revised EIS has not defined “adjacent lands” and the extent of the study area remains unclear. Adjacent lands and the corresponding extent of the study area should be defined within the EIS in order to confirm that the evaluated study area is consistent with the requirements of the County OP (2023) and relevant natural heritage legislation. Otherwise, relevant natural heritage policies appear to be adequately considered within the EIS and are detailed in Section 2.0, including a review of the County of Wellington OP, PPS, Greenbelt Plan, and Ontario Regulation 162/06. In some cases, conformity to the relevant policy framework has yet to be demonstrated, as is discussed further below.

It is understood that the development will include the extension/improvement of Ochs Street, north of the subject property. Trees along this street have been identified both on the Draft Plan and Tree Preservation Plan, however it is unclear if the scope of the EIS has included impacts associated with these works. Clarification should be provided as to whether an evaluation of ecological impacts associated with these works, if any, has been completed and details should be provided.

Similar to the previous EIS, the revised EIS states that “some” of the background information reviewed was gathered from the County OP, Conservation Halton, Ministry of Natural Resources and Forestry, and the Natural Heritage Information Centre (NHIC). Within NRSI’s 2023 review comments it was recommended that fulsome details of all background information sources that were reviewed as part of the EIS be provided. It was further recommended that common natural heritage information resources such as the Ontario Reptile and Amphibian Atlas (Ontario Nature 2019), Ontario Butterfly Atlas (MacNaughton et al. 2023), Ontario Mammal Atlas (Dobbyn 1994), and Ontario Odonate Atlas (NHIC 2023) be consulted as part of the background review. It is noted that the Ontario Reptile and Amphibian Atlas (Ontario Nature 2019) has been included in the background review, however not all background sources recommended above have been listed within the EIS.

Recommendations

- Identify the extent of the study area, including a definition of “adjacent lands”;
- Complete fulsome screening for Species at Risk (SAR) that may exist within the subject property or adjacent lands;
- Provide confirmation as to whether ecological impacts associated with the Ochs Street extension/improvement works have been considered. If an assessment has been completed, details should be provided; and,
- Provide the results of all background information reviewed as part of the EIS.

Field Surveys

The field surveys completed as part of the EIS have been identified in Section 3.2 of the report. NRSI staff identified within the comments made on the previous EIS that spring surveys, specifically spring vegetation and amphibian call surveys, had not been completed. The revised EIS identifies that these surveys were completed in 2023 and it is our opinion that the survey dates of both the vascular plant and amphibian call surveys appear appropriate. The EIS identifies that a single amphibian call survey station (SWT2) was established and that no calling amphibians were recorded, though a single Northern Leopard Frog (*Lithobates pipiens*) was observed within a pool associated with the regulated watercourse in the southeast of the subject property. Other wetlands within the subject property, including the SWC3-1, MAM3-9, and MAMM1-12 vegetation communities were not assessed for suitable amphibian breeding habitat or potential amphibian movement corridors. Rationalization for this exclusion should be provided. The EIS also referenced a Natural Heritage Evaluation prepared by Beacon Environmental for the property directly south of the subject property (97 Queen Street). It is noted that surveys undertaken for this study recorded numerous calling amphibians. It is recommended that greater detail be provided on the results of these surveys. If regulated natural heritage features overlapping the subject property were found to be providing habitat to calling amphibians, this should be identified within the EIS. If calling amphibians were recorded within the wetland that overlaps the subject property and is adjacent to the development area, this should be identified.

Recommendations

- Provide a rationalization as to why all wetland vegetation communities within the subject property (SWC3-1, MAM3-9, and MAMM1-12) were not assessed for suitable amphibian breeding habitat and potential amphibian movement corridors; and,

- Compare the results of Beacon Environmental's amphibian call surveys to those completed by Colville in 2023. If regulated natural heritage features overlapping the proposed development have been found to provide habitat to calling amphibians, this should be identified.

Habitat for Endangered or Threatened Species

Section 5.4.2. of the Wellington County OP mandates that development and site alteration may not be permitted if impacts to SAR, considered endangered or threatened, are anticipated. Specifically, the OP states:

> "*Development and site alteration will not be allowed in significant habitat of endangered or threatened species except in accordance with provincial and federal requirements. Development or site alteration adjacent to significant habitat of endangered or threatened species shall require a satisfactory Environmental Impact Assessment that demonstrates there will be no negative impact on the significant habitat of endangered or threatened species or its ecological function.*"

In order to determine whether or not endangered or threatened species occur within the subject property, as well as demonstrate any proposed development will result in "no negative impacts", it is necessary to conduct wildlife and habitat surveys that will effectively detect the presence of existing wildlife communities and habitat. Section 4.2.2. of the EIS provides a description of the acoustic monitoring completed to assess potential habitat for SAR bats. Based on the extent of the proposed tree removal area, it is our opinion that the number of acoustic bat monitoring stations (2) is adequate and the locations of each station are suitable. While we generally agree with the conclusions drawn from the acoustic survey results, some further analysis is typically required in order to confirm the findings made within the EIS. The EIS should identify the number of acoustic recordings collected that were not able to be auto-classified as “Low Frequency” versus “High Frequency”, since all of Ontario's SAR bats fall within the “High Frequency” category and therefore this assessment is dependent on the overall number and timing of High Frequency bat passes. Analysis of Little Brown Myotis detections should also include consideration for the time of night during which they were detected. Based on the data presented in the report, we agree it is unlikely that a maternity roost is present within this area and we agree that no impact to habitat of SAR bats is likely to occur based on the prescribed tree removal area. Section 5 of the EIS discusses Tri-colored Bats under the subheading titled “Myotis species”, however this species is a “Perimyotis” rather than “Myotis” bat.

The previous EIS identified that suitable bat habitat was found in the woodland, however isolated trees along the northern edge of the property are also identified as having the potential to contain suitable bat roosting habitat. No discussion has been provided within the revised EIS regarding the potential for bat habitat to be present within the FODM11 hedgerow communities that are found north and west of the proposed development area. The EIS indicates that numerous large diameter (50-100cm) Sugar Maple (*Acer saccharum*) exist within these communities, which are directly adjacent to the proposed “Street A” and “Street B”, which will require grading works in proximity to these trees. Should impacts to these trees be likely as a result of the required road grading works, confirmation should be provided that no potential bat habitat will be impacted within this area.

Recommendations

- Identify the number of acoustic recordings collected that were not able to be auto-classified as “Low Frequency” versus “High Frequency”;

- Little Brown Myotis detections should also include consideration for the time of night during which they were detected and these details should be provided; and,

- Discuss whether and/or how individual trees within the FODM11 hedgerow areas, or elsewhere within the subject property, have been assessed for suitable habitat for bat SAR. Should suitable habitat be identified, further analysis and consultation with the MECP may be required in order to ensure conformity with the requirements of the ESA (2007).

<u>Significant Wildlife Habitat</u>

Section 6.2 of the EIS states that no woodland areas will be removed to facilitate development on the subject property. Despite this, Lot 11 and Block 22 of the proposed development each overlap a small portion of the WODM5 community south of the development area. The EIS identifies that Eastern Wood-pewee (*Contopus virens*) were heard calling from within the WODM5 community on the eastern portion of the subject property and that survey results indicate that the woodland is being used as breeding habitat. In our experience, the entirety of the contiguous woodland in which Eastern Wood-pewee is determined to be breeding is then considered Significant Wildlife Habitat (SWH), as Habitat for Species of Conservation Concern. Instead, the EIS excludes the portion of the WODM5 community that overlaps the development area from this identified SWH. It is explained that this approach was taken based on this area lacking the canopy cover to be considered woodland or forest, as well as it being dominated by tall shrubs rather than trees and it therefore being considered not representative of typical habitat for this species.

During the May 2023 site visit, NRSI staff reviewed this area with Colville staff and confirmed that the portion of the WODM5 community that has been excluded from the identified SWH is consistent with the description provided in the EIS. Specifically, the area proposed for removal was found to be dominated by invasive species and contains few native tree species. Based on our review, it was noted that this community contains very little native tree cover and canopy coverage in the feature is well-below that of the broader WODM5 community, and is more representative of thicket conditions rather than woodland. This is supported by data presented within the TPP, which identifies that the density of trees >10cm in diameter at breast height is quite low within this area. Given that the portion for this community that is proposed for removal is an isolated lobe, we are generally in agreement that the removal of this area is unlikely to impact the identified SWH, as the remainder of this community will be preserved and setback from the proposed development by 10m. It is anticipated that this approach will effectively achieve "no negative impacts" to the identified SWH as a result of the development. As discussed further below, it is recommended that trees that require removal from within the identified WODM5 feature be compensated for within the subject property in order to offset their removal.

Recommendations

- Provide recommendations for the compensation of trees that require removal from within the WODM feature. This should consist of native species selected in consideration of the natural inventory work completed on site. It is recommended that replacement trees be planted within the subject property.

Significant Woodlands

Section 5.5.4. of the County of Wellington OP identifies the following with respect to the Greenlands System and Significant Woodlands, which are relevant to this ZBA:

> *"In the Rural System, woodlands over 4 hectares and plantations over 10 hectares are considered to be significant by the County, and are included in the Greenlands system… In the Urban System, woodlands over 1 hectare are considered significant by the County, and are included in the Greenlands system.*
>
> *Detailed studies such as environmental impact assessments may be used to identify, delineate and evaluate the significance of woodlands based on other criteria such as: proximity to watercourses, wetlands, or other woodlands; linkage functions; age of the stand or individual trees; presence of endangered or threatened species; or overall species composition."*

The EIS has identified White Cedar (*Thuja occidentalis*) (FOC2-2 and FOC4-1) forest communities as Significant Woodlands throughout the subject property and excluded the contiguous Moist Deciduous Woodland (WODM5) community from this feature. It is stated within the EIS that this has been done to be consistent with the Provincial Policy Statement (PPS) (2020) and for the identified Significant Woodland to coincide with vegetation communities that meet the ELC definition of forest (60% or more canopy cover). The WODM4 community overlapping a portion of the subject property is a large vegetation community (>20ha) that contains regulated watercourses, wetlands, and a variety of other treed vegetation communities. This includes the White Cedar forest communities (FOC), which the EIS identifies as providing deer wintering habitat as well as seeps, a specialized habitat for wildlife considered SWH. EIS also identifies that trees within this contiguous feature are likely to contain roosting opportunities for SAR bats. While the WODM5 community has been excluded from the identified Significant Woodland, the majority of this community has been identified as SWH, as described above, and will be setback from development by 10m. All portions of the FOC2-2 and FOC4-1 community will be preserved and setback from the proposed development by 10m.

The EIS identifies that WODM5 community has been excluded from the identified Significant Woodland based on canopy cover in the that community being than 60% and often dominated by Hawthorn (*Crataegus* sp.). During the 2023 site visit completed by NRSI and Colville staff, this community was examined with particular attention paid to the portion of the WODM5 feature that has been proposed for removal. Based on our review, we agree that the portion of this community proposed for removal and excluded from the identified Significant Woodland is primarily occupied by invasive species and native shrubs, rather than tree species that dominate elsewhere in the WODM5 community further northeast. Based on this, it is our opinion that the portion of the WODM5 community identified for removal may more accurately be considered thicket than woodland and its exclusion from the identified Significant Woodland area is warranted.

The EIS identifies that the proposed stormwater management pond will discharge into the adjacent woodland area, which includes both Significant Woodland and SWH. The author states that "water discharged from the stormwater pond will have the potential to affect hydrology and tree health within a small portion of the woodland" and that individual tree health may decline as a result of road salt and de-icing compounds contaminating water that is discharged into the woodland. Despite this, the author puts forth that the function of the woodland will not be negatively impacted and that individual tree mortality may be offset by the planting of salt-tolerant tree species native to the subject property. While we generally agree that this approach may be suitable to ensuring that the woodland area experiences no negative impact as a result of this development component, more detail is required. Specifically, the anticipated volume of water to be discharged into the woodland on an annual basis should be provided and used to better inform the assessment of this impact. The specific area in which tree impacts will occur as a result of the outflow should also be identified. The EIS identifies that 2 years of monitoring will be completed following the completion of the development to evaluate impacts on tree health and soil stability. A specific monitoring plan should be prepared that outlines the frequency of monitoring, assessments that will be completed, and mortality thresholds that will trigger the requirement to plant replacement trees within this area.

The EIS provides general recommendations towards the mitigation of impacts to the Significant Woodland area, including directing future residential lighting away from woodlands. It is recommended that additional mitigation measures be provided to more effectively reduce impacts that may arise as a result of residential development. It is recommended that rear-yard fencing be prescribed at the limit of each residential lot, outside of the prescribed 10m setback. Rear-yard fencing will help in limiting the potential for the dumping of yard-waste as well as limit the likelihood of future residents encroaching into the woodland. The EIS identifies that the Significant Woodland identified SWH will be protected through the establishment of a 10m buffer, however no buffer planting or ecological enhancements have currently been proposed. In its currently prescribed format, this area is more accurately considered a setback. It is recommended that restoration and enhancement measures be prescribed for this area to achieve the creation of a suitable buffer area that will effectively protect the woodland from increased edge effects associated with the development. This should include the planting of native trees and shrubs suitable to the subject property. It is recommended that a monitoring plan also be proposed for these plantings to ensure the successful establishment of a vegetative protection buffer.

Recommendations

- Identify the quantity of stormwater proposed for discharge into the woodland;
- Identify the extent of the area in which tree impacts are anticipated to occur as a result of the stormwater management pond discharge;
- Provide greater detail regarding the proposed monitoring plan for trees that may be impacted by the stormwater management discharge. Details should include the frequency of monitoring, assessments that will be completed, and mortality thresholds that will trigger the requirement to plant replacement trees within this area;
- Provide recommendations to more effectively mitigate woodland edge impacts that may be caused by the proposed development. Consideration should be given to the inclusion of rear-yard fencing; and,
- Identify restoration and/or enhancement measures that will be used to create a suitable woodland buffer within the 10m Significant Woodland setback. This should include the planting of trees and shrubs. It is also recommended that the monitoring plan proposed within the EIS include an evaluation of buffer plantings.

<u>Wetlands (Core Greenlands)</u>

With regards to wetlands, Section 5.4.1. of the County of Wellington OP states:

> *"All wetlands in the County of Wellington are included in the Core Greenlands. Development and site alteration will not be permitted in wetlands which are considered provincially significant. Provincially significant wetlands are shown in Appendix 3 of this Plan. All other wetlands will be protected in large measure and development that would seriously impair their future ecological functions will not be permitted. The appropriate Conservation Authority should be contacted when development is proposed in or adjacent to a wetland."*

As stated in the County OP, adjacent lands are defined as lands within 30m for Core Greenlands and Greenlands. A considerable portion of the proposed development limit overlaps with the regulated wetland areas in the southwestern portion of the development. Specifically, Lots 1-3 each overlap the 30m regulation limit associated with the Coniferous Swamp wetland identified in Figure 4. While the 30m regulation limit has not been mapped in this area, Lot 7 also appears to be within 30m of the wetland limit. It is noted that the wetland limits were refined through a site visit with Conservation Halton staff.

The EIS references Conservation Halton's *Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document* (HRCA, 2020). Specifically, it is noted that Section 2.39.3 of the policy document states that "Except as provided for in Policies 2.39.1 and 2.39.2, no new development is permitted within 30 metres of a Provincially Significant Wetland or a wetland greater than or equal to 2 hectares in size". The size of the wetland overlapping a portion of the subject property has not been identifies within the EIS. The extent of the wetland has also not been identified outside of the subject property. However, based on the extent of the wetland identified in Figure 4 and the extent of the vegetation community the EIS identifies as corresponding with the wetland limits, it is anticipated that this wetland area is greater than 2 hectares in size. The author does not address whether or not the proposed development conforms to this policy requirement. It is anticipated that consultation with Conservation Halton will be required in order to confirm whether or not the proposed development conforms with the Conservation Authority's policy requirements. Specifically, confirmation should be sought from the conservation authority as to whether a reduced setback will be accepted by Conservation Halton. Confirmation of the suitability of the reduced setback from the conservation authority is also a requirement of the Township of Puslinch Zoning By-law (2018).

The EIS states that changes in the wetland hydrology as a result of the proposed development are not anticipated to impact this feature. However, no water balance assessment has been completed to support this conclusion. Given that development has been proposed directly adjacent to the wetland and within the regulated area associated with the wetland, a water balance assessment should be completed to confirm that water quality and quantity will not change post-development such that the wetland is not negatively impacted.

Despite having proposed reduced wetland setbacks (15m), no additional mitigation measures have been provided to reduce the potential impacts of development on these features. Consistent with the discussion provided above, it is recommended that buffer enhancement measures be prescribed within the reduced setback areas to more effectively protect the retained wetland. It is anticipated that, at minimum, this should include the planting of suitable tree and shrub species native to the study area. It is recommended that a monitoring plan also be proposed for these plantings to ensure the successful establishment of a vegetative protection buffer.

Recommendations

- Identify the 30m regulation area limit in relation to Lot 7;
- Complete a water balance assessment for the wetland to confirm that development within the western portion of the subject property will not negatively impact the retained wetland;
- Consult with Conservation Halton to confirm the suitability of proposed development in relation to Conservation Halton regulated areas. Confirmation should be sought as to whether the proposed development limits in relation to the identified regulated wetland areas conform to the Conservation Authority's policy requirements; and,
- Identify enhancement measures that will support the establishment of a self-sustaining vegetation protection buffer within the proposed 15m wetland setback. It is also recommended that a monitoring plan also be proposed for these plantings to ensure the successful establishment of a vegetative protection buffer.

Tree Preservation Plan

The following comments and recommendations have been provided based on our review of the TPP prepared by Colville:

- Discussion within the TPP states that the Butternut (*Juglans cinerea*) directly adjacent to the subject property and development area is presumed to be a hybrid. Based on the site visit completed during May 2023 and the physical attributes observed, we agree with this conclusion. However, the tree appears to be directly adjacent to Lot 1 and the canopy of the tree appears to extend within the development area. The TPP should be revised to visually identify the minimum tree protection zone for this tree in order to adequately confirm that the development will not result in any injury or impact to this tree or its roots. Should impacts be anticipated, a more detailed evaluation of the tree's hybridity status may be required in order to appropriately demonstrate that it is not a pure Butternut;

- It is recommended that the combined tree protection area for all trees be visually identified in order to more effectively demonstrate that they may be realistically retained and that the proposed development will not result in their injury or impact. Currently, numerous trees have been prescribed for retention despite their minimum tree protection zone being overlapped by the proposed development area. This includes tree #430 and #455. Neither the tree protection area or limit of grading have been identified in relation to one another. As such, it is unclear whether or not many of these trees will be impacted by the proposed development and associated grading. At minimum, the tree protection area anticipated to be established to preserve the trees currently prescribed for retention should be mapped and delineated by the proposed tree protection fencing alignment;
- Many of the boundary trees currently prescribed for retention appear to have canopies and associated root zones that overlap the development area. This includes the canopy/root zone of tree #544, an off-property tree, which appears to be directly overlapped by "Street B". Similar to the above-comment, the tree protection zone for each of these trees and a combined "tree protection area" should be mapped and delineated with a proposed tree protection fencing alignment;
- Consistent with the comments made within the TPP, any injury or removal of boundary tree will require the written permission of each respective landowner prior to its removal. It is recommended that this be obtained prior to any tree removal activity being initiated;
- Consistent with Colville's comments under "Summary and Recommendations", tree retention and removal prescriptions should be informed by final grading and development details; and,
- We are in agreement with Colville's comment that compensation for trees removed from the subject property should be considered. In lieu of specific tree replacement requirements within the County or Township, it is recommended that tree compensation of 2:1 replacement, or greater, be considered.

Conclusion

Based on our review of the EIS, TPP, and additional application materials, it is NRSI's position that recommendations made within the 2023 peer review letter prepared by NRSI have been generally addressed through the revised reports prepared by Colville. Additional comments and recommendations have been made within this letter that should be addressed in order to adequately demonstrate that the proposed development will not result in negative impacts to regulated natural heritage features on and adjacent to the subject property. It is anticipated that each item may be addressed through a revised EIS and TPP.

Please do not hesitate to contact us if you require further clarification on these matters.

Sincerely,
Natural Resource Solutions Inc.

[redacted]

Jack Richard, R.P.F.
Registered Professional Forester and Biologist

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
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Hydrogeological Assessment
Geochemistry
Phase I / II ESA
Regional Flow Studies
Contaminant Investigations
OLT Hearings
Water Quality Sampling
Groundwater & Surface Water Monitoring
Groundwater Protection Studies
Groundwater Modelling
Groundwater Mapping
Permits to Take Water
Environmental Compliance Approvals
Designated Substance Surveys

Our File: 2323

February 2, 2024

Township of Puslinch
7404 Wellington Road 34
Puslinch, Ontario N0B 2J0

Attention: Lynne Banks
Development and Legislative Coordinator

Re: 2nd Submission Comments
11 Main Street, Morriston (Puslinch), Ontario
Zoning By-law Amendment / Draft Plan of Subdivision Application
Proposed Residential Subdivision

Dear Lynne,

Harden Environmental Services Ltd. (Harden) is pleased to provide hydrogeological comments for the second submission zoning by-law amendment and draft plan of subdivision applications for 11 Main Street (Lot 31, Concession 8) in the hamlet of Morriston, Township of Puslinch, Ontario (the site).

Harden provided hydrogeological review comments in April 2023 relating to the hydrogeological study prepared for the site by Terraprobe (2023). Our revised comments provided herein are based on the 2nd submission responses and documents. We have also considered other development proposals in the local area and revised our comments accordingly for consistency given the proposed intensification of the hamlet.

Groundwater flow direction and water table: Terraprobe indicated that additional groundwater monitoring will be completed for the site, including seasonal high groundwater conditions. The project hydrogeologist must adequately characterize the shallow groundwater flow regime across the site and determine the seasonal high groundwater table across the site. Groundwater level monitoring is recommended monthly for at least one full year, including the spring groundwater high, to demonstrate seasonal fluctuations. The design elevations of building foundations, septic leaching beds, SWM facilities and LIDs (e.g., infiltration facilities) must be evaluated in relation to the high water table.

Groundwater contribution to Bronte Creek: Terraprobe indicated that further field investigations will be completed to assess the presence of groundwater seepage during seasonal high groundwater conditions. We recommend the use of shallow piezometers to monitor vertical gradients within Bronte Creek on the site, with monitoring completed at the same frequency to groundwater level monitoring on the site (i.e., monthly for at least one year, including the spring groundwater high).

Site plan differences: The revised hydrogeological report must be prepared in accordance with the updated site plans.

Shallow groundwater quality: Terraprobe obtained groundwater quality samples three shallow monitoring wells on the site as part of the nitrate impact assessment report, which were analyzed for nitrate, nitrite, phosphorus, ammonia/ammonium, and pH. Additional analysis is requested to characterize the shallow groundwater quality, including general chemistry, metals and nutrients, with comparison to the Ontario Drinking Water Quality Standards.

Water supply: Terraprobe indicated that test wells are to be installed as part of further investigations, which will also include a private well survey. The water supply assessment must be completed in accordance with MECP Guideline D-5-5 Private Wells: Water Supply Assessment. The assessment must include installation of Regulation 903 wells onsite in the aquifer targeted for water supply, a pumping test and water quality analyses. Impacts to nearby well users must be evaluated, including existing and approved developments within the area of influence (e.g., 97/107 Queen Street). We are also requesting a fulsome analysis of the aquifer water quality by analyzing all parameters in Tables 1 and 2 of Ontario Regulation 169/03.

Supply well construction: The site is underlain by the Guelph Formation and the Goat Island / Gasport Formation aquifer separated by a regional aquitard. Wells that connect these two aquifers (i.e., multiple aquifer penetrating wells) should not be permitted on any lot as part of the development. Both existing and newly constructed supply wells for the site should be either installed in the upper bedrock aquifer or appropriately cased into the lower bedrock aquifer, in accordance with R.R.O. 1990, Reg. 903: Wells, to minimize potential groundwater movement between the upper and lower bedrock aquifers.

Nitrate impact assessment: The impact of phosphorus and nitrate loading to Bronte Creek must be evaluated by the project hydrogeologist. The assessment should consider whether Bronte Creek is a Policy 2 creek and whether it can accommodate additional phosphorus and nitrate loading. We also recommend collection of at least one surface water sample from the onsite creek for analysis of background surface water chemistry.

Groundwater recharge facilities: The soakaway pits were designed by Crozier (December 2023) based on the hydraulic conductivity estimates determined by Terraprobe (2023). The infiltration estimates should be confirmed with soil infiltration testing at representative locations and appropriate depths based on the proposed septic beds and soakaway pits. Infiltration testing will confirm soil conditions and field saturated hydraulic conductivity/infiltration rates. The proposed depths/elevations of subsurface infiltration structures must also be evaluated alongside the annual high groundwater table elevation across the site.

Construction dewatering: The revised hydrogeological report must consider the high groundwater table in the assessment of construction dewatering requirements. If groundwater from dewatering activities must be discharged to surface water sources additional groundwater quality samples should be obtained for comparison to the Provincial Water Quality Objectives.

Phase Two ESA: The Phase One Environmental Site Assessment (ESA) completed by Niagara Soils Solutions Ltd. (March 2022) identified two areas of potential environmental concern (APECs) and recommended a Phase Two ESA be completed. A Phase Two ESA report is required for the site.

Excess soil management: Any import/export of fill/soil from the site must be conducted in accordance with O. Reg. 406/19: On-Site and Excess Soil Management, the Rules for Soil Management and Excess Soil Quality Standards (Soil Rules) and O. Reg. 153/04, as amended.

We appreciate the opportunity to provide these comments. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Harden Environmental Services Ltd.

[redacted] [redacted]

Angela M. Mason, M.Sc., P.Geo., QP_{ESA}
Senior Hydrogeologist

Stan Denhoed, P.Eng., M.Sc.
Senior Hydrogeologist

Conservation Halton

Planning & Regulations
905.336.1158
2596 Britannia Road West
Burlington, Ontario L7P 0G3
conservationhalton.ca

February 6, 2024

Lynne Banks,
Township of Puslinch
Planning and Development
7404 Wellington Road 34
Puslinch, ON N0B 2JO

BY E-MAIL ONLY (lbanks@puslinch.ca)

To Lynne Banks:

Re: Second Submission Zonin By-law Amendment and Draft Plan of Subdivision
CH File Number: PZBA-391
11 Main Street, Morriston
Agent: Weston Consulting Owner: WDD Main Street Inc.

Conservation Halton (CH) staff has reviewed the above-noted application as per our regulatory responsibilities under Ontario Regulation 162/06 and our provincially delegated responsibilities under Ontario Regulation 686/21 (e.g., represent provincial interests for Sections 3.1.1-3.1.7 of the Provincial Policy Statement (PPS)).

The following documents were received January 10, 2024 and reviewed as part of the second submission application:

1. Comment Response Matrix; Weston Consulting; January 2024
2. Draft Plan of Subdivision; Weston Consulting
3. Planning Justification Addendum; Weston Consulting; December 21, 2023
4. Addendum – Hydrogeological Assessment; Terraprobe; December 21, 2023
5. Environmental Impact Study; Colville Consulting Inc.; December 2023
6. Update Tree Preservation Plan (I know we don't comment on this but included it for context)
7. Fluvial Geomorphological and Meander Belt Width Assessment; Geo Morphix; February 17, 2023
8. Functional Servicing & Preliminary Stormwater Management Report; Crozier Consulting Engineer; December 2023
9. Engineering Plans – Various

Proposal

The applicant is proposing a Zoning By-law Amendment (ZBA) and Draft Plan of Subdivision application for a proposed residential subdivision consisting of 21 detached dwellings lots, environmental protection lands and municipal roads.

Ontario Regulation 162/06

CH regulates all watercourses, valleylands, wetlands, Lake Ontario and Hamilton Harbour shoreline and hazardous lands, as well as lands adjacent to these features. The property is regulated by CH as it is contains a tributary to Bronte Creek and contains the flooding and erosion hazards associated with that watercourse. The subject property also contains a wetland greater than 2ha in size. In this area, CH regulates a distance of 15 metres from the greater of the flooding and erosion hazards associated with this watercourse and 30 metres to 120 metres from the limit of the wetland. Permission is required from CH prior to undertaking any development within CH's regulated area and must meet CH's Policies and Guidelines for the Administration of Ontario Regulation 162/06, dated April 27, 2006 (last amended, November 26,2020) https://www.conservationhalton.ca/policies-and-guidelines/.

Provincial Policy Statement (Sections 3.1.1-3.1.7)

CH reviews applications based on its delegated responsibility to represent the Province on the natural hazard policies of the PPS (3.1.1-3.1.7 inclusive).

Key Comments

The following Key Comments are provided based on the review of the material submitted by the applicant, CH staff have the following comments:

1. Based on the updated wetland limits from the survey (provided via email August 29, 2023), the subject wetland was confirmed as being greater than 2 ha in size. Please note for any wetlands greater than 2 ha, CH regulates 120 metres from the greatest extent of the wetland limits. Development maybe permitted between 30m and 120m if it is determined to not have an impact to the feature. All applicable drawings, figures and reports will need to be updated to ensure that all development is located outside of 30m setback to the wetland limits (including the Environmental Impact Study - Section 6.4 – Wetlands and Figure 4 - Refined Extent of Natural Heritage Features on the Subject Property and Engineering Plans: Figure 2 – Preliminary Site Servicing West).
2. The Draft Plan of Subdivision will have to be updated to reflect the requirement noted above in Key Comment 1. The lot lines will have to be adjusted to reflect the limits of the wetland.
3. An additional wetland has been identified by the consultant through ELC in the EIS (Figure 3) that was not delineated in the field by CH staff as it was not identified at that time. This portion of the wetland will have to be delineated by CH staff in the field (in the appropriate season) and the 30m regulatory setback applied to this portion of the wetland. Please contact CH staff to coordinate a site visit to stake this portion of the wetland.
4. At detailed design, an emergency overflow weir should be provided for the pond that can pass the uncontrolled 100-year flow.
5. There appears to be deficit in surface runoff to the wetland as the front of lots 2 to 4 and the road will be directed to the SWM pond. Please revise drawings and reports to relocate the soak-away pits on Lots 2, 3 and 4 to allow overflow to be directed to the rear yard, not the storm sewer.

Recommendation

CH recommends that the **Key Comments** above are addressed in a revised submission prior to approval of the application. CH would not be able to support the approval of the ZBA or the Draft Plan of Subdivision until the comments above are addressed.

To facilitate CH's review, the following should be included in the resubmission:

1. Consolidated response table (word format preferred) addressing CH's fundamental Key Comments above;

2. Cover letter listing all documents submitted;
3. A digital copy of all resubmission materials in reduced file size format for fast loading and viewing (digital download preferred). Redlined drawings and reports with tracked changes are also appreciated; and
4. Please contact CH at the time of the formal submission to determine the appropriate fee.

Please note that CH has not circulated these comments to the applicant, and we trust that you will provide them as part of your report.

We trust the above is of assistance. Please contact the undersigned with any questions.

Sincerely,

[redacted]

Heather Dearlove, B.Sc.

Environmental Planner
905.336.1158 ext. 2231
hdearlove@hrca.on.ca

Ministry of Transportation

West Operations
Corridor Management Section West

659 Exeter Road
London, Ontario N6E 1L3
Telephone: (226) 973-8580
Facsimile: (519) 873-4228

Ministère des Transports

Opérations ouest
Section de la gestion des couloirs routiers de l'Ouest

659, chemin Exeter
London (Ontario) N6E 1L3
Téléphone: (226) 973-8580
Télécopieur: (519) 873-4228

Ontario

Date: March 27, 2024

To: Lynne Banks, Township of Puslinch

Re: ZBA Second Submission – 11 Highway 6 - WDD Main Street (Morriston)

The Ministry of Transportation (MTO) has completed our review of the 2nd submission of the revised draft plan of subdivision prepared by Weston Consulting dated December 20, 2023, for 11 Highway 6, Morriston ON. The plans were reviewed in accordance with the requirements of MTO's highway access control policies, and the *Public Transportation and Highway Improvement Act* (PTHIA), MTO's Highway Corridor Management Manual (HCMM) and all related guidelines and policies. The following outlines our comments:

Highway 6 in close proximity to the subject property is a ***Class 2B – Provincial Arterial*** with a posted speed of 80 km/hr, and designated as a ***Controlled Access Highway*** (CAH). As such, all requirements, guidelines and best practices in accordance with this classification and designation shall apply.

The owner should be aware that the property lies within MTO's Permit Control Area (PCA), and as such, MTO Permits are required before any demolition, grading, construction or alteration to the site commences. In accordance with the Ontario Building Code, municipal permits may not be issued until such time as all other applicable requirements (i.e.: MTO permits/approvals) are satisfied.

The MTO does not oppose the proposed zoning amendments, however the following comments will need to be addressed as conditions of draft plan approval or MTO permit.

Blocks and Land Use:

It is premature to comment on any block configuration until a municipal road configuration is determined to be acceptable by MTO and supported by an approved Traffic Impact Study (TIS), MTO comments on the TIS detailed below.

- The draft plans achieve MTO required 14.0m setback, however future submission should clearly show/label the setback along the Highway 6 frontage.

Stormwater Management:

- To ensure that stormwater runoff from this property does not adversely affect our highway drainage system or highway corridor, MTO requires the owner to submit a Storm Water Management Report (SWMR) along with the above-noted grading/drainage plans for the proposed development for our review and approval. MTO Stormwater Management Requirements for Land Development Proposals can be obtained from the following website:
  https://www.ontario.ca/page/resources-transportation-planners#section-5
  - The owner's drainage consultant should refer to the ministry website for applicable IDF curves and the ministry's Stormwater Management Requirements for Land Development Proposals.
    http://www.mto.gov.on.ca/IDF_Curves/terms.shtml
  - The owner's drainage consultant shall ensure that all return periods are assessed (2yr, 5yr, 10yr, 25yr, 50yr, 100yr and Regional).

- Stormwater Management Blocks are to be assumed and owned by the Township of Puslinch.

Site access & Traffic Impact Review

All access to the development shall be from the County and Municipal Road network. The MTO preferred access is to be from Ochs St, to meet MTO access spacing requirements (400m minimum and 800m desirable) from the Highway 6 and Badenoch St intersection, as the existing Main St intersection does not meet access spacing requirements.

MTO would be willing to review a sight line analysis as proposed by Township/County staff to review both locations to further support access, pending the following comments are addressed in a TIS resubmission:

- MTO will require the MTO/TAC protocol analysis to be completed for all four legs of the intersection of Highway and Badenoch St.
  - Page 18, Section 7.1.1, only provides analysis for SBLT lane, analysis for the NB, WB, EB lanes shall be included in the resubmission.

- MTO will require the MTO/TAC protocol to be completed for the right turn lane analysis.
  - Page 19, Section 7.1.2, notes it is not possible, please see section below for information to perform right turn lane analysis.

- The Synchro files show a PHF= 0.95-96 for future horizon years, MTO policy requires PHF= 0.88 (rural), or 0.92 (urban/suburban).
  - See section below regarding MTO PHF Policy to prepare the resubmission.

- In addition to the proposed intersection sightline analysis, MTO suggest alternative measure be reviewed and considered to support access from Ochs St (i.e. posted speed reduction, higher enforcement or photo-radar along this section.

Proposed Conditions of Draft Plan Approval

The following are MTO's proposed Conditions of Draft Approval:

1. That prior to final approval, the owner(s) to submit to the Ministry of Transportation for review and approval, a copy of a Traffic Impact Study indicating the anticipated traffic volumes and their impact on Highway 6 and Badenoch St intersection. The Traffic Impact Study will be prepared in accordance with MTO's Traffic Impact Study Guidelines. The owner's transportation consultant shall be RAQS certified.

2. That prior to final approval, the owner shall submit a stormwater management report along with grading/drainage plans for the proposed development for review and approval.

3. That Prior to final approval, the owner shall submit to the Ministry of Transportation for review and approval a draft copy of the M-Plan for this subdivision.

4. That prior to final approval, the owners shall provide the Ministry of Transportation for review and approval, the Conditions of Draft Plan Approval and Draft Subdivision Agreement to ensure our requirements have been incorporated.

5. That prior to final approval, 0.3 metre reserve along Highway 6 frontage shall be identified on the final plan, and that the Owner's/Developer's Solicitor provides the Ministry of Transportation with a signed Undertaking to convey this block to the Ministry of Transportation immediately following registration of the plan, to the satisfaction of the Ministry of Transportation.

Notes to Draft Plan Approval - Conditions of MTO Permits:

The owner should be made aware that under the *Public Transportation and Highway Improvement Act* (PTHIA), MTO permits are required prior to development of the subject property. The owner shall submit site plans, site-servicing plans, grading plans, and drainage plans for the proposed development to MTO for review and approval.

1. MTO Building and Land Use permit(s) will be required prior to any bulk grading, and subdivision servicing.

2. MTO Building and Land Use permit(s) for all of the individual residential lots proposed, as all fall within the MTO Permit Control Area.

If any further clarification is required regarding the MTO comments or if any issues are encountered during the additional consultation or application phases, please feel free to contact Allan Hodgins at Allan.Hodgins@ontario.ca or (226) 973-8580 who will be more than happy to assist.

Regards,

[redacted]

Allan Hodgins
Corridor Management Planner

c. Maureen McIver, Corridor Management Officer, MTO

Salvini Consulting Inc.
185 Deer Ridge Drive
Kitchener, ON · N2P 2K5
519-591-0426
julia@salviniconsulting.com

March 7, 2024

Lynne Banks
Development and Legislative Coordinator
Township of Puslinch
7404 Wellington Road 34
Puslinch, ON · N0B 2J0

Re: WDD Main Street Traffic Impact Study (TIS)
December 2023, GHD
Township Peer Review Comments

Dear Lynne,

I've reviewed the December 2023 TIS prepared by GHD for the proposed residential subdivision in Morriston and provide my comments below:

- Base traffic data, the background growth assumptions, the traffic generation and distribution, and the future total traffic volumes are all acceptable. I am in agreement with the capacity analyses at the Badenoch/Ochs and Ochs/Back intersections.
- The sightline assessment exiting Ochs Street to Badenoch Street was undertaken with the following parameters from the TAC Geometric Design Guide for Canadian Roads:
    - Driver's eye set back 4.4 metres from the edge of the traveled way
    - Driver's eye height of 1.08 metres for the passenger vehicle
    - Driver's eye height of 1.8 metres for the truck/snow plow
    - Object height of 1.3 metres representing the top of a car
- A design speed of 60 kph was chosen for the assessment representing 10 kph beyond the posted speed limit of 50 kph. Given the tight assessment, Township staff would like to see a speed study on Badenoch Street at the crest of the hill to confirm that 60 kph is appropriate. The speed study should provide a speed assessment by direction.
- The sightline assessment indicates that using these parameters, the available sightlines meet the TAC requirements for the passenger vehicle but there is about a 3 metre shortfall in the sightline for the truck (out of a requirement for 158.4 metres). The calculation of available sightlines is based both on the design drawings for reconstructed Badenoch Street and were confirmed in the field to be slightly higher than on the design drawings. Township staff have confirmed that the height of the driver's eye for the snow plow is 2.6 metres. The consultant should revise the drawing to confirm if the appropriate sight distance can be achieved with the additional height to the driver's eye.

- The parameters above represent daylight conditions where the top of an approaching vehicle can be seen. At night there are streetlights on Badenoch Street to illuminate oncoming vehicles and given the curve in the road, headlights from westbound traffic will be pointing upward and will be more easily seen from the east.
- The study does not address the reconstruction of Ochs Street. Ochs Street is narrow and requires reconstruction to meet Township standards. It is also my understanding that it will be realigned slightly to the east.
- Crozier, the Civil Engineer for the project, has prepared a drawing illustrating how the retaining wall at the southwest corner of the Badenoch/Ochs intersection could be reconfigured to meet the sightline requirements at the intersection. This will be reviewed in more detail with GM BluePlan. This drawing illustrates a reconstructed Ochs Street. Township staff confirmed that the distance between the front of a snow plow and the driver's eye can fit in the 4.4 metre setback from the traveled way (see photo below). The design of the shifted retaining wall must consider the sight triangle for the snow plow and include the 4.4 metre setback to ensure proper sight distance for the snow plow driver.
- A proposed cross-section is included in the study for new Streets A and B. The consultant suggests that the cross-section will accommodate a single lane of traffic in each direction plus parking on both sides of the road. This should be reviewed in more detail with GM BluePlan and Township staff. The paved portion of the road is proposed at 6.5 metres with a 1.25 metre shoulder on both sides. If there were cars parked on both sides of the road, there would not be 6 metres of clear width for a firetruck.
- MTO comments on the previous version of the TIS were provided to the consultant on August 2, 2023. MTO will have to provide further comments on this revised TIS.
- We have shared these comments with staff from the County and they are in agreement with them.

Please let me know if there is anything further to discuss on this application or if you have any further questions.

Sincerely,

[redacted]

Julia Salvini, MEng, PEng, FITE
President

Cc: Mike Fowler, Township of Puslinch
Pasquale Costanzo, County of Wellington
Steve Conway, GM BluePlan Engineering
Parch Lad, GM BluePlan Engineering

Figure 1: View of Snow Plow exiting Ochs Street to Badenoch Street

Lynne Banks

From: Pasquale Costanzo <pasqualec@wellington.ca>
Sent: Wednesday, March 6, 2024 9:48 AM
To: Julia Salvini; Lynne Banks; 'Hodgins, Allan (MTO)'
Cc: Mike Fowler
Subject: RE: WDD Main Street - Final Comments

Sensitivity: Confidential

Hi Lynne and Julia,

The County concurs with Julia's comments and expresses the same concerns with sighting at the Badenoch St (WR36) and Ochs St intersection.

Any questions please let me know.
Take care

Pasquale Costanzo, C.E.T., CMMII Infrastructure Specialist
Technical Services Supervisor
County of Wellington, Roads Division
T 519.837.2601 x 2250
E pasqualec@wellington.ca

From: Julia Salvini <julia@salviniconsulting.com>
Sent: Wednesday, March 6, 2024 9:24 AM
To: 'Lynne Banks' <lbanks@puslinch.ca>; Pasquale Costanzo <pasqualec@wellington.ca>; 'Hodgins, Allan (MTO)' <Allan.Hodgins@ontario.ca>
Cc: 'Mike Fowler' <mfowler@puslinch.ca>
Subject: RE: WDD Main Street - Final Comments
Sensitivity: Confidential

Lynne, I can make either of those days work with a preference for Wednesday.

I've attached an updated draft of my comments based on our previous discussion.

Julia

From: Lynne Banks <lbanks@puslinch.ca>
Sent: Wednesday, March 6, 2024 9:18 AM
To: Julia Salvini <julia@salviniconsulting.com>; Pasquale Costanzo <pasqualec@wellington.ca>; Hodgins, Allan (MTO) <Allan.Hodgins@ontario.ca>
Subject: WDD Main Street - Final Comments
Importance: High
Sensitivity: Confidential

Good Morning –

The owner of the above property reached out to me on Friday regarding his frustration in the delay in getting traffic comments so that they can address them in their next submission. After speaking with Courtenay, we would like to have a meeting with you and have you provide your final comments prior to the meeting so that we can discuss any concerns that will need to be addressed in their next submission.

Please let me know if you are available on Monday, March 11th at 2:00 or Wednesday, March 13th between 11-3. I would like to have this meeting as soon as possible so that the owner doesn't escalate his concerns by reaching out to Council.

Thanks –

Lynne

TOWNSHIP OF
PUSLINCH
EST. 1850

Lynne Banks
Development and Legislative Coordinator
Township of Puslinch
7404 Wellington Rd 34, Puslinch ON N0B 2J0
519-763-1226 ext. 226 Fax 519-736-5846 www.puslinch.ca

Township of Puslinch
Planning and Development
7404 Wellington Road 34,
Puslinch, ON
N0B 2J0

January 10, 2024
File: 10779

County of Wellington
Planning and Development
74 Woolwich Street
Guelph, ON
N1H 3T9

Attn: Lynne Banks, Development and Legislative Coordinator, Township of Puslinch
Meagan Ferris, Manager of Planning and Environment, County of Wellington
Zach Prince, Senior Planner, County of Wellington

Re: Second Submission Zoning By-law Amendment and Draft Plan of Subdivision
11 Main Street, Morriston
Township of Puslinch

Weston Consulting is the planning consultant for WDD Main Street Inc., the registered owner of the lands located at 11 Main Street (Lot 31, Concession 8) in the Township of Puslinch (herein referred to as the "subject lands"). We are pleased to submit the following materials in support of Zoning By-law Amendment and Draft Plan of Subdivision applications for a proposed residential subdivision consisting of 21 detached dwelling lots, environmental protection lands, and municipal roads.

Background

A preliminary Concept Plan was submitted to the Township to receive feedback prior to making a formal first submission. The Township provided Pre-Consultation comments to the applicant dated February 1st, 2022 which identified comments to be considered as well as materials required for a Complete Application for Zoning By-law Amendment and Draft Plan of Subdivision.

The initial submission was made on March 1, 2023 and comments were received between June and September 2023. The table below lists all drawings and reports enclosed with the second submission, which is in response to said comments:

No.	Document	Consultant
1.	Comments Response Matrix	Weston
2.	Draft Plan of Subdivision	
3.	Planning Justification Report Addendum	
4.	Hydrogeological Assessment Addendum	Terraprobe
5.	Environmental Impact Study	Colville
6.	Tree Preservation Plan	
7.	Meander Belt Cover Letter	GeoMorphix
8.	Meander Belt Width Report	
9.	Functional Servicing and Preliminary Stormwater Management Report (Incl. Hydrologic and Hydraulic)	Crozier

10.	Engineering Plans (Grading, Servicing, Erosion & Sediment Control, SWM/Drainage)	
11.	Traffic Impact Study	GHD

We trust that the above documents are sufficient for your review and circulation of the Zoning By-law Amendment and Draft Plan of Subdivision applications. Should you have any questions please contact the undersigned at ext. 290 or Mina Rahimi at ext. 339.

Yours truly,
Weston Consulting
Per:

[redacted]

Paul Tobia, BURPl, MCIP, RPP
Senior Planner

c. WDD Main Street Inc.

Comments Response Matrix

Draft Plan and Zoning By-law Amendment Application (ZBA)

First Submission Comments

Township of Puslinch

Weston File: 10779

January 2024

Contents

1. GM Blueplan Engineering Sergio Zaga, M.Eng. April 24, 2023		
Comment	**Consultant**	**Response**
Deficiencies / Outstanding Matters 1. Right-of-way Profiles (Grading Plans) The proposed development proposes an 18m wide rural cross section complete with roadside ditches and reduced pavement widths. A 20m wide urban cross-section complete with curb and gutter, storm sewer system and sidewalk is required per Township of Puslinch Municipal Development Standards and Township of Puslinch Standard Drawing 102 (STD-102). Please revise for the next submission.	Crozier	All drawings have been updated with a 20 m urban right-of-way per Standard Drawing 102 (STD-102). Storm sewer has been incorporated to direct stormwater runoff to the proposed stormwater management facility.
2. Cul-de-sac Radius (Grading Plans) As per Township of Puslinch Municipal Development Standards, the cul-de-sac bulb right-of-way radius shall be revised from 18m to 20m.	Crozier	The cul-de-sac radius has been revised from 18 m to 20 m.
3. Quality Control (FSR) The FSR needs to demonstrate how Enhanced quality control is met (i.e. 80% total suspended solid removal). It appears that a treatment train is not created as grassed swales are the only method of quality control for the runoff being infiltrated. An additional mechanism such as but not limited to an oil/grit separator would be required to have a treatment train.	Crozier	Enhanced quality control will be met through the implementation of an oil grit separator upstream of the proposed stormwater management facility. The stormwater management facility will provide additional settling to meet the enhanced quality control requirements.
4. Infiltration Water Quality (FSR) The proponent should be cognizant of any potential impacts of infiltrating road runoff which contains chlorides and other pollutants. There could be a potential for contaminant spills or oils to be infiltrated in the ground via the proposed infiltration trenches (no oil/grit separator is proposed in the FSR). We recommend infiltration of	Crozier	Based on the Hydrogeological Report the soils on-site are not conducive to infiltration to infiltration (10 mm/hr infiltration rates); therefore, lot level infiltration has not been proposed. All infiltration trenches have been removed and replace with storm sewer and an end of pipe stormwater management facility.

‘clean’ runoff only (i.e. infiltration of building rooftop runoff and/or grassed areas only). In addition, the proposed drinking water wells are located at the front of the lot in close proximity to the infiltration trenches which introduces further concerns regarding infiltration of possible roadway contaminants. We defer to the Township Hydrogeologist and Wellington Source Water Protection for comments on the infiltration water quality and the effect on drinking water wells.		
5. Infiltration Trenches/Galleries (Servicing Plans/FSR) The FSR proposes surface ponding up to 0.3m in the roadside ditches and subsurface storage/infiltration in a series of longitudinal infiltration galleries located below the proposed roadside ditches. While this concept could work in principle for a flat area, we express concerns in the ability to capture and store the runoff when some of the roads are graded at close to an 8% slope. The stormwater management calculations assume that 0.3m ponding is available throughout the roadside ditches and that the sub-surface galleries can fill up with water. Even with the construction of check dams, terracing or elevated culverts as mentioned in the FSR, due to the steepness of the roads, the volume potential outlined in the stormwater management calculations would be extremely challenging to achieve. Furthermore, it is unclear how the 0.3m ponding in the ditch is proposed to work with driveway culverts. The Town is not in support of a roadside ditch system in urban centers and hamlets, let alone a roadside ditch system that has the potential to pond water for prolonged periods of time. Additional concerns with the location of infiltration galleries and utility infrastructure – this will introduce a maintenance concern for the Township.	Crozier	Acknowledged. All infiltration trenches have been removed and replace with storm sewer and an end of pipe stormwater management facility.
6. Post-Development Drainage Plan (FSR) Please label the imperviousness of the external areas on the Post-Development plan for consistency.	Crozier	The Post-development Drainage Plan has been revised to include the imperviousness of the external drainage catchments.

7. Roadway Grade (Grading Plan) Please note that the maximum allowable roadway grade is 6% in the Township of Puslinch.	Crozier	Maximum allowable roadway grades have been maintained everywhere possible. There are a few minor locations where the maximum grade exceeds 6%.
8. Ochs Street Labels (Plans) Please label Ochs Street on all plans.	Crozier	Ochs Street has been labelled on all plans.
9. Infiltration Gallery Detail (Grading Plan) The function of the 150mm diameter perforated pipe and surface ponding capability of the system is questionable. It appears that the 150mm diameter perforated pipe would convey the drainage prior to the ability of the system to pond on the surface or use the last 150mm of storage in the gallery. Inconsistencies between the FSR and infiltration gallery detail with respect to gallery and overflow pipe dimensions. (i.e. FSR states 1.0m deep gallery with 100mm diameter overflow pipe, detail shows 0.9m deep gallery with 150mm diameter overflow pipe). The notes regarding placing sod on top of geotextile wrapped media need further clarification as the topsoil is not proposed to be wrapped in geotextile.	Crozier	Acknowledged. All infiltration trenches have been removed and replace with storm sewer and an end of pipe stormwater management facility.
10. Quantity Control of Stormwater (FSR) The post-development 2-year storm event does not appear to match pre-development flow rates. Please revise.	Crozier	The stormwater management modelling has been revised to incorporate the quantity controls within the proposed stormwater management facility. Based on the modelling the post-development flows have been reduced to the pre-development flows for all storm events. Details of the outlet control structure will be included during the detailed design stage.
11. External Areas (FSR) Please confirm if the external catchments are to be conveyed through the site in the proposed development. In the VO model, the external catchments are added in at the end of the model while the report text it states that the catchments will drain through the	Crozier	The VO model and Functional Servicing and Stormwater Management Report have been updated to discuss the external catchment flows in greater detail. All storm events from Catchment EX1 are directed to a low-lying depression area located in the eastern corner of the Old Morriston

site to Bronte Creek. If these areas are conveyed through the site, the stormwater management calculations (quality and quantity control) need to demonstrate that the proposed stormwater management system can handle the conveyance of the two external areas without surcharging the system.		Baseball Diamond. An earth berm along the south and east property limits of the baseball diamond allows stormwater to pond within the park limits. If the storage limits are reached, stormwater will drain southwest between the Lot 1 and Lot 2 towards the Bronte Creek tributary via sheet flow, consistent with pre-development conditions. Note, a figure has been prepared and included in Appendix D of the revised report outlining this scenario. All storm events from Catchment EX2 are to be conveyed through the site by the proposed storm sewer infrastructure and internal roadway towards the proposed stormwater management facility, ultimately outletting to the Bronte Creek tributary. The stormwater modelling has been updated to reflect this scenario. Storm sewer design sheets will be completed at the detailed design stage to ensure the proposed storm sewer network can accept the additional external flows.
12. Stormwater Model – Visual OTTHYMO (FSR – VO Schematics) Please replace the wording of the "Post-Development" schematic title to reflect a post-development uncontrolled scenario. Please replace the wording of the "Post-Development w/ Mitigation" to be "Post Development Controlled". This will make it consistent with Table 8 in the report and will make ultimate conditions clear.	Crozier	The Visual OTTHYMO and schematics has been updated to reflected Table 8.
13. Fire Storage Tank (Servicing Plans) Please give representation to the location of the fire storage tank on the Servicing Plans.	Crozier	The location of the fire storage tank has been represented on the Site Servicing Plans (Figure 1).

14. FSR Text (FSR) Please review the text presented in Section 7.3 paragraph four describing imperviousness.	Crozier	Section 7.3 has been reviewed and revised to account for the removal of the infiltration trenches and the implementation of the end of pipe stormwater management facility.
At this time, we cannot support the approval of the Zoning By-law Amendment and Draft Plan of Subdivision until the above comments are addressed as it is unclear how the stormwater management objectives for the site will be achieved and how the Township of Puslinch standard 20m wide urban right-of-way cross section will impact the development concept. Revised stormwater management facility locations shall be explored outside of the municipal right-of-way. The development concept, associated drawings and reports must be revised to include the 20m wide urban municipal right-of-way cross section as outlined in the Township of Puslinch Municipal Development Manual.	Crozier / Weston	Acknowledged.

2. County of Wellington – Planning and Development Department Meagan Ferris - (519) 837-2600 EXT. 2120		
Comment	**Consultant**	**Response**
Planning Comments: **General** 1. All of the supporting information has identified that subject parcel as being “11 Main Street, Morriston”; however, the County’s records do not appear to align this specific address with this parcel. This is simply being noted for clarification purposes. It is further noted for clarification purposes that the proposal intends to extend “Ochs Street”; however, based on the County’s information the proposal would have a minor extension to Back Street.	N/A	Acknowledged.
2. This proposal is also related to a Draft Plan of Subdivision which has been submitted to the County, but has not yet been deemed complete. As this zoning is specifically related to another planning application and associated process that does not have	N/A	Acknowledged.

same statutory time lines and forms the basis for the proposed Zoning By-law amendment, the Township may want to consider this and how it will impact the decision timelines for the subject Zoning By-law amendment. It is suggested that the Township focus their review on the Draft Plan of Subdivision first.		
3. It is noted that this development proposal does not include a proposed Stormwater Management Pond and this approach will require a detailed review and acceptance from the Township's Engineers. It is also noted that an individual park is not proposed due to proximity to an existing park. Parkland dedicated would be anticipated based on this proposal. Ownership of the large woodland block will likely need to be clarified and discussed, including if there is interest from the Township in developing trails through the woodlands. At this time, it does not appear any trails are proposed.	Crozier	A typical stormwater management pond (dry pond) is now proposed for the development. Acknowledged. Acknowledged.
4. Public Engagement – The applicant's Planning Justification Report has indicated that the statutory requirements under the Planning Act will suffice for public engagement for the subject development; however, public engagement will need to considered based on how the Township addresses dealing with concurrent applications (see item 2 above). It is further noted that changes to the Planning Act have removed the requirements for Draft Plans of Subdivision to have public meetings. The Township should consider if they still wish to host a Public Meeting for the Draft Plan of Subdivision and/or require a developer lead Open House.	Weston	Acknowledged. The Planning Act has removed the requirements for Draft Plan of Subdivision to have public meetings.
Official Plan 5. The subject property is located within the Urban Centre of Morriston and is designated as: Residential and Green Land System. The Residential designation allows a broad type of residential uses of varying types and densities. Some non-residential uses are also permitted such as home occupations and convenience stores; however, the development is specifically proposed for residential purposes.	Weston	Acknowledged.

The Greenland System is broken down into two types of designations – the Core Greenland System which includes the following features: flood plain and Provincially and Locally Significant Wetlands; and the Greenland System which includes the following features: Significant Woodlands. It is noted that Morriston is part of the County's Urban System; however, through County OPA 119 (Phase 1 of the Municipal Comprehensive Review), this area is identified as part of the Rural System and as a "Secondary Urban Centre". The applicable conservation authority is the Conservation Halton (CH); however, it is noted that changes to the Planning Act will require a coordinated review between the CH and the Township' and County's Ecological Consultants. The site is also partially within the Paris Galt Moraine Policy Area and staff well need confirmation that the Township's Hydrogeologist is satisfied that Section 4.9.7 Paris and Galt Moraine Policy Area are addressed.		
6. Based on information available to planning staff the subject the property is not located within a Wellhead Protection Area.	N/A	Acknowledged.
7. The County Official Plan has policies in relation to Rural Servicing, with Section 11.2.3 of the Official Plan requiring a Servicing Options Assessment to be completed for multi-lots on private services. The need for an addendum letter that confirms these policies have been assessed has been requested by the County as part of the related Draft Plan of Subdivision.	Weston/Crozier	Options for sanitary servicing include connection to municipal sanitary services, a communal sewage works or individual wells and onsite sewage systems. The Town of Morriston does not currently have sanitary sewers, therefore a municipal sewer connection or extension is not feasible. A communal sewage works could be considered, however a servicing block for both the treatment and disposal works would be required. If surface discharge were to be considered, a suitable receiver would have to be identified and evaluated. The ownership of the communal sewage works would also have to be considered. If private ownership is proposed through a condominium structure or similar, a Municipal Responsibility Agreement with the upper or lower Tier municipality would be required.

		Privately owned individual on-site sewage systems are proposed for this development. This servicing approach is consistent with the greater community and is suitable for rural estate subdivisions. Privately owned sewage systems are owned an operated by the property owner and there is no requirement for additional maintenance or review from the municipality. A similar rationale can be employed on the water servicing strategy. Individual privately owned wells are proposed. We defer to the hydrogeologist to comment on the suitability of individual wells for this development.
Zoning 8. The subject lands are zoned primarily as Future Development 2 (FD2 Zone), with a portion being within the Urban Residential (UR) Zone and the Natural Environment (NE) Zone. The Township's Environmental Protection Overlay applies to all of the features. Within the FD Zone, a single detached dwelling is permitted subject to the zone standards of the UR Zone. Within the UR Zone the following uses are generally permitted: dwellings (singles, semis, duplexes, townhouses); bed and breakfast; additional residential units; boarding/lodging and rooming house; group home; home business; long care facilities; private home day care; retirement home; parks; community garden; and a public school.	Weston	Acknowledged.
Proposed Zoning The Zoning By-law amendment request is to place the property into one, consistent zone (the UR Zone) that allows the intended multi-lot residential use and to establish provisions for reduced lot sizes. Planning staff will consider if all of the uses in the UR Zone would be appropriate given the development proposal.	Weston	Acknowledged.
The NE Zone currently appears to apply to areas identified as Core Greenland's (i.e. wetlands and floodplain). It appears the proposed Zoning By-law Amendment intends to rezone all the features to the Natural Environment (NE) Zone and to maintain the Overlay. Planning staff generally supports an approach to protect the features; however, any proposed refinements to the Zoning will need to be reviewed in the context of the County Official Plan and the supporting Environmental Impact Study.	Weston	Acknowledged.

It is recommended that the Zoning By-law also consider the inclusion of the significant woodlands buffer. The applicant's EIS identifies this buffer to be 10 m; however, the peer review Ecologist will need to confirm if this is appropriate. This will be reviewed and considered by Planning staff in consultation with the peer review Ecologist.	Weston	Acknowledged.
Municipal Development Standards & Township Design Guidelines 9. It is anticipated that the Township's consultants will be utilizing the Municipal Development Standards as part of their review and it is assumed that the applicant has considered this document in the preparation of the Draft Plan of Subdivision submission.	Weston	Acknowledged.
10. A review of the Township's Design Guidelines is suggested to be completed by the applicant to ensure that the development proposal meets any required standards. This can be addressed in the future Planning Justification Report addendum.	Weston	Please refer to the letter prepared by Weston Consulting.
Studies 11. Planning Justification Report a) The PJR does not appear to speak to the Provincial Policy Statement policies specific to Natural Heritage (Section 2.1) and Water (Section 2.2); however, it is noted associated supporting studies have been submitted. The aforementioned policies items can be addressed through a minor addendum letter. b) It also appears that a refinement to the Greenland System mapping is being sought, but not explicitly mentioned in the PJR. Discussion regarding pertinent refinements and associated process will be required. This can take place as part of the detailed EIS review.	Weston/Colville	a) Please refer to the addendum prepared by Weston Consulting. b) Please refer to the revised EIS.
12. Traffic Impact Study - The subject proposal intends to connect a new road to Back Street which then accesses Badenoch St. East. One lot is proposed to have access either to Main Street or an unopened road allowance owned by the Township to Queen Street; however, it is unclear. This will need to be clarified by the applicant. Badenoch St. East is a County owned road and the County's Roads Department will provide further detailed comments regarding the submitted Traffic Impact Study as will the Ministry of Transportation. The Township Engineer should assess impacts to local	GHD	Noted.

roads. It is noted that the Study determines that no upgrades are required.		
13. The applicant has prepared a Phase 1 Environmental Site Assessment. This study recommends that a Phase 2 assessment be completed.	NSSL	Acknowledged.
14. It is anticipated that all other studies will be reviewed by pertinent agencies or consultants.	N/A	Acknowledged.
Additional Comments 15. It would be useful for architectural renderings of housing types to be provided to the Township to assist Council and to assist with future public engagement.		The housing typology has not yet been further refined and renderings will be provided within a subsequent submission.
16. It is requested that have a conceptual plan provided that shows all of the setbacks proposed for lots. It is noted that the pre-consultation proposal had shown a smaller number of lots and providing details regarding setbacks and general building location would greatly assist the Township and Council in their review and consideration.	Weston	Please refer to the concept plan prepared by Weston Consulting.
These comments are intended to provide initial feedback to the applicant and Township on the initial Zoning By-law submission. As more information is provided and detailed review of the application is 5 completed more comments may arise. I trust these initial comments will be of assistance.	N/A	Acknowledged.
It is noted that it appears all of the requested studies have been submitted by the applicant; however, planning staff have identified a number of items for the Township to consider, including if it is appropriate to proceed with the Zoning By-law amendment when there is a related Draft Plan of Subdivision proposal that hasn't been deemed complete and will impact that timing for a recommendation on the associated Zoning By-law Amendment.	N/A	Acknowledged.
The Township may also wish to require the following items before proceeding with this application – items 10; 11 a); 15 and 16.	N/A	Acknowledged.

3. Natural Resource Solutions Inc. Jack Richard, R.P.F.		
Comment	**Consultant**	**Response**
<u>Comments on Reviewed Materials</u> **Environmental Impact Study** The author states that the “EIS has been prepared to delineate the extent of natural heritage features on the subject property” and assess the potential impacts of development on natural heritage features on and adjacent to the subject property. “Adjacent lands” are not defined in the report, and therefore the actual extent of the study area for this EIS is unclear. This section details the documents reviewed to inform the development of the EIS and field program. The EIS does not indicate whether or not a Terms of Reference was completed to allow the reviewing agencies the opportunity to approve the EIS scope of work. Relevant natural heritage policies appear to be adequately addressed within the EIS and are detailed in Section 2.0, including a review of the County of Wellington OP, PPS, Greenbelt Plan, and Ontario Regulation 162/06. The EIS states that “some” of the background information reviewed was gathered from the County of Wellington Official Plan, Conservation Halton, Ministry of Natural Resources and Forestry, and the Natural Heritage Information Centre (NHIC). Fulsome details of the background information reviewed are not presented within this section of the EIS. Based on references made elsewhere within the EIS it is anticipated that additional background review sources, such as the Ontario Breeding Bird Atlas (Bird Studies Canada 2004) and Significant Plant List for Wellington County (Anderson and Frank 2004) were used to inform this EIS.	Colville	Noted. Please refer to the revised EIS and Section 4.0 which includes study findings.
Despite this, it is recommended that the EIS incorporate a more stringent review of available natural heritage background data in relation to wildlife reported from the subject property. To supplement the NHIC screening used to evaluate potential species presence, resources such as the Ontario Reptile and Amphibian Atlas (Ontario Nature 2019), Ontario Butterfly Atlas (MacNaughton et al. 2023), Ontario Mammal Atlas (Dobbyn 1994), and Ontario Odonate Atlas (NHIC 2023) should be consulted. Due to the presence	Colville	Please refer to Section 3.0 of the revised EIS which includes an updated resources list.

of watercourses on the property, Aquatic Species at Risk (SAR) data should be obtained from the Department of Fisheries and Oceans (DFO, 2023) online mapping tool. The results of these screenings should be presented with a summary of SAR and Species of Conservation Concern (SCC) reported from the vicinity of the study area, as well as a description of whether suitable habitat for the species occurs on the subject property.		
Recommendations • Identify the extent of the study area, including a definition of "adjacent lands"; • Complete fulsome screening for SAR that may exist within the subject property or adjacent lands; and • Provide the results of all background information reviewed as part of the EIS.	Colville	Addressed in various sections of the EIS.
<u>Vegetation</u> The report states that two botanical inventories were conducted on the property in August and September, 2022. Typically, vascular plants surveys will consist of three seasonal inventories to capture the breadth of seasonal vegetation that my occur within a given area. Due to the timing and number of surveys completed within the subject property, it is unlikely that spring and early summer vegetation will have been accurately recorded within the field program.	Colville	Please refer to the revised EIS which provides the results of background information obtained.
The report also states that the Dry-Moist Old Field Meadow (CUM1-1) was "cultivated" to facilitate archaeological assessments completed in the fall of 2022. The Stage 2 Archaeological Property Assessment Report completed by AMICK Consultants Ltd. and submitted as part of the Application states that this was completed in October 2022.	Colville	Noted.
The EIS identifies that one Butternut (Juglans cinerea) tree was observed adjacent to the subject property and expected to be a hybrid based on visual field observations. Data or photos to support this finding have not been presented in the EIS or associated TPP, nor has a description of the methods used to evaluate this individual. Based on the materials included in the EIS and supporting application, no Butternut Health Assessment appears to have been submitted to the Ministry of Environment, Conservation and Parks (MECP).	Colville	The Butternut tree was assessed on multiple occasions during 2023 leaf-on season. External characteristics strongly suggest hybridization with other Juglans species.
Recommendations	Colville	See above comment.

Based on our review of the EIS, it is our opinion that the following steps are required to complete the EIS, in order to adequately address aspects related to the natural environment: • Confirm that the field program has adequately assessed the full breadth of seasonal vegetation within the subject property, including spring and early summer species. If this has not been accomplished within the currently completed field program, additional surveys may be required. • The proponent should provide a detailed description of methods used to determine hybridity, clear images of the Butternut features (i.e., leaflet, buds, twig, bark, pith, etc.), and an accompanying description of why the assessed features suggest the Butternut is a hybrid. Genetic sampling is recommended if field hybridity tests are inconclusive, and consultation with the MECP may be required.		
<u>Habitat for Endangered or Threatened Species</u> Section 5.4.2. of the Wellington County OP mandates that development and site alteration may not be permitted if impacts to SAR, considered endangered or threatened, are anticipated. Specifically, the OP states: *"Development and site alteration will not be allowed in significant habitat of endangered or threatened species except in accordance with provincial and federal requirements. Development or site alteration adjacent to significant habitat of endangered or threatened species shall require a satisfactory Environmental Impact Assessment that demonstrates there will be no negative impact on the significant habitat of endangered or threatened species or its ecological function."* In order to determine whether or not endangered or threatened species occur within the subject property, as well as demonstrate any proposed development will result in "no negative impacts", it is necessary to conduct wildlife and habitat surveys that will effectively detect the presence of existing wildlife communities and habitat. Currently, it is unclear if the field program described within the EIS has effectively achieved this as little detail has been provided on the specific methods used for certain surveys, such as aquatic surveys. Also, no rationale has been provided as to why spring season surveys	Colville	Additional field studies in 2023 were conducted to assess potential use of the property by wildlife and occurrence of SAR plants. No additional plant or non-bat wildlife SAR were documented on the property.

were not completed as part of the EIS. As a result, it is our opinion that the overall survey effort, as described within the EIS, may be insufficient to document the potential presence of some types of SAR species or their habitat within the subject property.		
Section 4.2.2 of the EIS identifies that the potential for roosting bat habitat was assessed in woodlands, hedgerows, and isolated trees on the subject property. It is stated on page 15 of the EIS that suitable bat habitat was found in the woodland, however isolated trees along the northern edge of the property are also identified as having the potential to contain suitable bat roosting habitat. The author states that this habitat (northern hedgerow) is of lower quality and unlikely to be utilized by bats based on the presence of higher-quality potential habitat within the woodland. Little rationale is provided to support this finding and it is recommended that this interpretation be confirming with the MECP. Impacts to all possible bat roosting habitat within the subject property should be considered. Should impacts be likely to occur as a result of the proposed development, it is anticipated that consultation with the MECP will be required to ensure conformity with the ESA (2007).	Colville	Additional assessment of potential bat roost trees and acoustic monitoring was conducted in 2023. Additional SAR wildlife species were limited to incidental detections of Little Brown Myotis and Tri-colored Bat. Discussion included in various sections of the updated EIS.
Section 4.2.3 of the EIS states that reptiles and amphibians were surveyed using active hand searches. The methods for these searches should be detailed further in this section, as hand searching is not a method defined within the referenced protocol (OMNRF 2016). Further, confirmation should be provided as to whether or not hand searches were completed under a Wildlife Scientific Collector's Authorization permit. The report should also clarify the timing and weather conditions of each of these surveys to ensure that adequate survey effort was completed in suitable weather. The Ontario Species at Risk Snake Survey protocol referenced (OMNRF 2016) requires that surveys be completed in sunny conditions when air temperature is between 10 and 25 degrees Celsius, or in overcast conditions when air temperature is between 15 and 30 degrees Celsius. The protocol also states that surveys should occur between 9am and 5pm in the springtime, and between 8am and 12pm, or 5pm and 8pm in the summer. No survey data has been provided within the EIS.	Colville	Please see the revised EIS which includes additional discussion provided.
The protocol is also specific to snakes and inadequate for assessing amphibian occurrence, as implied in this section title. Amphibian presence should not be ruled out based on findings of this survey alone. In order to assess the potential presence of SAR amphibians within the subject property, amphibian call surveys should be completed	Colville	Previous assessment of the property indicated that potential amphibian breeding habitat on the property is limited. Call surveys completed in 2023 verified that the property is not providing significant breeding habitat for amphibians.

within each of the existing wetlands. Clarification should be provided as to why no amphibian call surveys were conducted within the subject property despite the presence of wetlands and watercourses. The EIS states that no "suitable potential breeding habitat" was observed within the subject property, however no field surveys appear to have been completed within the time of year to assess this habitat type. Wetlands on the subject property, including the SWC3-1, MAM3-9, and MAMM1-12 vegetation communities should be assessed for suitable amphibian breeding habitat and potential amphibian movement corridors. If it is determined that anuran habitat may occur on the property or in the adjacent wetlands, anuran call surveys should be completed in accordance with the Marsh Monitoring Program Participant's Handbook for Surveying Amphibians (2008). This protocol requires that three anuran call surveys are completed in the months of April, May, and June. As various amphibian species emerge for breeding at different times in the spring-summer seasons, multiple surveys are required to confirm the presence of absence of various species.		
Little information is provided within the EIS regarding the aquatic habitat assessments referenced in Section 4.3 of the EIS. It is stated that these assessments were completed during August 10 and September 27, 2023, though this is anticipated to be 2022. It is understood that a separate field assessment was completed during November 17, 2022, by GEO Morphix to characterize the watercourse and confirm reach delineation results. While detailed methods and data is provided within this report, no analysis is provided regarding the field data and presence of aquatic habitat. No protocols or methods have been described in the EIS for the August 10 and September 27 assessments, and it is unclear if relevant information such as water temperature, aquatic vegetation, groundwater indicators or other parameters were evaluated during these assessments. No rationale or supporting data is provided in the EIS as to why the western watercourse is assumed to be warmwater habitat. Further, the EIS states that the small watercourse within the eastern portion of the property is not considered to be a watercourse but provides no data or rationale to support this finding. Clarification should be provided as to how this conclusion was made and whether this feature is considered a headwater drainage feature. In Section 5.1, the author states that aquatic assessments were not completed as part of this assignment. While this is stated in relation to the potential for Redside Dace (Clinostomus elongatus), an aquatic SAR, clarification should be provided as to what aquatic assessments, if any, were completed as part of the assessment of impacts for the proposed development.	Colville	Please refer to the revised EIS which includes additional discussion and clarification provided. The watercourse on this property does not meet the typical assessment standards of OSAP or HDFA, however adequate description of the watercourse is provided in the report.

Recommendations • Identify the full extent of candidate roosting habitat for bat SAR within the subject property and provide measures to ensure that the development will not result in any negative impact to these features. It is recommended that consultation with the MECP be completed to ensure the assessments completed and overall proposed development conform with the requirements of the ESA (2007), including Sections 9 and 10, is achieved; • Conduct fulsome vegetation and wildlife surveys, as well as describe the timing, location, and methods applied for the 2022 natural environment surveys, specifically for surveys which do not conform with the referenced standards or those not typically conducted under the submission of an EIS; • Identify the methods used to complete aquatic assessments within the subject property and a rationale for the selection of these protocols; • Present data and field evidence used to draw conclusions regarding the presence, condition, and types of aquatic habitat identified within the EIS (e.g., water temperatures, aquatic vegetation, groundwater indicators, etc.); • As stated above, explanation as to how the Butternut discussed in the EIS was determined to be a hybrid is required. The TPP states that “appropriate setbacks” should be “based on DBH (Diameter at Breast Height)” but no explanation of what is appropriate is provided. The proponent should identify the setbacks that apply to hybrid butternut, if any, and demonstrate that the setbacks are compliant with MECP guidance, the ESA, and Ontario Regulation 830/21; • Demonstrate and confirm that the proposed development will have no negative impact to any significant habitat of endangered or threatened species, or its ecological function.	Colville	Please see the above.
Species of Conservation Concern Section 5.1.1 of the EIS identifies additional species of conservation concern with records of occurrence near the subject property, however surveys to assess for the presence of these species were not completed. Specifically, surveys for Snapping Turtle (Chelydra serpentina) were not completed, despite the fact that the EIS identifies that habitat is assumed to be present within aquatic features on the subject property.	Colville	None of the wetland features on the property provide suitable habitat for Snapping Turtle or Eastern Ribbonsnake. Clarification provided in various sections of the report

As the subject property contains tributaries to the Bronte Creek and wetlands associated with the East Morriston Swamp Wetland Complex, potential habitat within the subject property should be assessed, including suitable nesting habitat and substrates.		
The EIS also states that potential habitat for Eastern Ribbonsnake (Thamnophis sauritus) is limited to off-property wetland features. Eastern Ribbonsnake is known to occupy marshes and streams bordered by low vegetation, and thus suitable habitat may be present within the subject property in the MAMM1-12, MAM3-9, and MAM2-2 communities, as well as surrounding watercourses and drains. As the SAR Snake Survey Protocol (OMNRF 2016) used for reptile surveys is not indicated for Eastern Ribbonsnake survey use, existing survey efforts for this species are considered inadequate.	Colville	Please see the above comment.
Recommendations • Provide a detailed evaluation of suitable habitat and habitat features (i.e., overwintering habitat, nesting substrates, basking structures) for turtles on the subject property. Conduct surveys to confirm turtle presence within suitable habitat, where present. • Provide a detailed evaluation of suitable habitat for Eastern Ribbonsnake in meadow marsh vegetation communities and other aquatic features on the subject property. Conduct surveys to confirm Eastern Ribbonsnake presence within suitable habitat, where present.	Colville	Please see the above comment.
<u>Significant Woodlands</u> Section 5.5.4. of the County of Wellington OP identifies the following with respect to the Greenlands System and Significant Woodlands, which are relevant to this ZBA: *"In the Rural System, woodlands over 4 hectares and plantations over 10 hectares are considered to be significant by the County, and are included in the Greenlands system… In the Urban System, woodlands over 1 hectare are considered significant by the County, and are included in the Greenlands system.* *Detailed studies such as environmental impact assessments may be used to identify,*	Colville	The extent of the Significant Woodland on the property has been refined to coincide with vegetation communities that contain 60% or greater canopy cover. Portions of the WODM5 community have been excluded from the woodland, as these areas do not meet this standard. Clarification has been provided in the EIS.

delineate and evaluate the significance of woodlands based on other criteria such as: proximity to watercourses, wetlands, or other woodlands; linkage functions; age of the stand or individual trees; presence of endangered or threatened species; or overall species composition." The EIS correctly identifies the presence Significant Woodlands within the subject property, however Section 5.2 of the EIS states that the extent of the Significant Woodland has been refined to the White Cedar forest communities (FOC2-2 and FOC4-1). It is stated that this has been done to be consistent with "provincial guidance" however no guidelines or correspondence have been referenced within the EIS. ELC mapping provided within the EIS show these communities as being contiguous with adjacent WODM5 community north of the FOC communities. The provincial Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement (2005) states that woodlands that overlap or abut one another should be considered more valuable or significant than those that are not. Being that these different woodland communities are directly connected to one another the entirety of the woodland should be considered significant. However, the EIS excludes portions of the WODM5 woodland from the identified Significant Woodland despite identifying the remainder of the WODM5 community as being included in the Significant Woodland, further northeast. A clear explanation for this has not been provided in the EIS. As the EIS identifies the WODM5 community as a single woodland vegetation community, it is unclear why a portion of this community has been excluded from the identified Significant Woodland. It is our opinion that the entirety of this feature should be considered Significant Woodland.		
Currently, the EIS states the proposed development lots have been setback 10m from the identified Significant Woodland limit and that this buffer will be sufficient to avoid directly impacting trees within the woodland as well as species within the woodland. Despite this, Figure 4 of the EIS clearly shows Lots 11 and 12 directly overlapping portions of the WODM5 woodland community. Civil Engineering Drawings (February 2023) for the proposed development prepared by Crozier Consulting Engineers show septic beds at the back of these lots, directly overlapping the existing woodland area. As discussed above, this community should be considered as part of the Significant Woodland and the establishment of lots within the canopy of the woodland is resulting in a direct impact to this feature, which is considered "Greenlands" under the Wellington County OP. As stated in the County OP, Significant Woodlands must be protected from	Colville	Please see the above comment.

development or site alteration that would negatively impact the woodland or its ecological function (2022).		
The Civil Engineering Drawings also identify a proposed stormwater sewer outlet feeding into the 10m Significant Woodland setback area. No impact assessment has been provided for this development component in relation to the Significant Woodland.	Colville/Crozier	Assessment of impacts related to pond outlet included in updated EIS.
Recommendations • Provide detailed explanation as to how the Significant Woodland was refined and reference relevant provincial guidelines; • Confirm that the proposed development will not impact the Significant Woodland feature, or its ecological function. This should include the entirety of the Significant Woodland feature, including the WODM5 community that is contiguous with the FOC communities identified by the author; • Revise the proposed 10m setback limit in relation to the proposed development lots and refined Significant Woodland area. It is recommended that this be established based on the dripline of the refined Significant Woodland area. These features should be delineated with a high level of accuracy, using GPS technology; and • Evaluate impacts associated with the establishment of development components, including septic beds, building envelopes, and stormwater outlets, that have been proposed in direct proximity to or overlapping the Significant Woodland. If negative impacts to the woodland are anticipated as a result of these development components, refinements may be required to the proposed development; and • Specify the restrictions that will be implemented to ensure that development lots adjacent to the Significant Woodland do not negatively impact this feature or its ecological function. Consideration should be given to installing fencing for lots adjacent to the Significant Woodland, to better protect this feature, in addition to the implementation of a rear yard use condition.	Colville	Please see the above comment.
<u>Significant Wildlife Habitat</u> It is our opinion that the potential for certain Significant Wildlife Habitat (SWH) types have not been fully explored within the EIS. The EIS states that the WODM5 and	Colville	Assessments for potential bat maternal roost colonies conducted using acoustic monitors. Please refer to the revised EIS for discussion provided.

FOC4-1 communities south of the proposed development contain potential bat roosting habitat and should be considered Candidate Bat Maternity Colony SWH. However, earlier in the report it is stated that the FODM11 also contains potential bat roosting trees but no discussion has been provided as to why this feature is not considered SWH.		
The EIS also identifies Confirmed SWH for seeps within the FOC4-1. The EIS states that amphibian breeding habitat is not likely occur on the subject property due to a lack of vernal pools observed on the subject property. It is further stated that amphibian breeding is assumed to occur off property within the East Morriston Swamp Wetland Complex. However, wetlands associated with this complex occur within the subject property and have been identified as vegetation communities suitable to support this SWH. As wetlands within the subject property were not appropriately surveyed in spring conditions, or under suitable survey conditions described by the Marsh Monitoring Program, we disagree with the assessment that the potential for amphibian breeding habitat to occur within the subject property can be discounted at this time.	Colville	Amphibian call surveys completed to assess use of wetlands. Please refer to the revised EIS which includes discussion provided in various sections.
Finally, Section 6.2 of the EIS states that no woodland areas will be removed to facilitate development on the subject property. Despite this, the proposed development directly overlaps areas of woodland that should be considered Significant, as described above. The EIS further states within this section that Eastern Wood-pewee were heard calling from the woodland on the eastern portion of the subject property and that survey results indicate that the woodland is being used as breeding habitat. As such, the entirety of the contiguous woodland in the southern portion of the subject property must be considered SWH (Habitat for Species of Conservation Concern), rather than the "refined" woodland area identified by the authors, as discussed above. The EIS states that Eastern Wood-pewee is somewhat tolerant to urban land uses, however no reference is provided to support this. The species profile of Eastern Woodpewee published by the MECP (2014) and Committee on the Status of Endangered Wildlife in Canada Assessment and Status Report of Eastern Wood-pewee (2012) both indicate that urban development and habitat degradation are considered a primary threat to this species.	Colville	The portion of the WODM5 community proposed for removal is not typical habitat of EWP and not included as habitat for this species. Clarification provided in report.
Recommendations • Bat Maternity Colonies, Amphibian Breeding Habitat (Woodland), Amphibian	Colville	Please refer to the above comment.

Breeding Habitat (Wetland), and Amphibian Movement Corridor SWH should be re-evaluated following appropriate surveys; and • Appropriately identify the extent of Habitat for Species of Conservation Concern to include all woodland areas providing Eastern Wood-pewee habitat and complete an updated impact assessment that addresses the full extent of this habitat.		
<u>Wetlands (Core Greenlands)</u> With regards to wetlands, Section 5.4.1. of the County of Wellington OP states: *"All wetlands in the County of Wellington are included in the Core Greenlands. Development and site alteration will not be permitted in wetlands which are considered provincially significant. Provincially significant wetlands are shown in Appendix 3 of this Plan. All other wetlands will be protected in large measure and development that would seriously impair their future ecological functions will not be permitted. The appropriate Conservation Authority should be contacted when development is proposed in or adjacent to a wetland."* The EIS does not provide a detailed discussion as to how wetlands within the subject property have been identified. Wetland delineations should be completed in accordance with the Ontario Wetland Evaluation System (OWES) and trained personnel. The proponent should clarify whether these wetland communities were mapped by OWES certified staff, and if not, rationalize why this exercise was not completed.	Colville	Wetland boundaries delineated per OWES guidance. Boundary verified with CH staff.
While the EIS references background information material and mapping provided by Conservation Halton, the Application does not appear to conform with Section 5.4.1 of the County of Wellington OP, which requires that the relevant Conservation Authority be consulted when a development is proposed within or adjacent to a wetland. As stated in the County OP, adjacent lands are defined as lands within 30m for Core Greenlands and Greenlands. It is also recommended that refinements made to the extent of wetland within the subject property be confirmed with Conservation Halton staff.	Colville	Noted.
Recommendations • Consult with Conservation Halton to confirm the delineation of wetland	Colville	Please refer to the above comments.

boundaries as identified in EIS, as well as suitability of proposed development in relation to Conservation Halton regulated area; and • Confirm that appropriate erosion and sediment controls, referenced within the EIS and ZBA Application, will be implemented to ensure that the adjacent wetlands, and other regulated natural features, are not impacted during the construction of the proposed development.		
Additional Recommendations • The report should identify the extent of the proposed Natural Environment Zone, and demonstrate that the Zone ascribes to the 30m setback required from the limit of this Zone, as required by Section 4.31 of the Township of Puslinch Zoning By-Law (2021). • While wildlife observed on the subject property are associated with residential land uses, lighting and noise as a result of the proposed development are still expected to have an impact as a result of increasing overall proximity and exposure of light and noise disturbance to resident wildlife. This disturbance also reduces the overall quality of the habitat, which may inhibit use by sensitive species known to occur in the area. It is recommended that mitigation measures for light and noise reduction, such as limited construction activity times and Dark Sky Association standards, are described at later detailed design stages. • In addition to breeding bird timing windows, vegetation removal windows should also consider MECP guidance for bat habitat removal. The report states that exclusion fencing should be installed at least 1m from the dripline of trees to be retained in the significant woodland. However, tree removal is not permitted within the significant woodland. Any erosion and sediment controls should also aim to present sediment transfer to significant woodland features.	Colville	Noted.
Tree Preservation Plan The following comments and recommendations have been provided based on our review of the Tree Preservation Plan prepared by Colville Consulting: Similar to the EIS, the TPP states that the Butternut found within the study area is assumed to be a hybrid, however no data is provided to support this finding;	Colville	The Butternut tree was assessed on multiple occasions during 2023 leaf-on season. External characteristics strongly suggest hybridization with other Juglans species. Further discussion can be found in the revised EIS.

No discussion has been provided within the TPP regarding the potential for mature trees inventoried within the subject property to provide bat roosting habitat. As it is understood from the EIS that trees within the subject property may contain potential roosting habitat, impacts to these trees should be considered and conformity to the ESA (2007) and MECP requirements should be achieved. This may include limiting tree removal to avoid the bat active season (April 1 to September 30);	Colville	Assessments for potential bat roosting habitat was conducted using snag surveys and acoustic monitors. Please refer to the revised EIS for further discussion provided.
Consistent with Colville's comments under “Summary and Recommendations”, tree retention and removal prescriptions should be informed by final grading and development details;	Colville	Noted.
The TPP states that tree removal compensation may need to be provided for the removal of boundary trees. It is recommended that consideration towards compensation should not be exclusively limited to boundary trees and that all tree removals be entitled to compensation;	Colville	Noted, compensation recommendations updated.
Consistent with Colville’s recommendation in the TPP, all boundary tree removals must be authorized by each owner prior to removal. It is recommended that written consent be provided prior to the removal of any boundary tree;	Colville	Addressed, requirement for written consent has been included.
The TPP recommends that any tree roots encountered outside of the tree protection (hoarding) area should be flush-cut to promote new growth. It is recommended that this work be completed with appropriate arboricultural tools and under the supervision of an arborist. If the root damage is extensive and determined to be critical, tree replacement should be discussed with Township;	Colville	Addressed, the recommendations have been updated to reflect tree replacement where extensive root loss occurs.
The TPP states that any required vegetation removal should be conducted in a manner to avoid impacts to nesting birds and wildlife that may be utilizing habitats on the Subject Property. It is recommended that tree removals be timed avoid the active bird season (April 1 – August 31) and bat active period, as stated above;	Colville	Noted. Timing of tree removal has been recommended between October 1st and May 31st to avoid active bird season and bats.
Numerous tree removals have been identified within Lots 11 and 12. As discussed above, these trees fall within the WODM5 community identified in the EIS, which should be considered Significant Woodland; and	Weston / Colville	The extent of the Significant Woodland on the property has been refined to coincide with vegetation communities that contain 60% or greater canopy cover. Portions of the WODM5 community have been excluded from the woodland, as these areas do not meet this standard. Clarification has been provided in the EIS.

The Draft Plan of Subdivision (Drawing D3.2), prepared by Weston Consulting shows the "edge of trees" as being well within Lot 12, however the woodlot dripline is shown as being outside the limit of development. It is presumed this is a related to inconsistencies in the identification of the Significant Woodland boundary, as discussed above, however clarification should be provided.	Weston/Colville	Site plans have been further updated. Further discussion in EIS.
Conclusion Based on our review of the EIS, TPP, and additional application materials, it is NRSI's position that additional steps must be taken to adequately address the natural heritage policies relevant to the proposed development, identify the fulsome extent of natural heritage features within and adjacent to the subject property, and effectively demonstrate that the proposed development will avoid negatively impacting these features. Recommendations have been described above to address these concerns and complete the EIS and TPP.	Colville	Noted and addressed through comment responses above and refinements to EIS and TPP.

4. Harden Environmental Services Ltd.
Stan Denhoed, P.Eng., M.Sc.

Comment	Consultant	Response
The hydrogeological study appears to be preliminary and should be updated to provide the following information. **Groundwater flow direction:** The groundwater elevations shown on Figure 8 suggests that groundwater is flowing northwesterly. Bronte Creek is located south of the site and is flowing in a southeasterly direction. Bronte Creek is located at a significantly lower elevation and is likely the local area of groundwater discharge. We recommend that additional water levels be obtained from the site given that only three water levels over the course of four weeks were obtained in the driest part of the year. We recommend that relative elevations of the groundwater monitors be accurately determined (with centimeter accuracy) and that the groundwater flow direction be reassessed or an explanation for the northerly flow direction explained. The additional groundwater levels will also provide valuable information relative to finished floor elevation of basements in	Terraprobe	We agree with the reviewer that the anticipated shallow groundwater flow direction is expected to follow topography and be directed to the south toward Bronte Creek and associated wetland areas. Monitoring wells were drilled on August 16, 2022, with subsequent groundwater monitoring over three dates in August and September. Groundwater conditions may not have adequately recovered to static conditions given the seasonal low groundwater conditions at the time of monitoring. Additional groundwater monitoring will be completed for the site, including seasonal high groundwater conditions to further assess shallow groundwater flow directions at the site. Geodetic ground surface elevations and horizontal coordinates (UTM) have been provided for each of the borehole locations within the completed borehole logs. The boreholes have

the spring of the year.		been surveyed for horizontal coordinates and geodetic elevations with a Trimble R10 Receiver connected to the Global Navigation Satellite System and the Can-Net Virtual Reference Station Network.
Groundwater Contribution to Bronte Creek: Bronte Creek is located downgradient of the site and is likely a zone of groundwater discharge. The natural heritage study and hydrogeological assessment should identify seepage/springs in the creek riparian zone to determine if there are any significant discharge areas that require protection.	Terraprobe	Field investigations completed to date have occurred in August/September 2022, at which time seasonal conditions did not indicate areas of significant groundwater discharge. Further field investigations will be completed to assess for the presence of groundwater seepage/spring during seasonal high groundwater conditions.
Site Plan Differences: The Terraprobe February 23, 2023 report has a different lot layout than that shown in the nitrate impact assessment prepared by Terraprobe on February 23, 2023. This should be corrected.	Terraprobe	Comment noted, the completed nitrate assessment and addendum materials have been prepared in accordance with the updated site plan. A revised hydrogeological investigation has not been issued at this time.
Shallow water quality was not assessed as part of this study. We recommend that the shallow water quality be assessed as part of the hydrogeology study. The shallow groundwater system will be the receiver of septic system effluent and existing impacts from farming and upgradient developments should be determined to inform an overall hydrogeological impact assessment on groundwater quality. The hydrogeological assessment should comment on improvements to or deterioration of shallow groundwater quality as a result of the proposed development and assess potential impact to Bronte Creek and the wetlands.	Terraprobe	Shallow groundwater sampling was completed as part of the nitrate loading impact assessment letter dated February 23, 2023 from three monitoring wells. Background nitrate concentrations were observed to range from 0.31 mg/L to 6.01 mg/L with a geometric mean of 1.68 mg/L. Background nitrate concentrations were factored into the completed nitrate impact assessment.
Water Supply: No water supply wells were installed and tested at this site. We are recommending that at least two water wells be installed and tested for water quality and to be tested for potential interference between existing wells in the Hamlet and new wells and between new wells within the development.	Terraprobe	Two test wells are to be installed as part of further investigations. Prior to the start of testing a private well survey will be completed to determine locations, construction details, and operational history of private domestic supply wells within a 250 m radius of the site. As part of the well survey permission to monitoring private domestic supply wells will be requested over the duration of well testing. Based on a review of well records we expect adequate

		groundwater (quality and quantity) will be available to support proposed residential uses.
Nitrate impact assessment: We are satisfied with the nitrate impact assessment that recommends nitrate reduction treatment in the effluent to less than 15 mg/L. The assessment does not address water quality impacts from the development on downgradient features such as wetlands or Bronte Creek.	Terraprobe	Nitrate impact to the identified wetlands and Bronte Creek were evaluated through the completion of a nitrate dilution assessment for the subject property (23,104 m^2), assuming an infiltration rate of 0.15 m/yr (silty sand), an impervious factor of 0.1, and nitrate concentrations of 15 mg/L from a total of 23 residential lots each with an annual sewage flow of 365 m^3 (1,000 L/day). The resultant increase in nitrate at the downgradient property boundary was calculated at 1.6 mg/L. Detailed calculations are provided as part of the addendum to the hydrogeological investigation.
Groundwater Discharge: The Colville Consulting report on Natural Heritage concludes the following. Based on our assessments, the majority of these wetland areas appear to occur on lower portions of the slopes and are sustained by groundwater. The hydrogeological assessment should comment on the potential for reduction of groundwater discharge to the wetlands and mitigation efforts made to reduce or eliminate this impact.	Terraprobe	The potential impact of site development on groundwater discharge was assessed through the completion of a water balance for the subject property. The results of water balance assessment are provided in the addendum to the hydrogeological investigation dated December 20, 2023. It is expected that through the maintenance of pre-development rates of infiltration across the developed property that potential impacts to surface water features potentially receiving groundwater discharge can be mitigated.
Groundwater Recharge Facilities: The Crozier and Associates Functional Servicing Report includes groundwater recharge facilities. The hydrogeological assessment should confirm that these facilities will maintain groundwater discharge to wetlands and Bronte Creek where it need to occur.	Terraprobe	As detailed under the completed FSR completed by Crozier Associates Inc. based on the expected design infiltration rate of 10 mm/hr end pipe infiltration features are not considered feasible. Lot level soakaway pits were recommended to accept and infiltrate roof runoff, with a recommended volume of 5.5 m^3. These measures have been implemented as part of the mitigated water balance assessment completed as part of the FSR to demonstrate re-development rates of infiltration are to be maintained following site development and as such, impacts for groundwater discharge to surface water features including Bronte Creek and associated wetland areas are not anticipated.

5. MTO
Jessica Pegelo - Corridor Management Planner

Comment	Consultant	Response
Site access & Traffic Impact Review MTO are in the process of reviewing the TIS and further comments will be provided. All access to the development shall be from the County and Municipal road network.	GHD	Acknowledged, awaiting comments.
Building and Land Use MTO requires all buildings, structures and features integral to the site to be located a minimum of 14 metres from the highway property limit, inclusive of landscaping features, fire-lanes, parking and storm water management facilities.	Weston	Acknowledged.
Storm Water Management MTO are in the process of reviewing the Functional Servicing and Preliminary Stormwater Management Report and further comments will be provided.	Crozier	Acknowledged, awaiting comments.
Signs Any/all signage visible from Highway 6, including temporary development signs, must conform to MTO policies and guidelines, and will require a valid MTO Sign Permit before installation.	N/A	Acknowledged.
Encroachments Any encroachments and proposed work within the Highway 6 property limits are subject to MTO conditions, approval and permits, prior to construction. All provincial highway property encroachments are strictly regulated and must meet all conditions set out by MTO.	N/A	Acknowledged.
Conditions of Draft Plan Approval It is anticipated that the following will be MTO's Conditions of Draft Plan Approval. Other Conditions may be required once MTO have reviewed the official circulation: 1. That prior to final approval, the Owner shall submit to the Ministry of Transportation	Owner	Acknowledged.

for their review and approval, a copy of a Stormwater Management Report indicating the intended treatment of the calculated stormwater runoff.		
2. That prior to final approval, the Owner shall submit to the Ministry of Transportation for their review and approval, a copy of a Traffic Impact Study.	Owner	Acknowledged.
3. That prior to final approval, the Owner shall enter into a legal agreement with the Ministry of Transportation whereby the owner agrees to assume financial responsibility for the design and construction of all highway improvements identified in the Ministry of Transportation approved Traffic Impact Study.	Owner	Acknowledged.
4. That prior to final approval, the Owner shall submit a Grading Plan, Drainage Plan and Site Servicing Plan for MTO review and approval.	Owner	Acknowledged.
5. That prior to final approval, the Owner shall submit to the Ministry of Transportation for review and approval, a draft copy of the M-Plan for the subdivision.	Owner	Acknowledged.
6. That prior to final approval the Owner will submit to the Ministry of Transportation for review and approval, a draft copy of the Subdivision Agreement.	Owner	Acknowledged.
MTO reserve the right to request additional conditions.	Owner	Acknowledged.
Notes to Draft Plan Approval The owner should be made aware that under the Public Transportation and Highway Improvement Act, Ministry Building and Land Use permits are required for all new developments located within 45m of our highway property line and located within 395m of a provincial highway intersection.	Owner	Acknowledged.

6. Town of Puslinch Fire Department Brent Smith		
Comment	**Consultant**	**Response**
Provide an adequate water supply for firefighting purposes.	Crozier	Acknowledged. A fire storage cistern is proposed at the intersection of Ochs Street and Street 'B'.

7. Township of Puslinch Building Department Andrew Hartholt		
Comment	**Consultant**	**Response**
I have no comments at this stage of the application. The lots appear larger enough to accommodate a private sewage system and well as currently shown.	N/A	Acknowledged.

8. Township of Puslinch Public Works Mike Fowler		
Comment	**Consultant**	**Response**
1# Has the developer considered using the unopened road allowance to access Queen Street?	Weston	The unopened road allowance would bisect and fragment the existing wetland. The alternative is to utilize Ochs Street as the main access and propose one lot terminating at Main Street.
2# Main Street is identified as the main access route. At this time, this road section will require upgrading as it is not a full 7 metre platform which meets the Township standards for subdivision accesses and main traffic flow.	Crozier/GHD	Main Street is not the main access route. Ochs Street will be the main access route for the proposed development. Please refer to the External Grading Plan (Figure 5) which outlines the proposed urbanization and alignment of Ochs Street per Township Standards.
3# Is the consideration for the Back street access to be utilized as well? Again, this section of road would require updating as well.	Weston	The main access will be to Och Street to limit thoroughfare in the neighbourhood, however; Back Street is to be utilized as emergency access.

9. Township of Puslinch By-law Jacob Normore		
Comment	**Consultant**	**Response**
No comments or concerns at this time.	N/A	Acknowledged.

10. Source Water		
Comment	**Consultant**	**Response**
Since this property is not located in a vulnerable area (wellhead protection area, issues contributing area, intake protection zone etc.), the application can be screened out and it does not require a Section 59 notice under the Clean Water Act.	N/A	Acknowledged.

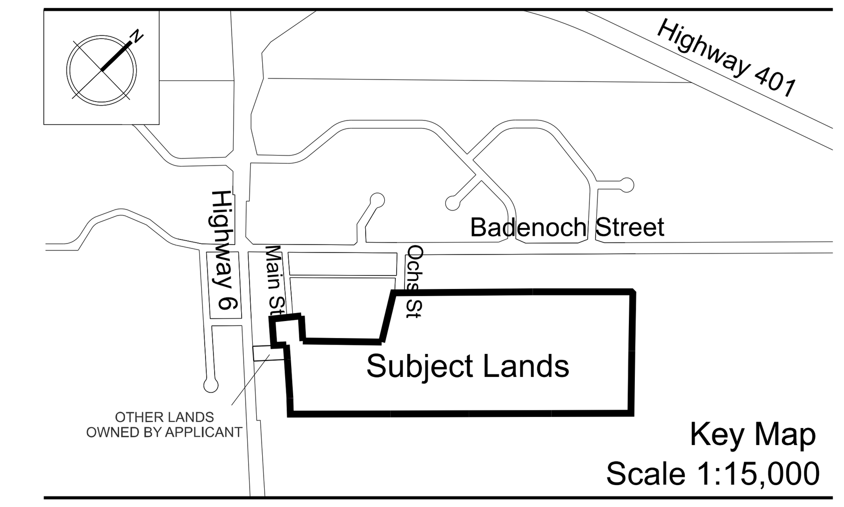
11. Halton Conservation		
Comment	**Consultant**	**Response**
The submission contains the majority of the information requested at the January 2022 Preconsultation (email correspondence from Ola Panczyk dated January 27, 2022) with the exception of the following documents/reports: • Delineation of all regulated features and hazards on a topographic survey prepared by an Ontario Land Surveyor, to the satisfaction of CH • Hydrologic and Hydraulic analysis prepared by qualified professional engineer • Hydrologic evaluation including feature-based water balance considering surface and groundwater	Colville Crozier	Crozier met with CH staff to confirm a Hydrologic and Hydraulic analysis is not required for the development based on proximity to the watercourse and the existing CH hydraulic modelling. See correspondence in Appendix E of the Functional Servicing and Preliminary Stormwater Management Report. Information on the water balance approach is provided in the Functional Servicing and Preliminary Stormwater Management Report.
The documents/report listed above will need to be submitted to support the ZBA application and the associated Subdivision Application (which has not been circulated	N/A	Acknowledged.

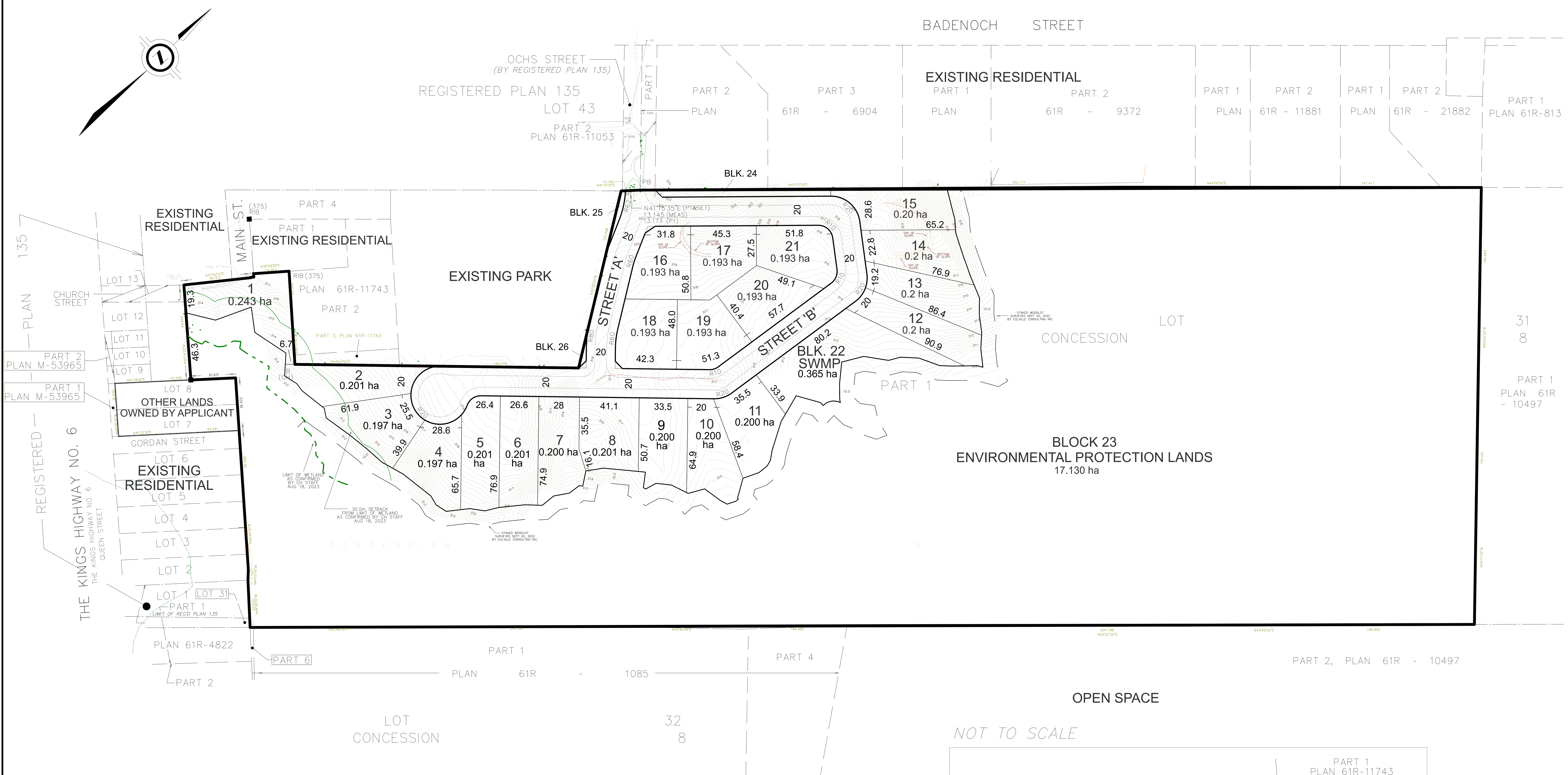
by the County of Wellington).		

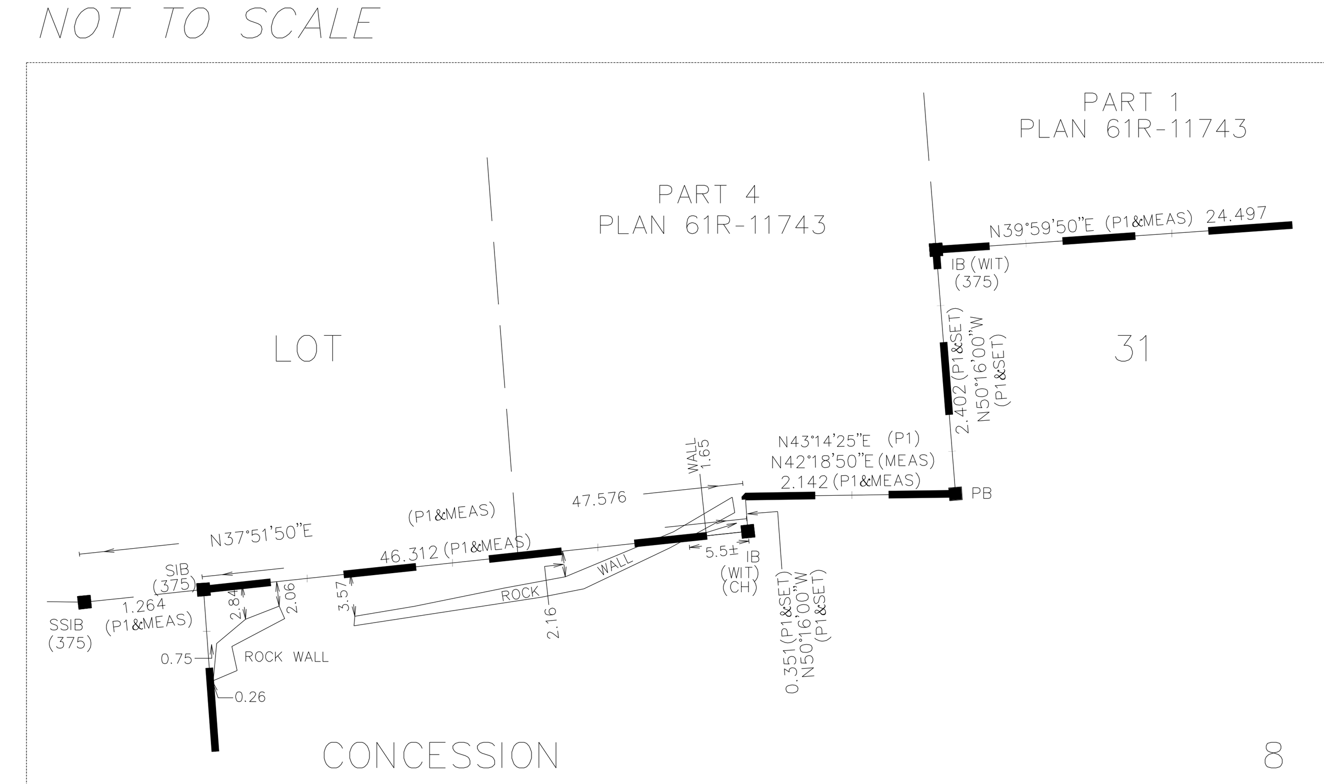
DRAFT PLAN OF SUBDIVISION

PART OF LOTS 7 & 8
NORTH OF QUEEN STREET
REGISTERED PLAN 135

AND PART OF LOT 31
CONCESSION 8
TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON







INTEGRATION DATA		
OBSERVED REFERENCE POINTS (ORPs): UTM ZONE 17, NAD83 (CSRS) (2010.0).		
COORDINATES TO URBAN ACCURACY PER SECTION 14 (2) OF O.REG 216/10.		
POINT ID	EASTING	NORTHING
ORP A	571 819.11	4 810 772.76
ORP B	572 189.46	4 811 593.30
COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.		

THE RESULTANT TIE BETWEEN ORP A AND ORP B IS 900.588 N24°17'31"E

OWNER'S CERTIFICATE:

I authorize Weston Consulting Group Inc. to prepare and submit this plan for draft approval.

Date: ____________

WDD MAIN STREET Inc. c/o FAISAL HAMADI
499 BRANT STREET
BURLINGTON, ONTARIO L7R 2G5
PHONE: 905-483-7399
info@wddinternational.com

SURVEYOR'S CERTIFICATE:

I hereby certify that the boundaries of the lands being subdivided and their correct relationship to the adjacent lands are accurately and correctly shown on this plan.

Date: ____________

RAYMOND J. SIBTHORP, OLS
J.D. BARNES LIMITED
257 WOODLAWN ROAD WEST, UNIT 101
GUELPH, ONTARIO N1H 8J1
PHONE: (519) 822-4031 www.jdarnes.com

ADDITIONAL INFORMATION:

[Section 51(17) of the Planning Act, R.S.O. 1990, c. P.13], as amended to December 01, 2023.
a), b), e), f), g), j) & l) - on plan.
c) - on key plan
d) - see statistics
h) - piped water to be installed by developer
i) - silty sand, sand and silt, and clayey silt
k) - all services to be made available by developer

DEVELOPMENT STATISTICS:

LOTS/BLOCKS	LOTS	AREA
Single Detached Lots (20 m+) [Lots 1-21]:	21	4.204 ha
SWMP [Blk. 22]:		0.365 ha
Environmental Protection Lands [Blk 23]:		17.130 ha
Additional lands [Blk. 24-26]:		0.076 ha
Roads:		1.329 ha
Total:	21	23.104 ha

SCALE

0 80m

WESTON CONSULTING

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T. 905.738.8080 F. 905.738.6637

Toronto: 268 Berkeley St.
Toronto, Ontario M5A 2X1
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REVISIONS LIST

20 DEC 2023	Revise cul-de-sac to R=20 m & lots 3-5.
03 OCT 2023	Remove wetland limits by Colville Sept 20, 2022. Remove original edge of trees & staked limit. Insert Staked Woodlot Surveyed Sept 20, 2022 by Colville Consulting Inc.
20 SEP 2023	Remove old treeline, Regulated Limits. Update using 2023-09-11 topo file
15 SEP 2023	Revise ROW width to 20m & revert back to north-east access
11 APR 2023	Revise per updated survey plan & survey text
23 FEB 2023	Revise per topo plan
14 DEC 2022	Revise St. B per grading plan (Crozier) & revise Lots 17-23
11 NOV 2022	Revise ROW width to 18 metres & design lots (min 0.2 ha)
20 OCT 2022	Update drawing using 2022-10-12 survey

File Number:	10779
Drawn By:	SM
Planner:	PT
Scale:	1:1500
CAD:	10040 Draft Plan D9 2023-12-20.dgn

Drawing Number: D9

Township of Puslinch
Planning and Development
7404 Wellington Road 34,
Puslinch, ON
N0B 2J0

December 21, 2023
File: 10779

Attn: Lynne Banks, Development and Legislative Coordinator, Township of Puslinch

Re: Planning Justification Addendum
Zoning Amendment and Draft Plan of Subdivision
11 Main Street, Morriston
Township of Puslinch

Weston Consulting is the planning consultant for WDD Main Street Inc., the registered owner of the lands located at 11 Main Street (Lot 31, Concession 8) in the Township of Puslinch (herein referred to as the "subject lands").

Description of Subject Lands

The subject lands are currently a vacant lot located southeast of the Main Street and Badenoch Street intersection in Morriston. The subject lands are surrounded by open spaces to the east, and south, and single-detached dwellings to the north and west. The subject lands have an approximate area of 23.48 hectares (58.03 acres) and an approximate frontage of 12 metres at the terminus of Main Street and 20 metres at the current terminus of Ochs Street.

Description of the Proposed Development

The proposed development includes a residential subdivision consisting of single-detached lots. The proposed development consists of 23 lots of approximately 0.2 hectare each and two public streets (Street A and B) with 20-metre right-of-ways which provide access to the site and future dwellings.

As per the County of Wellington comments, it was suggested that a review and analysis of PPS Section 2.1 and 2.2 be undertaken. Below is a review of relevant guidelines as it pertains to the proposed development:

2.1 Natural Heritage

2.1.1 Natural features and areas shall be protected for the long term.

2.1.2 The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.

2.1.3 Natural heritage systems shall be identified in Ecoregions 6E & 7E1, recognizing that natural heritage systems will vary in size and form in settlement areas, rural areas, and prime agricultural areas.

2.1.4 Development and site alteration shall not be permitted in:
a) significant wetlands in Ecoregions 5E, 6E and 7E1; and
b) significant coastal wetlands.

2.1.5 Development and site alteration shall not be permitted in:
a) significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E1;
b) significant woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)1;
c) significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)1;
d) significant wildlife habitat;
e) significant areas of natural and scientific interest; and
f) coastal wetlands in Ecoregions 5E, 6E and 7E1 that are not subject to policy 2.1.4(b)

unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

2.1.6 Development and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements.

2.1.7 Development and site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements.

2.1.8 Development and site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.4, 2.1.5, and 2.1.6 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

2.1.9 Nothing in policy 2.1 is intended to limit the ability of agricultural uses to continue.

The subject lands contain a woodland and a wetland, both of which are proposed to be conserved. A buffer of 15.0 metres has been provided to the wetland and a buffer of 10.0 metres has been provided for the woodland.

The natural features and associated buffers will be protected via conveyance to the Township and with the rezoning of this portion of the subject lands to "Natural Environment" and the "Environmental Protection" overlay.

An Environmental Impact Study has been prepared which provides details regarding the features and buffers and concludes that the proposed subdivision is not expected to have a negative impact on the natural areas.

2.2 Water

2.2.1 Planning authorities shall protect, improve or restore the quality and quantity of water by:
a) using the watershed as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development;
b) minimizing potential negative impacts, including cross-jurisdictional and cross-watershed impacts;
c) evaluating and preparing for the impacts of a changing climate to water resource systems at the watershed level;

d) identifying water resource systems consisting of ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed;

e) maintaining linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas;

f) implementing necessary restrictions on development and site alteration to:

1. protect all municipal drinking water supplies and designated vulnerable areas; and
2. protect, improve or restore vulnerable surface and ground water, sensitive surface water features and sensitive ground water features, and their hydrologic functions;

g) planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality;

h) ensuring consideration of environmental lake capacity, where applicable; and

i) ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.

2.2.2 Development and site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored. Mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore sensitive surface water features, sensitive ground water features, and their hydrologic functions.

The subject lands consist of proposed lots that are appropriately sized to accommodate private water and wastewater services (well and septic) as municipal services are not available. The proposal will maintain a safe level of drinking water and the water servicing needs for the proposed development will be provided via private drilled drinking water wells. The depth, size, and locations of the wells will be determined during the detailed design of each individual lot. It should be noted that the groundwater in the area is mostly used by privately drilled groundwater wells. Two test wells are to be installed as part of further investigations.

Prior to the start of testing a private well survey will be completed to determine locations, construction details, and operational history of private domestic supply wells within a 250 m radius of the site. As part of the well survey permission to monitoring private domestic supply wells will be requested over the duration of well testing. Based on a review of well records we expect adequate groundwater (quality and quantity) will be available to support proposed residential uses.

Privately owned individual on-site sewage systems are proposed for this development. This servicing approach is consistent with the greater community and is suitable for rural estate subdivisions. Privately owned sewage systems are owned and operated by the property owner and there is no requirement for additional maintenance or review from the municipality. It is our opinion that the proposal is consistent with the PPS and we trust that the above is sufficient in addressing the above-noted comment.

Should you have any questions please contact the undersigned at ext. 290 or Mina Rahimi at ext. 339.

Yours truly,
Weston Consulting
Per:

[redacted]

Paul Tobia, BURPl, MCIP, RPP
Senior Planner

c. WDD Main Street Inc.

December 21, 2023

Project No. A1220482.002
Brampton Office

Weston Consulting
2060 Lakeshore Road, Unit 301
Burlington, ON
N0B 2C0

Attention: Ms. Mina Rahimi

**RE: ADDENDUM - HYDROGOLOGICAL ASSESSMENT
PROPOSED RESIDENTIAL DEVELOPMENT
11 MAIN STREET
PUSLINCH, ONTARIO**

Dear Ms. Rahimi:

This addendum provides additional information to the report titled *"Hydrogeological Assessment, Proposed Residential Development, 11 Main Street, Puslinch Ontario"* dated February 23, 2023, completed by Terraprobe (File No 1-22-0482-46) regarding an impact assessment for natural areas including Bronte Creek and associated wetland areas, situated immediately southwest of the above noted subject property. The assessment considered potential impacts to shallow groundwater quality due to septic effluent, and shallow groundwater quantity through infiltration following site development.

Groundwater Quality Impacts

A nitrate impact assessment was previously completed for the property as detailed within the letter report titled *"Nitrate Loading Impact Assessment, Proposed Residential Development, 11 Main Street, Puslinch, Ontario"* dated February 23, 2023, completed by Terraprobe (File No. T122482.002). The impact assessment provided the results of shallow groundwater quality analysis and interpreted background nitrate concentrations, of 1.68 mg/L, and nitrate dilution calculations on a single lot basis. The results of assessment indicated that advanced tertiary treatment systems capable of nitrate reduction from standard concentrations of nitrate in effluent at 40 mg/L to target concentrations of 15 mg/L would be required.

It was requested as part of the peer review of the Hydrogeological Assessment and Nitrate Loading Impact Assessment that potential impacts to surface water features including Bronte Creek and associated wetlands be considered. To consider the impacts of the proposed residential development to identified surface water features the nitrate impact of the developed property was considered to assess the expected nitrate increase at the downgradient property boundary, and the potential increase in nitrate concentrations in shallow groundwater potentially discharging to surface water.

The following provides a summary of variables considered as part of the nitrate impact assessment for the subject property:

- Site Area (A) of 23,104 m^2
- Impervious factor (F) of 0.1 following site development
- Infiltration rate (I) of 0.15 m/yr (silt and sand soils)
- Development consisting of 23 residential lots (n)
- Daily sewage flows (Q) of 1,000 L/day per lot (365 m^3/yr/lot)
- Nitrate concentrations of 15 mg/L

Nitrate impacts for the subject property were calculated based on the following approach:

$$\textbf{NO3 Increase} = \frac{(Q) \times (n) \times (15\ mg/L)}{[(A) \times (1-(F)) \times (I)] + [(n) \times (Q)]}$$

Based on the above noted approach and considered variables, the expected nitrate increase at the downgradient property boundary was calculated at 1.6 mg/L. Based on the above calculations it is expected that through the use advanced tertiary treatment systems that impacts to shallow groundwater quality can be mitigated.

Water Balance Assessment

A water balance assessment was completed as part of the report *"Functional Servicing & Preliminary Stormwater Management Report, 11 Main Street, Estate Residential Development, Township of Puslinch, County of Wellington"*, dated December 2023, completed by Crozier & Associates Inc. (File No. 2366-6537). The detailed water balance summary is provided in Appendix D of the above noted Functional

Servicing report, climate information used in assessing the water balance can be summarized as follows:

- Precipitation 902 mm/yr
- Evapotranspiration 572 mm/yr
- Infiltration 134 mm/yr
- Runoff 201 mm/yr

The following table provides a summary of the calculated pre-development and post-development, both with and without mitigation water balance:

	Precipitation (m^3/yr)	**Evapotranspiration (m^3/yr)**	**Infiltration (m^3/yr)**	**Runoff (m^3/yr)**
Pre-Development	54,304	34,224	8,032	12,048
Post-Development (Without Mitigation)	54,304	23,558	4,365	26,381
Post-Development (With Mitigation)	54,304	23,558	8,051	22,695

Following development, it is expected that an unmitigated post-development infiltration deficit of 3,667 m^3 would result from site development, through the increase of impervious cover across the developable area. Shallow rates of hydraulic conductivity were assessed by Terraprobe as part of the Hydrogeological Assessment at rates of approximately 1.2×10^{-6} m/s, with a design infiltration rate of 10 mm/hr. Based on the design infiltration rate end pipe infiltration features are not considered feasible as part of the noted Functional Servicing report. Lot level soakaway pits were recommended to accept and infiltrate roof runoff, with a recommended volume of 5.5 m^3. Soakaway pits would be designed to accept runoff from rooftops for infiltration to the shallow subgrade. Through the implementation of lot level soakaway pit it is anticipated that an additional volume of 3,686 m^3 per year would be directed to infiltration, and pre-development rates of infiltration would be maintained flowing development.

Provided pre-development rates of infiltration are maintained following site development it is expected that potential groundwater discharge to surface water features, including Bronte Creek and associated wetland areas would be maintained following development. Through the implementation of advanced tertiary treatment systems, and lot level soakaway pits for proposed residential lots it is expected that potential impacts to Bronte Creek and associated wetlands area can be mitigated following site development.

We trust this information is sufficient for your present purposes. Should you have any questions concerning the above, please do not hesitate to contact the undersigned.

Yours truly,
Terraprobe Inc.

[redacted]

Paul L. Raepple, P.Geo.
Senior Hydrogeologist/Project Manager

Brampton Office

ENVIRONMENTAL IMPACT STUDY
11 MAIN STREET, MORRISTON, TOWNSHIP OF PUSLINCH

Prepared for:

WDD International
499 Brant Street
Burlington, ON
L7R 2G5

Prepared by:

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File No.: C22059
Date: December 2023

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1.0 INTRODUCTION

Colville Consulting Inc. was retained by WDD International to prepare an Environmental Impact Study (EIS) for a development proposed on the property located at 11 Main Street, in the Village of Morriston, Wellington County, hereafter referred to as the Subject Property. This EIS has been prepared to delineate the extent of natural heritage features on the Subject Property and assess the potential impacts of development on natural heritage features on and adjacent to the Subject Property.

This study has been requested by the County of Wellington and the Halton Region Conservation Authority (HRCA) to assess the extent of potential natural heritage features on and adjacent to the Subject Property, as well as assess potential impacts associated with a proposed development. This EIS has been prepared to assess potential impacts the proposed development may have on natural heritage features located on and adjacent to the Subject Property and provide mitigation measures to avoid or minimize any potential impacts. A summary of our assessment is included below.

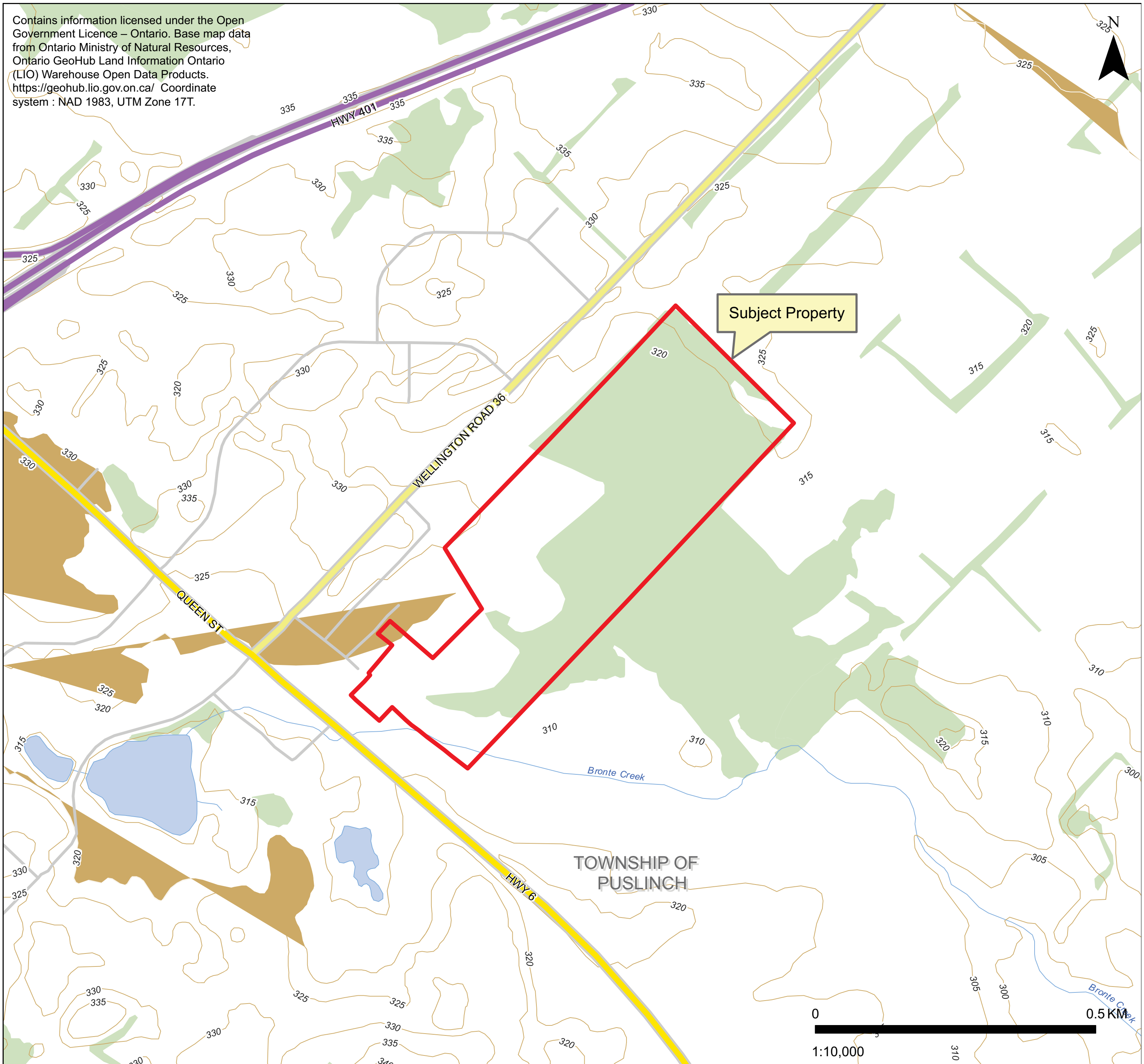
1.1 Description of Subject Property

The Subject Property measures approximately 23.1 ha (57.1 acres) in size and is generally located southeast of the intersection of Highway 6 and Badenoch Street in Morriston, Township of Puslinch (see Figure 1). There are no existing buildings or structures on the Subject Property and current land use consists of a mix of cultivated lands and natural heritage features. There is a significant amount of topographical variability throughout the Subject Property, with undulating topography resulting in upwards of 10 metres or more in elevation change across the property. Surface drainage on the west side of the property is generally directed towards a tributary of Bronte Creek, which runs along the western portion of the property. The remainder of surface drainage on the property is directed to the southeast towards minor drainages within the woodland feature.

Based on our review of background mapping, it is our understanding that mapped natural heritage features on the property consist of non-provincially significant and unevaluated wetlands, significant woodlands, and watercourses. Wetland features and hazard lands associated with the watercourse are designated “Core Greenlands” in the Wellington County Official Plan Schedule A7-2. The significant woodland on the Subject Property has been designated as “Greenlands” in the County of Wellington Official Plan due to size (over 1 hectare).

Two watercourses on the Subject Property have been identified as lands regulated by HRCA. One regulated watercourse is a tributary of Bronte Creek that bisects the southwestern corner of the Subject Property, and the other is an unnamed watercourse in the woodland feature on the central portion of the property. The extent of mapped natural heritage features on and adjacent to the Subject Property are illustrated in Figure 2.

As mapping indicates that natural heritage features are located on and adjacent to the Subject Property, any development within or adjacent to these features will be subject to environmental policies of wellington County, as well as policies of the HRCA. These policies generally require that proposed development demonstrate no negative impacts on the natural heritage features or their ecological functions.



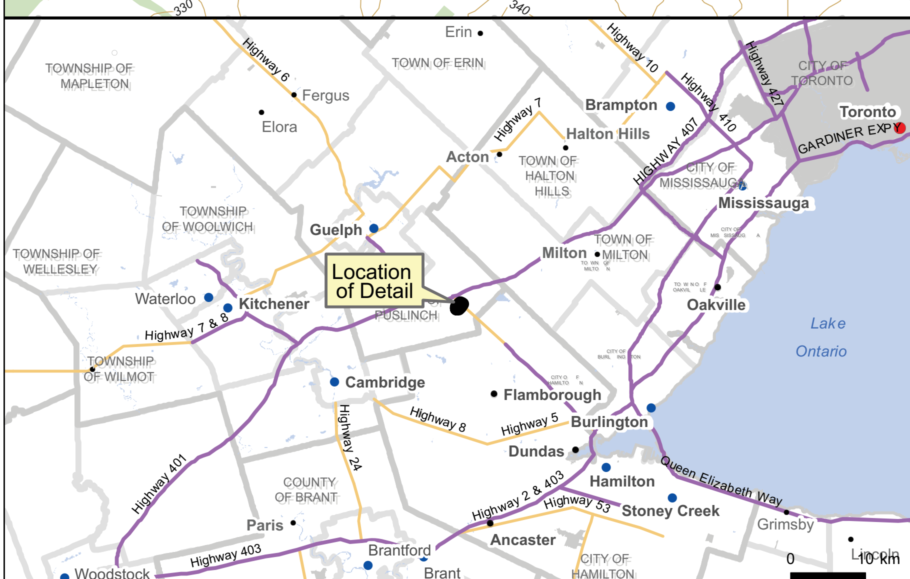


Figure 1
Location of Subject Property

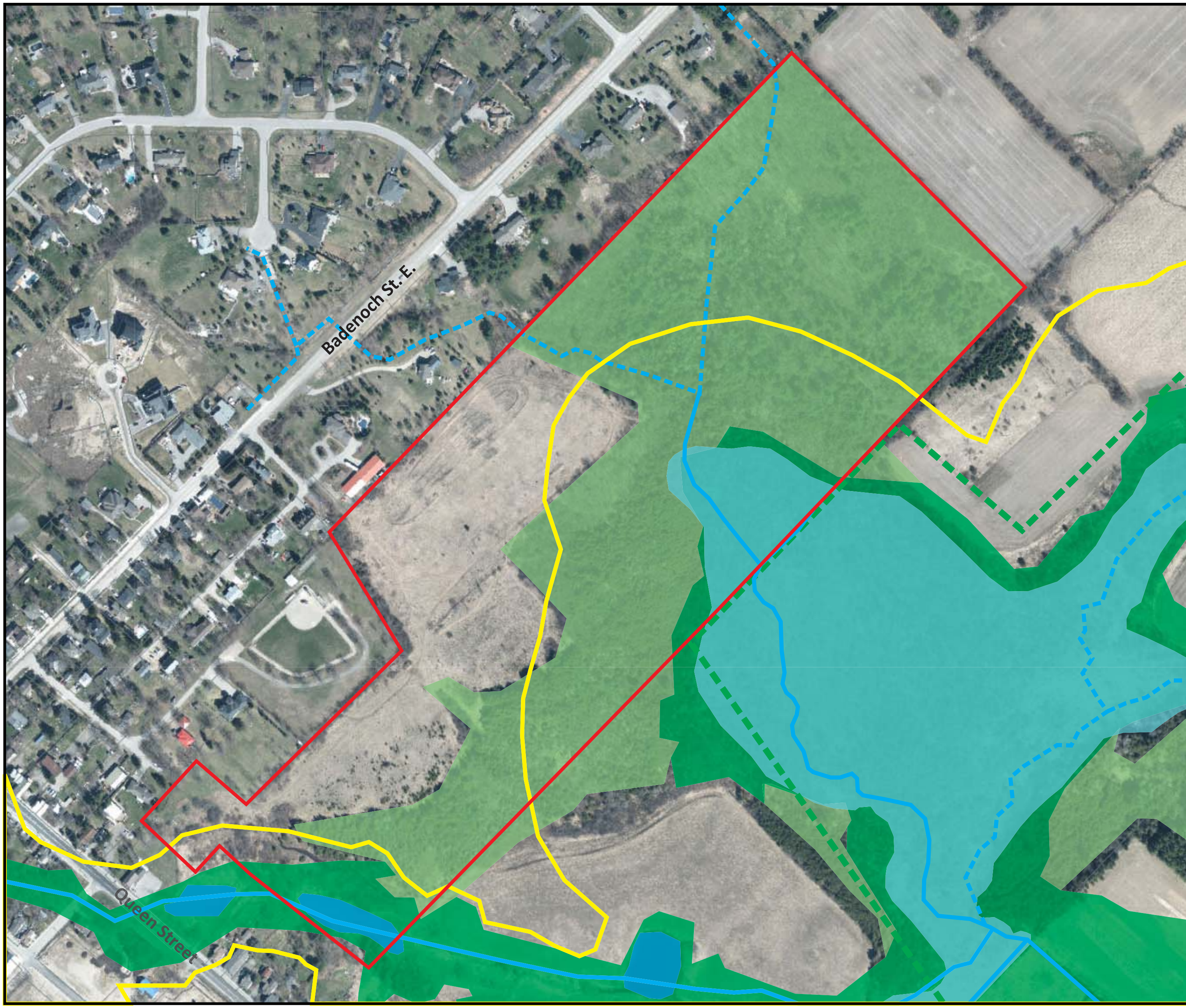
Environmental Impact Study for
11 Main Street, Morriston

Prepared for: WDD International

Prepared by: Colville Consulting Inc.

DATE: December 2023

FILE: C22059



Legend

Subject Property

Greenbelt Mapping

Natural Heritage System

MNRF Mapping

Non-Provincially Significant Wetland

Unevaluated Wetland

County of Wellington Official Plan Schedule A7-2

Core Greenlands

Greenlands

Halton Region Conservation Authority Mapping

Conservation Halton Regulated Lands

Regulated Watercourses

Non-Regulated Watercourses

Figure 2
Extent of Natural Heritage Features on the Subject Property

Environmental Impact Study for 11 Main Street, Morriston

Prepared for: **WDD International**

Prepared by: COLVILLE CONSULTING INC.

DATE: December 2023

FILE: C22059

1.2 Description of Proposed Development

It is our understanding that the proposed development includes 21 single detached lots along the northwestern portion of the Subject Property. All proposed residential lots are approximately 0.20ha in size and will front onto new streets to be constructed as part of the development. Development adjacent to the Subject Property will also include the extension of an existing street (Ochs Street) along the northern boundary of the Subject Property to provide access to the property.

To facilitate this proposed development, we understand that a Plan of Subdivision is required by the County of Wellington, and a zoning By-Law amendments is required by the Township of Puslinch. The approximate extent of the proposed development is illustrated in Appendix A.

2.0 ENVIRONMENTAL POLICY

2.1 Provincial Policy Statement

Land Use Policy and development in the province of Ontario is directed by the PPS, which was issued under the authority of Section 3 of the Planning Act and came into effect on May 1, 2020, replacing the PPS issued April 30, 2014. It states that decisions affecting planning matters "shall be consistent with" policy statements issued under the Act. This EIS has been prepared in compliance with Part V, Policy 2.1 of the PPS, which deals specifically with the long-term protection and management of natural heritage features and areas.

The intent of the PPS is to ensure that natural features and areas be protected for the long term. The PPS indicates that diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.

Natural heritage features and areas are defined in the PPS as those which are important for their environmental and social values as a legacy of the natural landscapes of an area and include: significant wetlands, significant coastal wetlands, fish habitat, significant woodlands south and east of the Canadian Shield, significant valleylands south and east of the Canadian Shield, significant habitat of endangered species and threatened species, significant wildlife habitat and significant areas of natural and scientific interest.

Unless it can be demonstrated that there will be no negative impacts on the natural heritage features or their ecological functions, development and site alteration is not permitted in or adjacent to:

- significant woodlands and valleylands south and east of the Canadian Shield;
- significant wildlife habitat;
- significant fish habitat; and
- significant areas of natural and scientific interest.

Furthermore, development and site alteration shall not be permitted on adjacent lands to the natural heritage features identified above, unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

2.2 Greenbelt Plan

The Greenbelt Plan was first introduced in 2005 to help shape the future of the Greater Golden Horseshoe. It was most recently updated in 2017 and continues to build on the PPS to establish land use planning framework for environmental and agricultural protection. The Subject Property is designated as Settlement Area within the Greenbelt Plan and mapped as "Towns/Villages" in Schedule 1: Greenbelt Area of the Greenbelt Plan.

The intent of this designation as it pertains to development is outlined in Section 3.4.1 and states the following:

> "Towns/Villages have the largest concentrations of population, employment and development within the Protected Countryside and tend to be the central settlement area(s) for their respective municipalities. Although most have full municipal water and sewer services, some only have a municipal water service and/or a combination of private and municipal water services. Towns/Villages are the focus of development and related economic and social activity."

The Greenbelt Plan also includes a Natural Heritage System. Section 3.2.1 defines the system as "…a continuous and permanent land base necessary to support human and ecological health in the Greenbelt and beyond". No portion of the Subject Property is mapped within the Natural Heritage System.

2.3 County of Wellington Official Plan

The County of Wellington Official Plan (2022) is intended to give direction to the physical development of the County, its local municipalities and to the long-term protection of County resources. To help achieve this goal and protect the natural heritage system within the County, a Greenlands System was developed. The Greenland System is illustrated in Schedule A of the Official Plan. Schedule A7-2 shows the community of Morriston and the Subject Property which are designated as a mix of Residential, Core Greenlands, and Greenlands.

The intent of the Greenland System as defined in Section 5.1 of the Official Plan is "to include those features and areas which are part of Wellington's natural heritage or areas in which natural or human-made conditions may pose a threat to public safety". These areas include, but are not limited to wetlands, environmentally sensitive areas, streams, waterbodies, woodlands, fish and wildlife habitat, and threatened and endangered species. The Greenland is divided into two broad categories, Core Greenlands and Greenlands.

Section 5.4 of the Official Plan outlines that policies surround Core Greenlands and the areas within them, which include areas that have a greater sensitivity or significance. These areas include provincially significant wetlands, all other wetlands, habitat of endangered or threatened species and fish habitat, and hazardous lands.

Section 5.5 discusses the other component of the Greenland System, Greenlands. Lands designated as Greenlands include the following as:

> "Other significant natural heritage features including habitat, areas of natural and scientific interest, streams and valleylands, woodlands, environmentally sensitive areas, ponds, lakes and reservoirs and natural links are also intended to be afforded protection from development or site alteration which would have negative impacts
>
> These areas are often found within Core Greenlands. Where they are outside Core Greenlands they are identified as Greenlands.".

Policy related to development within and adjacent to the Greenland System is discussed in Section 5.6 Impacts associated with development and when it is permitted in the Core Greenlands and Greenlands are elaborated on further in Section 5.6.2 which states:

> "Where development is proposed in the Greenland system or on adjacent lands, the County or local municipality shall require the developer to:
>
> > a) identify the nature of the features potentially impacted by the development;
> >
> > b) prepare, where required, an environmental impact assessment to ensure that the requirements of this Plan will be met, and consider enhancement of the natural area where appropriate and reasonable.
> >
> > c) address any other relevant requirements set out in Section 4.6.3 Environmental Impact Assessment.
>
> No development will be approved unless the County is satisfied that the Greenland and Environmental Impact Assessment policies are met."

As per Section 5.6.2.c above, Section 4.6.3 is defined the following:

> "Environmental impact assessments prepared by a qualified person may be required to evaluate the impacts a proposed development may have on the natural environment and the means by which negative impacts may be reduced or eliminated..."

This Environmental Impact Assessment has been prepared to satisfy the requirements of Section 4.6.3.

2.4 Halton Region Conservation Authority

The Halton Region Conservation Authority (HRCA) is responsible for the administration of Ontario Regulation 162/06, which provides the HRCA jurisdiction to regulate development activities within and adjacent to flood and erosion hazards, valleys, watercourses and wetlands. The guiding principle of this regulation is to ensure any development works proposed within regulated areas will have no adverse impact on flooding, erosion, pollution, dynamic beaches and the conservation of land.

In order to administer Ontario Regulation 162/06, the HRCA has created a document titled *Conservation Halton Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document (HRCA, 2020)*. The purpose of the document is to provide guidance for development applications that are located within and adjacent to regulated areas.

Regulated features on the Subject Property include a tributary of Bronte Creek and the associated floodplain, an unnamed watercourse, non-provincially significant wetlands, and unevaluated wetlands as identified by the Ministry of Natural Resources and Forestry (MNRF). The non-provincially significant wetland on the property is the northwest portion of the East Morriston Swamp Wetland Complex that extends southeast of the Subject Property. The unevaluated wetland on the Subject Property is associated with the riparian area along the north side of the tributary of Bronte Creek and is located on the southern edge of the Subject Property

HRCA policies related to the management of wetland and watercourses are contained in Section 2 and 3 of the policy document and include a series of policies that are intended to protect the hydrological and ecological function of these features.

Section 2.1 forms part of the guiding principles for the Policy. It states: "Except where allowed under Policies 2.4 – 2.50 (inclusive), development is prohibited within a watercourse, valleyland, hazardous lands, wetland…" No development on the property is proposed to occur within a watercourse, valleyland, hazardous lands, or wetlands.

Section 2.39.3 states that "Except as provided for in Policies 2.39.1 and 2.39.2, no new development is permitted within 30 metres of a Provincially Significant Wetland or a wetland greater than or equal to 2 hectares in size." Wetlands less than 2 hectares in size Section 2.40.5 states the following:

> "Any uses, other than those outlined in Policy 2.40.4, proposed within 15 metres to 30 metres of a wetland less than 2 hectares in size, will require a Permit pursuant to Ontario Regulation 162/06 and will need to be supported by a hydrological evaluation, prepared by professional hydrological and hydrogeological engineers (or qualified hydrogeologist), that meets the requirements outlined in Section 5".

3.0 STUDY APPROACH

3.1 Background Review

Prior to the commencement of primary field inventories, a review of background material available for the Subject Property and surrounding area was conducted. Some of the background information reviewed included:

- County of Wellington Official Plan (2022);
- Background data and mapping available from the Ministry of Natural Resources and Forestry (MNRF) and Conservation Halton;
- Conservation Halton Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document (HRCA, 2020);
- A search for information on rare, Threatened and Endangered species available through the Natural Heritage Information Centre (NHIC);
- Ontario Reptile and Amphibian Atlas, 2009-2019 (Ontario Nature 2023);
- Ontario Breeding Bird Atlas (OBBN); and
- Natural Heritage Evaluation, 97 Queen Street, Morriston, Wellington County (Beacon Environmental Limited (2023).

3.2 Field Inventories

In order to identify potential natural heritage constraints on the property, Colville Consulting Inc. conducted the following inventories:

- Three season botanical inventory of the property, with the inventories conducted in summer and fall of 2022 and spring of 2023;
- Ecological Land Classification description of vegetation communities on the Subject Property;
- Breeding bird surveys on and adjacent to the Subject Property;
- An assessment of the watercourse feature on the southwest side of the property;
- An assessment of potential bat maternal roost trees and installation of acoustic monitors;
- Hand searches for reptiles that may be using the property;
- Amphibian call surveys; and
- Document incidental wildlife observations during site visits, including any species of insects that may be considered locally rare or species at risk.

4.0 STUDY FINDINGS

4.1 Botanical Inventories and Vegetation Mapping

Botanical inventories of the Subject Property were conducted on August 10, September 24 and 26, 2022 and June 10, 2023. Vegetation communities (ELC Units – Lee et al. 1998) were mapped and described (Figure 3). A vascular plant checklist is provided in Appendix B and ELC data cards are provided in Appendix C. Species status was assessed for Ontario (Oldham and Brinker, 2009) and Wellington County (Frank and Anderson 2009. Site photos illustrating the vegetation conditions on the Subject Property are included in Appendix D.

4.1.1 Botanical Inventory

Two hundred (200) plant species were documented during our inventories (Appendix B). Of the 200 species observed, one species is listed as Endangered (Butternut), one is listed as provincially rare (Honey Locust), and three are ranked as locally rare (Butterfly Weed, Heart-leaved Aster, and Rough-leaved Goldenrod).

One triple stemmed Butternut tree was documented adjacent to the western edge of the property during inventories. An assessment of this tree was conducted twice during the 2023 leaf-on season and it was determined that this tree exhibited external characteristics typical of Butternut hybrids. Because of the location of this tree off-property and visible hybrid characteristics, no further genetic assessment was conducted to determine purity.

One provincially rare plant, Honey Locust (S2?), was documented on the Subject Property. A single Honey Locust sapling is located within the hedgerow, along the edge of the baseball diamond. Based on site characteristics, it is highly probable that this specimen was either planted or escaped and represents an introduced individual.

Three locally rare species (Butterfly Weed, Heart-leaved Aster, and Rough-leaved Goldenrod) were observed. The Butterfly Weed was observed near the treed hedge-row at the foot of Ochs Road and was likely introduced or escaped from a residential garden. Heart-leaved Aster was found in low numbers in the successional woodland adjacent to the eastern edge of the old field meadow. The Rough-leaved Goldenrod was observed in rare instances around open seepage areas within the White Cedar coniferous swamp. The locations of these species are illustrated in Figure 3.

4.1.2 Vegetation Communities

A total of 14 vegetation communities were identified on and adjacent to the Subject Property. These vegetation communities were classified and mapped according to the Ecological Land Classification System for Southern Ontario (Lee et al. 1998). The Subject Property generally occurs on rolling uplands (likely drumlins), composed of silt or silty very fine sand. In places, the soils are stoney and limestone boulders or cobbles are mixed with the tills. In the intervening lowlands, large wetland areas support seepage swamps with organic deposits that often exceed 40cm in depth.

Descriptions of the vegetation communities identified on and adjacent the Subject Property as provided below.

Dry - Moist Old Field Meadow Type (CUM1-1)

A large portion of the Subject Property supports an old field meadow. This former agricultural field has been left fallow for some time and now supports an abundance (60-100% vegetation cover) of Smooth Brome, Orchard Grass, Timothy Grass, Kentucky Bluegrass, Quack Grass, Tall Goldenrod, New England Aster, Heath Aster, Spotted Knapweed, Wild Carrot, Canada Thistle, and White Sweet Clover. To facilitate archaeological work on the site, the entirety of the CUM1-1 community was tilled in October 2022, after botanical inventories were conducted.

On the driest knolls, Canada Bluegrass, Gray Goldenrod, Spotted Knapweed, Wild Basil, Common Strawberry, Hawkweed and Sedge species dominate the lower ground layer (0.5 to less than 0.2m in height) forming a sparse (between 25 to 60%) cover. A slightly taller (0.5 to 1m in height) layer of Smooth Brome, Heath Aster, New England Aster, Tall Goldenrod, Wild Carrot and Orchard Grass forms greater than 60% cover.

White Sweet Clover dominates the sparse 1 to 2m height layer, along with some vines of Riverbank Grape and low shrubs of Common Lilac or saplings of Manitoba Maple, White Cedar and Staghorn Sumac.

Sumac Cultural Thicket Type (CUT1-1)

The southwestern edge of the old field meadow supports a cultural thicket which slopes down to a thicket swamp below. Orchard Grass, Tall Goldenrod, Reed Canarygrass and Panicled Aster cover 60 to 100% of the ground layer. Staghorn Sumac forms a 25 to 60% cover of tall shrubs, 1 to 2m + in height. An abundance of Riverbank Grape, Black Walnut saplings and Chokecherry shrubs also occur in this layer.

An abundance of young to mature Black Walnut trees occurs in the sparse 2 to 10m+ height layer, almost forming a Black Walnut Savanna, along with some Red\Green Ash, Common Apple and Staghorn Sumac trees, providing between 10 to 25% cover.

Legend

Subject Property

Watercourse

ELC Community

CUM1-1	Dry-Moist Old Field Meadow Type
CUT1-1	Sumac Cultural Thicket Type
THDM3	Dry-Fresh Deciduous Hedge-row Ecosite
FODM11	Naturalize Deciduous Hedge-row Ecosite
FOCM5	Naturalized Coniferous Hedge-row Ecosite
WODM5	Fresh-Moist Deciduous Woodland Ecosite
FOMM2-3	Dry-Fresh White Pine - Hardwood Mixed Forest Type
FOC4-1	Fresh-Moist White Cedar Coniferous Forest Type
MAM3-9	Forb Organic Meadow Marsh Type
FOC2-2	Dry-Fresh White Cedar Coniferous Forest Type
SWC3-1	White Cedar Organic Coniferous Swamp Type
SWT2-5	Red-osier Mineral Thicket Swamp Type
MAM2-2	Reed-canary Grass Mineral Meadow Marsh Type
MAMM1-12	Common Reed Graminoid Mineral Meadow Marsh Type

Botanical

Location of putative Butternut

Location of Butterfly Weed

Location of Heart-leaved Aster

Location of Rough-leaved Goldenrod

Wildlife

Location of calling Eastern Wood-pewee (First Visit)

Location of calling Eastern Wood-pewee (Second Visit)

Location of calling Eastern Wood-pewee (Both Visits)

Location of calling Eastern Meadowlark (First Visit)

Location of calling Grasshopper Sparrow (Second Visit)

A Location of Acoustic Bat Monitors

1 Location of Amphibian Monitoring Station

Figure 3
Extent of Vegetation Communities on the Subject Property

Environmental Impact Study for 11 Main Street, Morriston

Prepared for: **WDD International**

Prepared by: COLVILLE CONSULTING INC.

DATE: December 2023

FILE: C22059

<u>Dry - Fresh Deciduous Hedgerow Thicket Ecosite (THDM3)</u>

Separating the old field meadow from the adjacent residential properties of mowed lawns and a parkland, is a very dense thicket of tall Common Buckthorn shrubs, along with a few trees (often Manitoba Maple or Basswood) and Hawthorns forming a shrub hedge-row.

<u>Naturalized Deciduous Hedge-row Ecosite (FODM11)</u>

Hedge-rows of mature (greater than 10m tall) Basswood and Manitoba Maple or Sugar Maple and rarely Black Cherry trees are located adjacent to the old field meadow. The dense sub-canopy (2 to 10m in height) and understory layers (1 to 2m in height) are often dominated by Common Buckthorn, Hawthorn species, Riverbank Grape and young Manitoba maple or Cherry species. Thicket Creeper, Asters, Goldenrods, Grasses and Riverbank Grape are abundant in the ground layer.

Some of these hedge-row support mature and large diameter Sugar Maple trees. Located southeast of the meadow is a former hedge-row or fence line which has now been surrounded and infilled by Fresh - Moist Deciduous Woodland. A number of large Sugar Maple and Red Oak trees grow in a line above the successional woodland species.

<u>Fresh - Moist Deciduous Woodland Ecosite (WODM5)</u>

In places, the old field meadow is bordered by a Fresh - Moist Deciduous Woodland. The open canopy layer (greater than 10 to 25m + in height) is formed by a 10 to 25% cover of mature Basswood, Black Cherry, White Pine, Bitternut Hickory, Sugar Maple or Trembling Aspen trees. In places the canopy of this community it is more dense and ranges from 25 to 60% cover.

Common Buckthorn, Hawthorn species, vines of Riverbank Grape, Alternate-leaved Dogwood, White Cedar and White Elm form a denser cover (25 to 60% cover or occasional less) in the 2 to 10m height layer. Many large (10-25cm or 25cm + dbh) and open-grown Hawthorns are still standing, forming part of the original woodland cover, however many are now declining as they are being shaded out or over-topped by Common Buckthorn.

In the 1 to 2m + height layer, Common Buckthorn, Chokecherry, vines of Riverbank Grape and Red\Green Ash saplings form a cover greater than 60% (or occasionally less in places). The ground layer (0.5 to 1m in height or less) supports an abundance of seedlings and young saplings of Common Buckthorn and Red\Green Ash along with vines of Wild Red Raspberry, Riverbank Grape and Poison Ivy.

On the east end of the property, this successional woodland community also occurs under towering White Pine and very mature Basswood and Black Cherry trees associated with the FOMM2-3 ELC community.

<u>Dry - Fresh White Pine - Hardwood Mixed Forest Type (FOMM2-3)</u>

Tall White Pine (greater than 25m or less) and very mature Basswood and Black Cherry trees form a super canopy of less than 25% cover. Below the super canopy layer is a 25 to 60% cover of very mature Hawthorn (often dead or over-topped and shaded out by Buckthorn), Common Buckthorn and occasionally Hop Hornbeam trees in the 2 to 10m height range. This mature stand often occurs on upper slopes adjacent to lowland or seepage areas.

In the understory layer (1 to 2m in height), Common Buckthorn, Chokecherry, Black Cherry and Alternate-leaved Dogwood form greater than 60% cover. The ground layer, where it is mostly shaded, is often dominated by seedlings of Common Buckthorn and Red\Green Ash or Wild Red Raspberry, however in the full sun, a number of meadow openings occur throughout and support typical old field meadow species.

Fresh - Moist White Cedar Coniferous Forest Type (FOC4-1) with Forb Organic Meadow Marsh Type (MAM3-9) complex

Fresh - Moist White Cedar Coniferous Forest occurs on mid to lower slopes of the rolling uplands. This vegetation community is mostly even aged (25-50cm dbh or less) and dominated by White Cedar. Occasional openings in the dense canopy support stands of Trembling Aspen or Black Cherry, or thickets of Hawthorn - Common Buckthorn. The canopy layer is almost entirely dominated by a dense cover (60 to 100%) of White Cedar (in the 2 to 10m height layer). Forming an additional cover of up to 10% are stands or scattered super canopy trees (10 - 25m + in height) of Trembling Aspen, Black Cherry and occasionally White Pine.

A very sparse (0 to 10% cover) understory layer is composed of young White Cedar and occasionally Red\Green Ash trees or saplings with shrubs of Chokecherry and saplings of Black Cherry (in the 1 to 2m height layer). The ground layer often contains little to no vegetation where it is most shaded, but occasionally (10 to 25% cover or less) supports seedlings of White Cedar, Chokecherry and Red\Green Ash.

Forb Organic Meadow Marsh Type (MAM3-9) complex

Numerous seeps and open meadow marshes occur throughout the White Cedar forest. These areas have been complexed as Forb Organic Meadow Marsh Type. Seepage areas support openings of meadow marsh with pockets of organic soils (greater than 40cm in depth). Swamp Aster, Panicled Aster and Boneset form a greater than 60% cover of tall forbs in the 1 to 2m height layer. Below this layer is a ground cover (approx. 100% cover) of Creeping Bent Grass, Reed Canarygrass, Rice-cut Grass and Spotted Touch-me-not (in the less than or 0.5 to 1m height layer). Occasionally, tall shrubs of Willow species or Red-osier Dogwood form less than 10% cover in the 2 to 10m height layer. In places, open seeps with flowing groundwater support patches of Watercress.

Dry - Fresh White Cedar Coniferous Forest Type (FOC2-2)

Along the rim and upper slopes, adjacent to a coniferous swamp, is a linear stand (possibly a former hedge-row bordering the old field meadow) of Dry - Fresh White Cedar Coniferous Forest. Limestone boulders, likely removed when the adjacent agricultural field was first cleared and plowed, are piled here. Along this pile of stones is an open grown, contorted, and multi trunked White Cedar tree, perhaps a marker tree. This tree is now surrounded by an even aged stand (25-50cm dbh) of White Cedar and occasionally Trembling Aspen, forming a fringe of coniferous forest between the conifer swamp and old field meadow.

White Cedar Organic Coniferous Swamp Type (SWC3-1)

This White Cedar Swamp has pockets of deep organics and seepage areas throughout. This community grades uphill and then meets the fringe of Dry - Fresh White Cedar Coniferous Forest and the Fresh - Moist White Cedar Coniferous Forest. In places, this coniferous swamp has a closed canopy and trees 5 to 10m tall (mostly on the mineral soil edges), but mostly supports an open cover of stunted White Cedar trees 1 to 3m tall on organic deposits.

A sparse super-canopy (with less than 10% cover) occasionally supports Trembling Aspen or White Cedar trees 10 to 25m tall. White Cedar is dominant (25 to 60% cover or less) in the 2 to 10m height layer with the occasional Trembling Aspen trees and rarely some tall Glossy Buckthorn shrubs. White Cedar is also dominant (10 to 25% or more cover) in the 1 to 2m height layer with some shrubs of Glossy Buckthorn and Red-osier Dogwood.

The ground layer (60 to 100% cover) is dominated by mosses and Field Horsetail and supports an abundance of Sensitive Fern, Dwarf Raspberry, Coltsfoot, Rough Goldenrod, Swamp Aster, Rice-cut Grass and Marsh Fern.

Located at the south end of this community are two small areas Common Reed Graminoid Mineral Meadow Marsh Type (MAM1-12). A monoculture of phragmites occurs in these areas.

Red-osier Mineral Thicket Swamp Type (SWT2-5)

Bordering a stream corridor to the southwest and grading northeast into the White Cedar Coniferous Swamp is a Red-osier Thicket Swamp. Red-osier Dogwood is abundant in the 1 to 2m height layer, along with Swamp Aster, Panicled Aster, Grass-leaved Goldenrod and Tall Goldenrod, together forming greater than 60% vegetation cover.

Slender Willow, Bebb's Willow and occasionally Red-osier Dogwood form a tall shrub layer 2 to 10m in height with only 10 to 25% cover or less. The ground layer supports between 25 to 60% vegetation cover of Field Horsetail, Reed Canarygrass, Rush and Sedge species and occasionally Black Bulrush or patches of Creeping Bent Grass. There are occasional pockets of deeper organics but overall the substrates are mineral.

Reed-canary Grass Mineral Meadow Marsh Type (MAM2-2)

A culvert crossing Hwy 6 conveys a tributary to Bronte Creek onto lands adjacent to the property. Vegetation in this lowland area and stream corridor was described as a Reed-canary Grass Mineral Meadow Marsh. This depauperate area is almost entirely dominated by Reed Canarygrass and grades into the adjacent Red-osier Dogwood Thicket Swamp.

Naturalized Coniferous Hedge-row Ecosite (FOCM5)

A stand of mature White Cedar occurs as a hedgerow in the southwest corner of the property. This community occurs primarily on the adjacent lands and separates a large agricultural field from residential lands to the west.

4.2 Wildlife and Wildlife Habitat

4.2.1 Breeding Birds

Breeding bird surveys were conducted on June 11 and July 6, 2022 to inventory breeding birds on the Subject Property. Surveys were completed at least 15 days apart, under suitable weather conditions with little to no wind or precipitation. A thorough search of the subject property was completed during both surveys between dawn and no later than 10:00 am. All birds seen or heard calling were recorded and the highest breeding evidence per species was determined in accordance with the criteria of the Atlas of the Breeding Birds of Ontario (Cadman et al. 2007).

A total of 35 species of birds were observed or heard on or above the Subject Property. According to Ontario conservation status ranks (S-rank) designations, with the exception of one non-native species all other recorded species are considered to be “secure” (S5 - common, widespread and abundant) or “apparently secure” (S4 - uncommon but not rare) in the province of Ontario.

Table 1: List of Bird Species Documented on and Adjacent to the Subject Property.

Species	S Rank	Thicket/Meadow	Woodland	Adjacent Lands	Highest Breeding Evidence*	Breeding Code**
American Crow	S5		X		CO	FY
American Goldfinch	S5	X	X		PO	S
American Redstart	S5B		X		PO	S
American Robin	S5	X		X	CO	FY
Baltimore Oriole	S4B		X		CO	FY
Black-capped Chickadee	S5	X	X		PO	S
Blue Jay	S5	X	X		PO	H
Brown-headed Cowbird	S5	X			PO	S
Carolina Wren	S4		X		PO	S
Cedar Waxwing	S5	X	X		PO	H
Chipping Sparrow	S5B	X	X		PO	S
Common Grackle	S5	X		X	PO	H
Common Yellowthroat	S5B		X		PO	S
Cuckoo species (heard)	S4B/S5B	X			PO	S
Downy Woodpecker	S5	X	X		PO	S
Eastern Meadowlark	S4B	X			PO	S
Eastern Towhee	S4B	X	X		PO	S
Eastern Wood-pewee	S4B		X		PO	S
European Starling	SNA	X		X	CO	FY
Field Sparrow	S4B	X	X		PR	A
Grasshopper Sparrow	S4B	X			PO	S
Gray Catbird	S5B	X			PR	A
Great Crested Flycatcher	S5B		X		PO	S
House Wren	S5B	X			PO	S
Killdeer	S4B	X		X	PO	H
Indigo Bunting	S5B	X		X	PO	S
Mourning Dove	S5	X		X	PO	S
Northern Cardinal	S5	X	X		CO	FY
Northern Flicker	S5	X	X		PO	S
Pine Warbler	S5B		X		PO	S
Red-eyed Vireo	S5B		X		CO	NY
Red-winged Blackbird	S5	X			PO	S
Rose-breasted Grosbeak	S5B	X			PR	A
Song Sparrow	S5	X	X		PO	S
Yellow Warbler	S5B	X	X		PO	S

* OBS – observed, no evidence of breeding; PO – possible breeding; PR – probable breeding; CO - confirmed breeding
** X – observed in its breeding season, no evidence of breeding
H – species observed in its breeding season in suitable nesting habitat
S – singing male present in its breeding season in suitable nesting habitat
P – pair observed in their breeding season in suitable nesting habitat
A – agitated behavior or anxiety calls of an adult
FY – recently fledged young CF – adult carrying food for young NY – nest with young

The Eastern Meadowlark heard calling on the first site visit in the meadow are designated as Threatened in both Ontario and Canada.

The Eastern Wood-pewee heard calling on both site visits in the woodland are designated as Special Concern in Ontario and in Canada.

The Grasshopper Sparrow heard calling on the second site visit in the meadow is designated as Special Concern provincially and federally.

4.2.2 Assessment of Potential Bat Roosting Habitat

During the summer, the Little Brown Myotis, Northern Myotis and Tri-colored Bats are found in a variety of forested habitats, as well as abandoned buildings, barns and attics. In forested habitats, cavities in trees, loose bark, foliage and other cover objects are used for roosting. These species forage in a variety of habitats where flying insects and spiders are present, often in association with wetlands, ponds and streams. Overwintering typically occurs in caves.

Assessments of potential bat roosting habitat were conducted on November 23, 2022 and May 31, 2023 using methods described in MNRF (2017). Based on the results of this assessment, acoustic bat monitoring was conducted at the property to determine if maternity roost colonies were present and determine the presence of any SAR bats. Two passive acoustic monitors were deployed on May 31, 2023 and recovered on June 11, 2023 for a total of 12 monitoring days. Deployment locations were selected to assess potential use of the candidate roosting habitat in identified trees. The locations of the bat monitors are illustrated in Figure 3.

Two passive acoustic monitoring devices were used at two separate locations during the monitoring period. Both sites were monitored using identical equipment consisting of the SM4Bat Full spectrum monitor and SMM-U1 Omni-directional ultrasonic microphones developed by Wildlife Acoustics Inc. All bat calls that were recorded by the equipment were analyzed using the Kaleidoscope Pro auto-identification program and confirmed for accuracy through manual review. Table 2 below illustrates the total number of bat passes detected at both monitors during the deployment and a more detailed summary is provided in Appendix E.

Table 2. Summary of Bat Acoustic Monitoring Results.

	Big Brown Bat (EPFU)	Eastern Red Bat (LABO)	Hoary Bat (LACI)	Silver-haired Bat (LANO)	Eastern Small Footed Bat (MYLE)	Little Brown Bat (MYLU)	Northern Long Eared Bat (MYSE)	Tri-colored Bat (PESU)	Monitor Totals
Unit A	-	2	5	1	-	-	-	-	7
Unit B	4	3	87	42	-	21	-	2	159
Total Passes	4	5	92	43	0	21	0	2	166

*Bat passes do not equal the actual number of bats. Individual bats can make multiple passes significantly skewing the results.

A total of 166 identifiable bat passes were recorded over the duration of the monitoring period. A majority of passes were detected at Monitor B, with most recordings identified as Silver-haired Bats and Hoary Bats. Little Brown Bat and Tri-colored Bat were also detected during the monitoring period. Further discussion is provided in Sections 5.1 and 5.5.1 below.

4.2.3 Amphibian Call Surveys

Our assessment indicates that the potential amphibian breeding habitat on the property is limited to the watercourse on the west side of the property. Amphibian use of the watercourse was assessed using amphibian call surveys, which were conducted in the spring of 2023. The location of the amphibian survey station is illustrated in Figure 3.

The survey station was surveyed for a period of three minutes, between one half-hour after sunset, and midnight. All species of calling amphibians were recorded along with a calling code (0 – no calling; 1- calls not overlapping, can be discretely counted; 2 – calls overlapping, but numbers of individuals can still be estimated; 3 – full chorus, numbers of individuals cannot be estimated), along with an estimate of the number of individual amphibians where possible.

The first amphibian survey was conducted on April 3, 2023 and commenced at 20:43, while the air temperature was 9^{o}C, winds were estimated to be 1 on the Beaufort Scale and sky was partly cloudy. The May 8, 2023 visit commenced at 21:40. Conditions were mostly cloudy, with an air temperature of 14^{o}C and slight breeze. The final amphibian survey was completed on June 19, 2023 beginning at 21:34. Conditions were partly cloudy, with an air temperature of 19^{o}C and a gentle breeze.

No amphibians were heard calling during the surveys. Intermittent road noise from Highway 6 west of the monitoring station was significant throughout each of the survey periods. This road noise, along with the marginal potential breeding habitat in the area, limits the overall quality of breeding habitat available in the wetland.

Although no calling amphibians were heard during surveys, a single Northern Leopard Frog was noted in a watercourse pool on May 3, 2023. Our observations indicate that it is not likely that the hydroperiod of this pool is sufficient to provide suitable breeding habitat for this species. Amphibian species heard calling off-site included Spring Peepers and Gray Treefrogs.

During an assessment of the property south of the Subject Lands, Beacon Environmental (2023) reported detecting Spring Peepers, Gray Treefrogs, Wood Frog, Green Frog and American Toad at various monitoring stations.

4.2.4 Reptile Surveys

Active hand searches for reptiles and amphibians were conducted on June 23, July 14, August 10 and September 27, 2022, and May 3, June 10 and August 18, 2023, generally following methods described in OMNRF (2016). These searches resulted in the observation of one Eastern Gartersnake in the southeast corner of the meadow and into the woodland area.

4.2.5 Incidental Wildlife Observations

Incidental wildlife observations including signs were recorded during each visit to the Subject Property and included Eastern Chipmunk, Grey Squirrel, Red Squirrel, and White-tailed Deer.

Incidental insect observations include Cabbage White Butterfly *(Pieris rapae),* Calico Pennant *(Celithemis elisa),* Common Wood-Nymph *(Cercyonis pegala)* Cricket (*Gryllidae*), Dragonfly (*Odonata*), Emerald Ash Borer *(Agrilus planipennis),* Mosquito (*Culicidae*), Moth (*Lepidoptera*), Spittlebug (*Cercopidae*) and Skipper Butterfly (*Hesperiidae*).

4.3 Aquatic Habitat Assessment

A review of background mapping indicates that two tributaries to Bronte Creek are located on the property. The largest of the two tributaries is located on and adjacent to the west end of the property. This watercourse (identified as Reach TBC-1 in the 2023 GEO Morphix Fluvial Geomorphological Assessment) originates at the culvert under Highway 6 and conveys water across the southwest corner of the Subject Property. The channel of this watercourse is poorly defined within a Reed Canarygrass marsh and consists primarily of small, braided drainages that are often not discernible among the Reed Canarygrass. Where more defined sections of channel are present south of the property, bankfull width ranged from 1.0-2.0m in width and 0.2-0.3m in depth. The silty clay substates of this watercourse and adjacent areas support Reed Canarygrass and mixed emergent species.

No flow or standing water was present in the watercourse during assessments on August 10, 2022, September 27, 2022 and August 18, 2023, however a small pool of water within the Reed Canarygrass was present during assessments on April 3 and May 3, 2023. This pool was approximately 1m in length, 0.6m in width and approximately 0.15m in depth and was observed to be providing refuge for a single Northern Leopard Frog. No fish were observed in the pool, however shallow pools and the pond downstream are likely providing refuge for resident fish species. Fish community sampling was not completed in this watercourse as part of this assessment.

Background mapping also identifies a small watercourse on the eastern portion of the property. An assessment of this area indicates that a small ephemeral drainage is located within the woodland area, however this drainage is poorly defined and not considered to be a watercourse.

5.0 ASSESSMENT OF SIGNIFICANT NATURAL HERITAGE FEATURES

5.1 Species at Risk

Three Endangered species (Butternut, Little Brown Myotis and Tri-colored Bat) were observed or detected on the Subject Property and Threatened species observed on the property were limited to Eastern Meadowlark.

Butternut

Butternut is a medium-sized tree in the walnut family that can reach up to 30 m in height. This species is generally intolerant of shade and is often found growing in sunny openings within forests or in open areas. Butternut are known to hybridize with other members of the genus *Juglans*, including Japanese Walnut, Black Walnut and English Walnut.

The Butternut observed west of the property is a suspected hybrid based on physical characteristics and is not considered to represent a pure Butternut. The location of this tree is illustrated in Figure 3. Although this individual is suspected to be a hybrid, no portion of the proposed development is anticipated to impact this tree and adequate setbacks to prevent damage will be adhered to.

Myotis Species

Two Endangered bat species (Little Brown Myotis and Tri-colored Bat) were detected during acoustic monitoring. Tri-colored Bats are known to roost within forested habitats and may roost in clumps of dead foliage and lichens (ECCC 2018). In more anthropogenically-modified landscapes, maternity roosts may also include barns or similar human-made structures (ECCC 2018). Females roost alone or in small colonies.

Single passes by Tri-colored Bats were detected on June 2 and June 10, 2023. Based on the occurrences, these passes are considered to be incidental movement past the monitor and do not likely represent roosting associated with trees in the vicinity of Unit B.

Little Brown Myotis often use buildings and other anthropogenic structures (e.g., bat boxes, bridges, and barns) for maternal roosting, but will also use cavities of canopy trees, foliage, tree bark, crevices on cliffs, and other structures (ECCC 2018). Maternity colonies range from several to hundreds of females with young (ECCC 2018).

Twenty-one passes by Little Brown Myotis were detected over eight nights at Unit B. Nightly passes ranged from 0 to 5. Since Little Brown Myotis typically roost in maternal colonies with several individuals, the number of passes detected at Unit B suggest that these passes are related to incidental daily movements and none of the trees near Unit B are being used as maternal roosting habitat. It is possible that a maternal roost is present in the vicinity of the property, however no potential roost trees will be impacted by the proposed project.

Eastern Meadowlark

During the second breeding bird survey, one Eastern Meadowlark was heard calling in the meadow area adjacent to a deciduous hedgerow on the central portion of the property. The approximate call location of the Eastern Meadowlark is illustrated in Figure 3.

Eastern Meadowlark is an obligate grassland species that will breed in a variety of grassland habitat types, as well as pastures and hayfields, however Eastern Meadowlarks now nest most commonly in a variety of anthropogenic grassland habitats (pastures and hayfields) that effectively mimic the structural attributes (vegetation height and vegetation density) of native prairies (McCracken et al. 2013). Optimal nesting habitat for Eastern Meadowlark generally contains moderately tall (25 to 50 cm) grasses with abundant litter cover, a high proportion of grass cover and low proportions of shrub/woody vegetation cover and a low percent cover of bare ground (McCracken et al. 2013).

Based on the timing of the single Eastern Meadowlark observation on June 11, 2022, it is assumed that this individual was a solitary male and not part of a breeding pair on the Subject Property. Based on our assessments, the Subject Property does not appear to be providing breeding habitat for Eastern Meadowlark, however it does appear to be providing incidental foraging habitat.

As part of our assessment of this property, we also reviewed Species at Risk data from the Natural Heritage Information Centre (NHIC) for the Subject Property and adjacent lands. Information available from NHIC indicated that two Endangered species (Butternut and Redside Dace) as well as two Threatened species (Bobolink and Eastern Meadowlark) have been documented in the vicinity of the Subject Property. Data retrieved from the NHIC is provided in Appendix F.

Aquatic assessments were not completed as part of this assessment, however based on the intermittent nature of the west watercourse on the Subject Property, it was determined that Redside Dace habitat is not present on the property.

Bobolink are known to use habitats similar to Eastern Meadowlark. Although breeding bird surveys were conducted as part of this project, this species was not detected on or adjacent to the Subject Property. Therefore, it is our conclusion that the Subject Property is not providing habitat for this species.

5.1.1 Other Potential Species of Conservation Concern

In addition to the above, Special Concern species observed on the property were limited to Eastern Wood-pewee and Grasshopper Sparrow. The Eastern Wood-pewee is one of the most common and widespread songbirds associated with North America's eastern forests (COSEWIC 2012). Often associated with forest clearings and edges, Eastern Wood-Pewee breeds in virtually every type of wooded community in eastern North America (Watt et al. 2020). Breeding territories of Eastern Wood-pewee in Southern Ontario are reported to range from 1.37ha to 2.03ha in size (COSEWIC 2012). This species is relatively common in southwestern Ontario; however, declining population of this species has prompted the federal and provincial governments to designate this species as Special Concern.

Eastern Wood-pewee were heard calling from the woodland east of the meadow area on the eastern portion of the Subject Property. Eastern Wood-pewee were heard calling during each of the breeding bird surveys and appear to be using the woodland feature for breeding.

Grasshopper Sparrows were heard calling at three locations in the meadow community on the Subject Property during the second breeding bird survey on July 6, 2022. Grasshopper Sparrows typically arrive in southern Ontario in late-May, where they initially nest for 8-9 days, followed by a second clutch in Mid-June (Vickery 2020). Based on the timing of observations, it is likely that the observation on the Subject Property were of fledged juveniles from adjacent nesting sites who were using the property as incidental foraging.

Information obtained from NHIC indicates that two additional Special Concern Species (Snapping Turtle and Eastern Ribbonsnake) have been documented in the vicinity of the Subject Property. Potential habitat for Snapping Turtles is presumed to be present in the tributary to Bronte Creek and associated wetlands and pond downstream of the property, as well as the East Morriston Swamp Wetland Complex.

No Snapping Turtles were observed on or adjacent to the Subject Property and the lack of standing water in these wetlands makes the habitat unsuitable for prolonged use by this species.

Eastern Ribbonsnake is a semi-aquatic species that is almost always found close to water, such as wetlands and the shorelines of lakes and rivers, where it hunts for frogs and small fish. Potential habitat for Eastern Ribbonsnake is not located on or adjacent to the property. The limited standing water in wetlands on the property make these wetlands unsuitable for this species. This species may occur in portions of the East Morriston Swamp Wetland Complex, with any potential habitat located off-site.

5.2 Significant Woodlands

During our review of background mapping available for the property, it was noted that portions of the Subject Property have been designated as Greenland (Significant Woodland) in the County of Wellington Official Plan (Figure 2). The county of Wellington Official Plan provides a definition of woodland but does not provide criteria for delineating woodlands. To be consistent with the definition of woodland in the PPS and mapping standards of the MNRF, the extent of woodlands on this property were refined to coincide with vegetation communities that meet the ELC definition of forest (60% or more canopy cover).

Using this criteria, our assessment indicates that the woodland on this property generally follows the White Cedar Forest (FOC2-2 and FOC4-1) on the property. Since canopy cover in the WODM5 community on the property is less than 60% and often dominated by hawthorns, this vegetation community was generally excluded from the refined extent of woodlands illustrated in Figure 4.

To be considered as significant, Section 5.5.4 of the Wellington Official Plan states that "In the Urban System, woodlands over 1 hectare are considered to be significant by the County and are included in the Greenlands System." Section 5.5.4 also states that Significant woodlands will be protected from development or site alterations which would negatively impact the woodlands or their ecological functions.

As the woodland on and adjacent to this property measures more than 1ha in size, the refined woodland is considered to be significant woodland.

5.3 Wetlands

As illustrated in Figure 2, mapping available from the Ministry of Natural Resources and Forestry (MNRF) indicates that a portion of the East Morriston Swamp Non-Provincially Significant Wetland Complex (non-PSW) is located along the eastern end of the Subject Property and extends south of the property within the woodland feature. Our assessment confirmed the presence of three primary wetland vegetation communities on and adjacent to the property. A discussion of each community is provided below.

From our assessment, the current extent of the East Morriston Swamp Wetland Complex generally follows the extent of the SWC3-1 community on the southern portion of the property. Although no formal refinement was completed, the extent of the non-PSW is considered to follow this vegetation community.

Although not included in the mapped extent of the evaluated wetland, the SWC3-1 community generally follows the lower elevation sections of the slope on the western portion of the property, extending towards the Bronte Creek tributary on the west side of the property. For the purposes of this assessment, this portion of the SWC3-1 community is considered to be contiguous with the non-PSW.

Located on the western end of the property is a Red-osier Mineral Thicket Swamp, which also follows the lower elevation portion of a slope. This vegetation community serves as a transition to the Reed Canarygrass marsh associated with the Bronte Creek tributary. For the purposes of this assessment, these vegetation communities are considered to be wetland.

A site visit was conducted with Halton Conservation staff on August 18, 2023 to verify the extent of wetlands on this property. The refined extent of wetlands on this property are illustrated in Figure 4.

5.4 Watercourses and Fish Habitat

As illustrated in Figure 2, two tributaries to Bronte Creek have been identified on the Subject Property. The Bronte Creek tributary located on the western portion of the property was determined to be providing intermittent potential fish habitat, as this poorly defined watercourse contains isolated pools in the spring and dries completely during the summer. No obvious seeps or springs were noted in the Reed Canarygrass marsh, however it is assumed that some spring or seasonal groundwater inputs do occur. Further discussion of potential impacts to this watercourse is provided below.

The Bronte Creek tributary on the east side of the property was determined to be a minor drainage swale, which conveys water ephemerally across the property. Because this drainage is poorly defined, this drainage is not considered to be a watercourse and is not considered to be providing fish habitat. The proposed development will not affect flow conveyance in this watercourse or affect any potential erosion on the property.

5.5 Significant Wildlife Habitat

The SWH Criteria Schedule for Ecoregion 6E (OMNRF 2015) identifies four main types of Significant Wildlife Habitat (SWH): seasonal concentrations areas, rare vegetation communities and specialized wildlife habitat, habitats of species of Conservation Concern, animal movement corridors. These are discussed below in relation to the natural features on and adjacent to the site and an assessment table is provided in Appendix G.

5.5.1 Seasonal Concentration Areas

The Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E identifies 16 types of seasonal concentrations of animals that may be considered significant wildlife habitat. These include, but are not limited to:

- Waterfowl Stopover and Staging Areas (Aquatic and Terrestrial);
- Shorebird Migratory Stopover Area;
- Raptor Wintering Area;
- Bat Hibernacula;
- Bat Maternity Colonies;
- Bat Migratory Stopover Area

- Turtle Wintering Areas;
- Reptile Hibernaculum;
- Colonially -Nesting Bird Breeding Habitat (Bank and Cliff);
- Colonially -Nesting Bird Breeding Habitat (Tree/Shrubs);
- Colonially -Nesting Bird Breeding Habitat (Ground);
- Migratory Butterfly Stopover Areas;
- Landbird Migratory Stopover Areas;
- Deer Yarding Areas; and
- Deer Winter Congregation Areas.

Seasonal concentration areas are typically designated as significant wildlife habitat if it supports a species at risk or if habitat destruction is expected to result in large population loss.

Silver-haired bats were detected at each monitor during acoustic monitoring. As only one pass was detected by Unit A, no potential maternal colonies are located near this monitor.

A total of 42 passes by Silver-haired bats were recorded at Unit B. Passes ranged from 1-7 per night over the monitoring period. Because passes were generally less than 5 per night, these data do not indicate that a potential Silver-haired Bat maternal colony is located near this monitor.

Our assessment of the property indicates that it is unlikely that snake hibernacula are located within the cultural meadow portion of the property. As this portion of the property is generally high and will not likely maintain suitable soil moisture conditions over the winter, this portion of the property is not likely being used by snakes for overwintering. It is possible that hibernacula may be present in the cedar woodland near the bottom of slope, and if so, no impact to potential hibernacula will occur as a result of this project.

It is also possible that the cedar woodland and wetland areas are providing winter habitat for White-tailed Deer. For the purposes of this assessment, it is assumed that the cedar forest on the property is providing habitat as a seasonal concentration area for White-tailed Deer.

5.5.2 Rare Vegetation Communities

Rare habitat includes vegetation communities that are designated as extremely rare to uncommon in Ontario. Those that qualify as rare habitats are assigned an S-Rank of S1, S2 or S3 by the Natural Heritage Information Center.

The Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E identifies 7 specialized habitats that may be considered significant wildlife habitat. They are:

- Cliffs and Talus Slopes;
- Sand Barren;
- Alvar;
- Old Growth Forest;
- Savannah;
- Tallgrass Prairie; and
- Other Rare Vegetation Communities.

No rare vegetation communities are present on or adjacent to the Subject Property.

5.5.3 Specialized Habitats of Wildlife considered SWH

Some wildlife species require large areas of suitable habitat for their long-term survival and many wildlife species require substantial areas of suitable habitat for successful breeding. Their populations are at risk of decline when habitat becomes fragmented or reduced in size.

Specialized habitats for wildlife include:

- Waterfowl Nesting Area;
- Bald Eagle and Osprey Nesting, Foraging and Perching Habitat;
- Woodland Raptor Nesting Habitat;
- Turtle Nesting Areas;
- Seeps and Springs;
- Amphibian Breeding Habitat (Woodland);
- Amphibian Breeding Habitat (Wetlands); and
- Woodland Area-Sensitive Bird Breeding Habitat.

Several seeps were observed in the White Cedar forest during our assessments of the property. These seeps are located near lower positions on the slope and are too small to delineate on figures. Wetlands in the vicinity of these seeps did not contain standing surface water in the spring and no amphibian or specialized wildlife use of these areas were noted.

Although various wetland features are located on the property, no vernal pools are present that would provide suitable habitat for amphibian breeding. Amphibian call surveys completed in 2023 confirmed that no significant amphibian breeding occurs on the property.

5.5.4 Habitats of Species of Conservation Concern

Habitats of Species of Conservation Concern include wildlife species that are listed as Special Concern or rare, that are declining, or are featured species. Habitats of Species of Conservation Concern do not include habitats of Endangered or Threatened species as identified by the Endangered Species Act. The following habitats are considered candidate SWH:

- Marsh Breeding Bird Habitat;
- Open Country Bird Breeding Habitat;
- Shrub/Early Successional Bird Breeding Habitat;
- Terrestrial Crayfish; and
- Special Concern and Rare Wildlife Species.

As described above, Eastern Wood-pewee was heard calling during both breeding bird surveys from the woodland on the northeast portion of the property. For the purposes of this assessment, the woodland on the eastern portion of the property is considered to be Eastern Wood-pewee habitat and therefore also considered Significant Wildlife Habitat.

The portion of the WODM5 community on the central and southern portion of the property was observed to be dominated by tall shrubs of hawthorn, which are not typical habitat for Eastern Wood-pewee. Because available habitat on this portion of the property is not typical breeding habitat for Eastern Wood-pewee and was not being used by this species, the WODM5 community on the central and southern portion of the property is not considered to be breeding habitat for Eastern Wood-pewee or significant wildlife habitat.

Grasshopper Sparrows were heard calling within the cultural meadow on the Subject Property during the second breeding bird survey. Based on the timing of when calls were detected, it is our assessment that these individuals were likely recently fledged juveniles who were using the property for incidental foraging. It is therefore our assessment that the meadow on the property is not providing habitat for species of conservation concern.

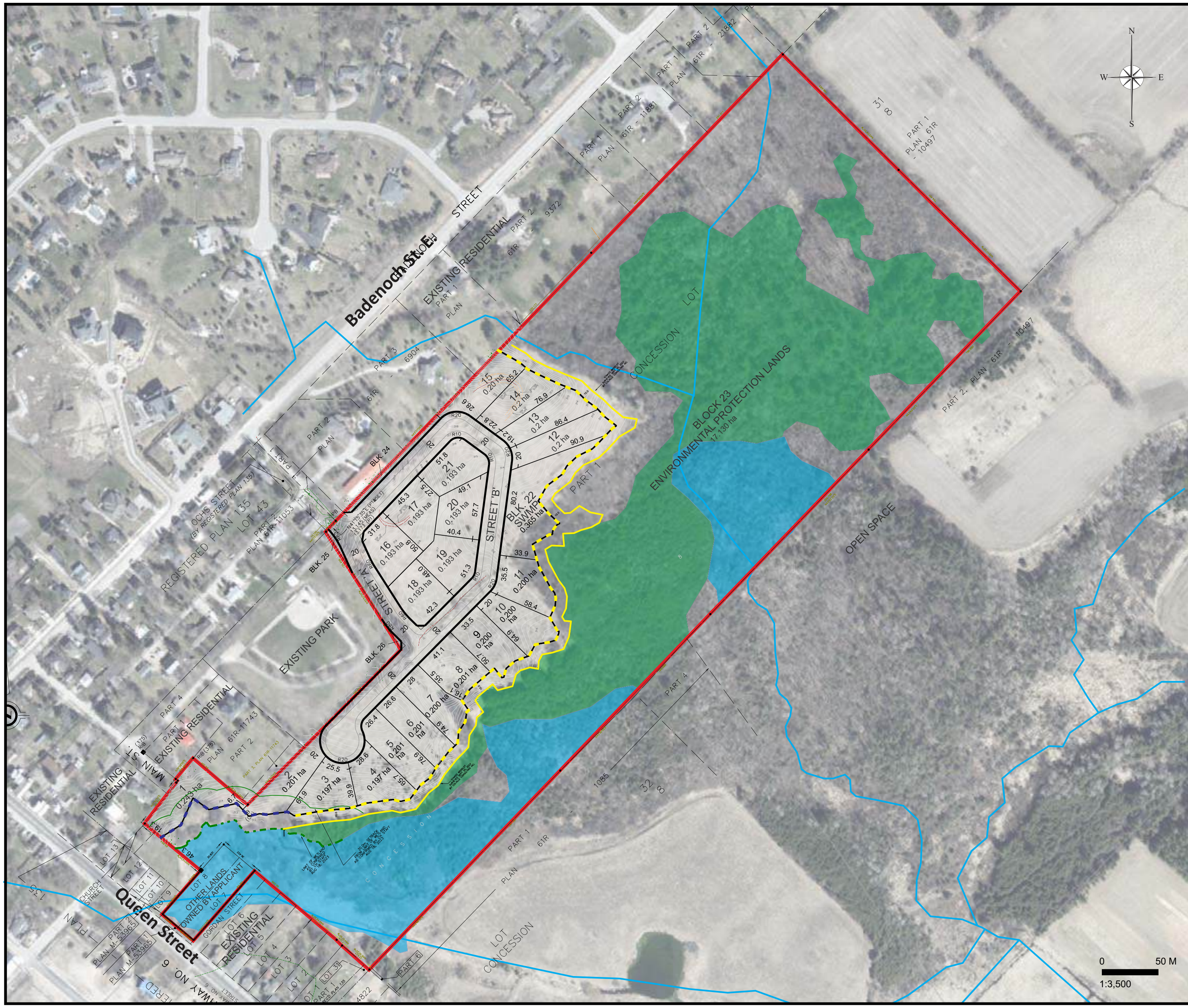
5.5.5 Migration Corridors

The Significant Wildlife Habitat Technical Guide (SWHTG) defines animal movement corridors as elongated; naturally vegetated parts of the landscape used by animals to move from one habitat to another. To qualify as significant wildlife habitat, these corridors should be a critical link between habitats that are regularly used by wildlife.

Based on our review of aerial imagery, it appears that the woodland and wetland features on and adjacent the Subject Property provide opportunities for localized wildlife movement in the area, but does not provide a corridor function.

5.6 Significant Areas of Natural and Scientific Interest (ANSI)

No Areas of Natural and Scientific Interest are located on or adjacent to the Subject Property.



Legend

- Subject Property
- Watercourse
- Extent of Significant Wildlife Habitat
- 10m Significant Wildlife Habitat Buffer
- 15m Wetland Buffer
- Refined Significant Woodland
- Refined Wetland

Figure 4
Refined Extent of Natural Heritage Features on the Subject Property

Environmental Impact Study for 11 Main Street, Morriston

Prepared for: **WDD International**

Prepared by: COLVILLE CONSULTING INC.

DATE: December 2023	FILE: C22059

6.0 IMPACT ASSESSMENT

The proposed development on the Subject Property includes 21 estate residential lots along the northwestern portion of the property, as well as a stormwater management pond. Proposed residential lots are approximately 0.20ha in size and will front onto new streets to be constructed as part of the development (see Appendix A and Figure 4). Development adjacent to the Subject Property will also include the extension of Ochs Street along the northern boundary of the Subject Property to provide access to the property.

The vast majority of the proposed development has been designed to be located within the cultural meadow portion of the Subject Property and incorporate buffers from woodland and wetland areas. An assessment of potential impacts to the various natural heritage features on and adjacent to the property is included below.

6.1 Significant Habitat of Endangered and Threatened Species

Three Endangered species (Butternut, Little Brown Myotis and Tri-colored Bat) were documented on the property during our surveys. As described previously in this report, the Butternut is considered to be a hybrid based on physical characteristics and is not considered to be a pure Butternut for the purposes of application of the Endangered Species Act.

Despite this tree being considered a putative hybrid Butternut, the tree is located adjacent to the Subject Property and suitable setbacks to prevent damage to the tree during construction activities will be adhered to. No negative impact to the putative hybrid Butternut is anticipated.

Little Brown Myotis and Tri-colored Bat were detected during acoustic monitoring. As described above, the passes recorded by Tri-colored Bats and Little Brown Myotis are considered to be incidental daily movements and no potential maternal roosts are suspected to occur in trees near the proposed development.

Threatened species observed on the property were limited to an Eastern Meadowlark, which was observed in the meadow portion of the property during the first breeding bird survey. This individual was only observed during the first visit and not the second visit, which suggests this male is not part of a breeding pair. As Eastern Meadowlarks often have multiple clutches per year and males often stay in close proximity nesting females (Vickery 2020), there are no indications that Eastern Meadowlark are breeding on the Subject Property and the observed use is assumed to be limited to foraging.

It is our assessment that the proposed project will have no impact on significant habitat of Endangered or Threatened Species.

6.2 Species of Special Concern

Two Species of Special Concern (Eastern Wood-pewee and Grasshopper Sparrow) were documented during our survey work. The Eastern Wood-pewee was heard calling within the woodland on the east side of the Subject Property and the Grasshopper Sparrow was observed foraging within the cultural meadow on the central portion of the property. The approximate observed locations of these species are illustrated in Figure 3.

Eastern Wood-pewee is one of the most common and widespread songbirds associated with North America's eastern forests (COSEWIC 2012). This species breeds in virtually every type of wooded habitat, from urban shade trees, roadsides, woodlots, and orchards to mature forests (McCarty 1996). Breeding territories of Eastern Wood-pewee in Southern Ontario are reported to range from 1.37ha to 2.03ha in size (COSEWIC 2012). Eastern Wood-pewee is still considered common in southern Ontario, however the declining population of this species has prompted the federal and provincial governments to designate this species as Special Concern.

Eastern Wood-pewee were heard calling from the woodland on the eastern portion of the Subject Property during both breeding bird surveys, suggesting that the woodland is being used as breeding habitat. Based on our observations, Eastern Wood-pewee were utilizing the interior portions of the woodland on the east side of the property, with the nearest detection approximately 120m from the woodland edge.

As illustrated in Figure 4, no portion of the refined woodland will be directly affected by the proposed development lots have been located 10m from the edge of the woodland. Based on the proximity of Eastern Wood-pewee to the proposed development and the understanding that Eastern Wood-pewee are somewhat tolerant to urban land uses, the proposed development will have no impact on habitat of Eastern Wood-pewee.

Grasshopper Sparrows were heard calling at three locations in the meadow community on the Subject Property during the second breeding bird survey on July 6, 2022. Based on the timing of observations, it is likely that the observations on the Subject Property were of fledged juveniles from adjacent nesting sites who were using the property as incidental foraging habitat. Because the Subject Property appears to only be providing incidental foraging habitat, proposed development in the meadow will not impact significant habitat of this species.

6.3 Significant Woodlands

As stated above, the woodland on this property has been refined to follow the White Cedar forest community. During our assessment it was noted that the portion of the woodland on and adjacent to the property was providing habitat for bird and wildlife species which are generally common in the vicinity of the property.

Based on the results of our observations, proposed lots were recommended to be located 10m from the extent of the woodland on this property. The recommended buffer will be sufficient to avoid directly impacting trees in the woodland, as well as avoiding any impacts to species using the woodland area.

Based on our assessment, the proposed residential lots adjacent to the woodland will have no impact on ecological functions of the Significant Woodland on and adjacent to the Subject Property. Despite the above conclusion, it is recommended that the mitigation measures included below be incorporated during future construction on the Subject Property.

As illustrated in Figure 4 and Appendix A, the stormwater management block has been located in the southeast corner of the proposed development, adjacent to the refined woodland boundary. It is understood that water from the stormwater pond will outlet into a flow dissipator and into the woodland. The pond and flow dissipator will have no impact on the functions of the woodland, however water discharged from the stormwater pond will have the potential to affect hydrology and tree health within a small portion of the woodland.

Our assessment of the woodland and wetland on the portion of the property adjacent to the stormwater pond indicates that these vegetation communities are dominated Eastern White Cedar. It is anticipated that soil moisture in the woodland area downstream of the outfall will increase as a result of the water discharged from the stormwater pond, however as this species is capable of growing in moist soil conditions, additional soil moisture is not likely to affect Cedar trees in the woodland.

Since this stormwater pond is intended to hold an attenuate runoff from installed impermeable surfaces such as roadways and driveways, it is expected that runoff from these areas will occasionally contain de-icing compounds. Road salt and de-icing compounds can be absorbed by trees, resulting in scorching of leaves and an overall decline in tree health. Various species are affected by these compounds differently, with Eastern White Cedar considered to be moderately tolerant to the effects of road salt.

It is anticipated that some of the White Cedar trees immediately downstream of the outfall may be affected by water quality, however this impact is likely to be localized. It is recommended monitoring be completed downstream of the outfall for two years after completion of the proposed project to assess any impacts stormwater may have on tree health or soil stability. If tree health concerns are noted, it is recommended that salt tolerant species, such as White Spruce of Balsam Poplar be installed in place of any declining White Cedars. Both of these species are known to occur on or adjacent to the property.

6.4 Wetlands

Our assessment confirmed the presence of three primary wetland vegetation communities on and adjacent to the property. For the purposes of this assessment, the extent of the East Morriston Swamp Non-PSW Wetland Complex generally follows the extent of the SWC3-1 community on the southern portion of the property. The Red-osier Mineral Thicket Swamp and the Reed Canarygrass marsh are also considered to be wetland. The refined extent of wetlands on this property are illustrated in Figure 4.

As illustrated in Figure 4, a portion of the development will be located near the Red-osier Mineral Thicket Swamp and the Reed Canarygrass marsh on the west side of the property. Based on our assessments, the Reed Canarygrass marsh occurs primarily in association with the Bronte Creek tributary and appears to be sustained by a combination of surface water runoff from upstream of the property and seasonal groundwater seepage. This portion of the wetland does not contain any vernal pools or appear to provide any significant wildlife habitat functions. The Red-osier Mineral Thicket Swamp occurs as a relatively narrow band of vegetation on the peripheries of the Reed Canarygrass marsh, generally occurring near of at the toe of the slope.

Based on our assessment of the wetland on the west side of the property, a 15m buffer from the wetland is recommended to maintain any ecological functions of this wetland. It is our assessment that wildlife functions in this wetland are impaired by road noise and disturbance along Highway 6 and that development associated with the proposed lots will not impact wildlife habitat in the wetland.

Although a water balance was not completed as part of this assessment, the majority of botanical species in the wetland are tolerant of a range of soil moisture conditions and are not likely to be affected by any potential changes to wetland hydrology. It is our assessment that continued surface and groundwater contributions to this wetland will be sufficient to maintain vegetation conditions and maintain the limited observed wildlife functions.

Additionally, as the Reed Canarygrass marsh will be maintained on the property, any flood attenuation functions provided by this portion of the wetland will be unaffected by the proposed development.

As illustrated in Figure 4 and described above, the wetland on the remainder of the property generally follows the White Cedar swamp, which occurs near and down gradient from the toe of slope. These wetland areas generally occur south of the White Cedar forest community, which occurs on the middle and upper portions of the slope. The White Cedar swamp communities on the property were observed to be providing limited specialized wildlife habitat functions, as very little, if any, surface water was observed in most wetland areas.

Based on our assessment, the proposed development on this property will not impact ecological or hydrological functions of wetland on this property.

6.5 Fish Habitat

The Bronte Creek tributary located on the western portion of the property was determined to be providing potential intermittent fish habitat. Proposed grading and future development on the site is planned to be located over 75m from this watercourse and the vegetation within the riparian and wetland feature will be maintained. From our assessment, the proposed development will have no impact on fish habitat in the Bronte Creek tributary.

6.6 Significant Wildlife Habitat

For the purposes of this assessment, it is assumed that the woodland and portions of the WODM5 community are providing significant wildlife habitat. Our assessment indicates that it is possible that scattered trees in the woodland are providing potential roosting habitat for bats. As no trees in the woodland areas will be removed to facilitate development on the property, potential bat roosting habitat on this property will not be impacted.

Our assessment of the White Cedar woodland and wetland areas indicate that these areas could be providing winter habitat for White-tailed Deer, due to the canopy of this community and the potential to minimize snow depths. Since no portion of these vegetation communities will be impacted by the proposed project, no impact to potential use by White-tailed deer will result from this development.

Several seeps were observed in the White Cedar forest during our assessments of the property. These seeps are located near lower positions on the slope and are too small to delineate on figures. Although no specific specialized habitat functions were noted in association with these seeps, these areas are located in the woodland and will not be directly impacted by the proposed development.

Eastern Wood-pewee was heard calling during both breeding bird surveys from the woodland on the northeast portion of the property. For the purposes of this assessment, the woodland on the eastern portion of the property is considered to be Eastern Wood-pewee habitat and also considered Significant Wildlife Habitat. Because potential habitat of Eastern Wood-pewee on the property will not be altered and development setbacks from the woodland will be sufficient to avoid impacts to this species, the proposed development will not affect potential significant wildlife habitat in the woodland.

6.7 Indirect Impacts

In addition to the direct impacts discussed above, it is anticipated that the proposed development may result in indirect impacts which may affect the ecological functions of the woodland and wetland features. Potential indirect impacts that could occur as part of this project include increases in ambient light and noise.

It is anticipated that security and decorative lighting will be installed on the proposed residences and street lighting, which could increase the existing ambient lighting in the area. As the area north and west of the Subject Property is already urbanized and most of the species observed utilizing the woodland adjacent to the development are common in association with residential land uses, it is not anticipated that the expected increase in ambient lighting will pose an impact to wildlife species using the woodland. To minimize any increases in ambient light to lands adjacent to the development, it is recommended that security lighting be directed away from the woodland and wetland areas. It is also recommended that shades be installed on lighting to avoid direct lighting upwards, which may adversely influence bird behaviors.

Although it is not anticipated that noise levels on the property will significantly increase as a result of everyday living activities, it is anticipated that an increase in noise may result for a short period of time during construction activities on the property. This increase in noise has the potential to temporarily disrupt wildlife in close proximity to the development, however based on the species observed, impacts are not anticipated to be significant.

7.0 MITIGATION MEASURES

As discussed above, it is our expectation that the proposed development will have no impact on the ecological functions of the significant woodland, wetlands, and watercourses on and adjacent to the Subject Property. To assist in avoiding any impacts associated with the proposed residential development, it is recommended that the following mitigation measures be implemented during detailed design and construction of residences on these properties.

- Any required vegetation removal should be conducted in a manner to avoid impacts to nesting birds that may be utilizing habitats on the property. The breeding bird period for this area is generally March 15 to August 31. A survey for active bird nests should be conducted prior to any vegetation removal or site alteration planned to occur during this window;
- Any grading or filling to be conducted on the Subject Property should be designed where possible to maintain existing overland flow patterns to help avoid hydrological and sedimentation impacts to the woodland and wetland.

- It is recommended that roof drains and runoff from impervious surfaces be directed towards the wetland and woodland where possible and the use of low impact development features be considered to assist with maintaining water infiltration.
- Exclusion fencing should be installed no less than 1m from the drip-line of trees to be retained in the Significant Woodland to ensure roots are not compacted or injured;
- Appropriate sediment and erosion controls should be installed prior to any grading, construction or site alteration works on the Subject Property to prevent sediment transfer to the wetland and watercourse features;
- Any silt fences should be properly embedded (as per Ontario Provincial Standard Specification 805) into the ground to reduce any offsite movement of silt;
- Native tree and shrub species should be incorporated into future landscape plans where possible; and,
- Any exterior lighting should be directed away from the Significant Woodland and wetland on and adjacent to the property where possible.

8.0 CONCLUSION

Colville Consulting Inc. was retained to complete an Environmental Impact Study to identify potential impacts associated with the proposed development on the Subject Property located at 11 Main Street, Village of Morriston, Wellington County. Our assessment of the property verified that natural heritage features located on or adjacent to the property include a tributary to Bronte Creek, wetland, woodland and areas likely functioning as significant wildlife habitat. The woodland and wetland features have been delineated and suitable buffers applied to prevent potential negative impacts from the proposed development.

Based on our observations of the property and adjacent areas, it is our conclusion that the proposed development will have no impact on ecological function of natural heritage features on and adjacent to the Subject Property. To assist with avoiding impacts, it is recommended that the above noted mitigation measures be implemented as required during development design, construction and post construction on the property.

Please do not hesitate to contact the undersigned at 905-935-2161 should you have any questions regarding the contents of this EIS.

Respectfully submitted by:

[redacted]

Brett Espensen, B.A. Hons, EP.
Colville Consulting Inc.

[redacted]

Ian Barrett, M.Sc.
Colville Consulting Inc.

9.0 LITERATURE CITED

Beacon Environmental Limited. 2023. Natural Heritage Evaluation, 97 Queen Street, Morriston, Wellington County. Beacon Environmental Limited. +31pp.

Cadman, M. D., D. A. Sutherland, G. G. Beck, D. Lepage and A. R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706 pp.

COSEWIC. 2011. COSEWIC assessment and status report on the Eastern Meadowlark Sturnella magna in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 40 pp.

COSEWIC. 2012. COSEWIC assessment and status report on the Eastern Wood-pewee *Contopus virens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 39 pp.

COSEWIC. 2013. COSEWIC assessment and status report on the Grasshopper Sparrow *Ammodramus savannarum pratensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 45 pp.

County of Wellington, June 1, 2022. County of Wellington Official Plan Office Consolidation. 240pp.

Environment and Climate Change Canada. 2018. Recovery Strategy for the Little Brown Myotis (*Myotis lucifugus*), the Northern Myotis (*Myotis septentrionalis*), and the Tri-colored Bat (*Perimyotis subflavus*) in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. ix + 172 pp.

Frank, R and A. Anderson. 2009. Significant Plant List for Wellington County. Wellington County Historical Society.

Halton Region Conservation Authority. 2020. Conservation Halton (The Halton Conservation Authority) Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document. 120pp.

Lee, H.T., W.D. Bakowsky, J.L. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Community Classification for Southern Ontario: First Approximation and Its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

McCarty, J.P. 1996. Eastern Wood-pewee (Contopus virens). In A. Poole and F. Gill, editors, The Birds of North America, No. 245. Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, DC. 20 pp.

McCracken, J.D., R.A. Reid, R.B. Renfrew, B. Frei, J.V. Jalava, A. Cowie, and A.R. Couturier. 2013. Recovery Strategy for the Bobolink (Dolichonyx oryzivorus) and Eastern Meadowlark (Sturnella magna) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. viii + 88 pp.

Oldham, M.J. and S.R. Brinker. 2009. Rare Vascular Plants of Ontario, Fourth Edition. Ontario Ministry of Natural Resources, Peterborough, Ontario. 188 pp.

Ontario Ministry of Municipal Affairs and Housing. 2020. Provincial Policy Statement. Queen's Printer for Ontario, Ontario, Canada.

Ontario Ministry of Natural Resources and Forestry. 2015. Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E. Ontario Ministry of Natural Resources and Forestry 39pp.

Ontario Ministry of Natural Resources. 2010. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005. Second Edition. Toronto, ON: Queen's Printer for Ontario. 248 pp.

Ontario Ministry of Natural Resources and Forestry. 2016. Survey Protocol for Ontario's Species at Risk Snakes. Ontario Ministry of Natural Resources and Forestry, Species Conservation Policy Branch. Peterborough, Ontario. ii + 17 pp.

Ontario Ministry of Natural Resources and Forestry. 2017. Survey Protocol for Species at Risk Bats within Treed Habitats - Little Brown Myotis, Northern Myotis & Tri-Colored Bat. Ontario Ministry of Natural Resources and Forestry Guelph District. 13pp.

Poisson, G., and M. Ursic. 2013. Recovery Strategy for the Butternut (*Juglans cinerea*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. v + 12 pp. + Appendix vii + 24 pp. Adoption of the Recovery Strategy for the Butternut (*Juglans cinerea*) in Canada (Environment Canada 2010).

Vickery, P. D. (2020). Grasshopper Sparrow (*Ammodramus savannarum*), version 1.0. In Birds of the World (A. F. Poole and F. B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.graspa.01

Watt, D. J., J. P. McCarty, S. W. Kendrick, F. L. Newell, and P. Pyle (2020). Eastern Wood-Pewee (*Contopus virens*), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.eawpew.01

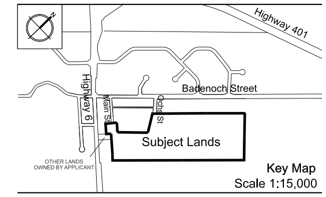
Appendix A

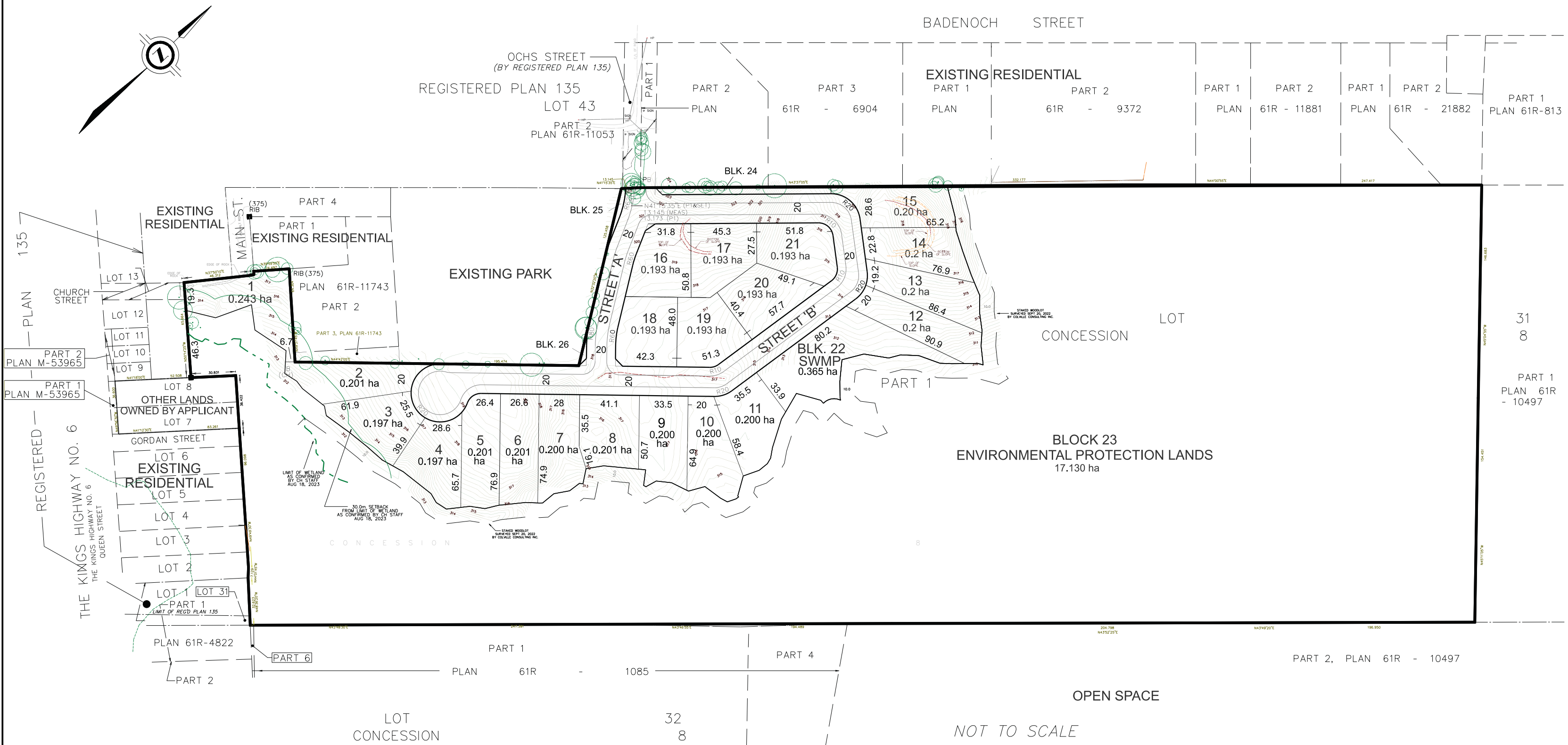
Development Plan

DRAFT PLAN OF SUBDIVISION

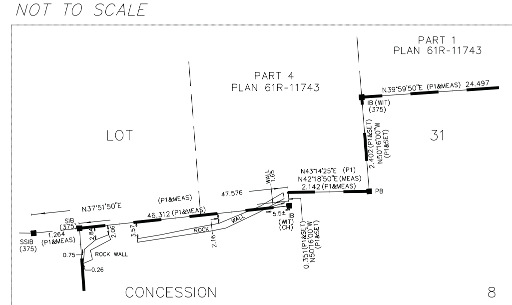
PART OF LOTS 7 & 8
NORTH OF QUEEN STREET
REGISTERED PLAN 135

AND PART OF LOT 31
CONCESSION 8
TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON





NOT TO SCALE



INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORPs): UTM ZONE 17, NAD83 (CSRS) (2010.0).

COORDINATES TO URBAN ACCURACY PER SECTION 14 (2) OF O.REG 216/10.

POINT ID	EASTING	NORTHING
ORP A	571 819.11	4 810 772.76
ORP B	572 189.46	4 811 593.30

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

THE RESULTANT TIE BETWEEN ORP A AND ORP B IS 900.588 N24°17'31"E

OWNER'S CERTIFICATE:

I authorize Weston Consulting Group Inc. to prepare and submit this plan for draft approval.

Date:

WDD MAIN STREET Inc. c/o FAISAL HAMADI
499 BRANT STREET
BURLINGTON, ONTARIO L7R 2G5
PHONE: 905-483-7399
info@wddinternational.com

SURVEYOR'S CERTIFICATE:

I hereby certify that the boundaries of the lands being subdivided and their correct relationship to the adjacent lands are accurately and correctly shown on this plan.

Date:

RAYMOND J. SIBTHORP, OLS
J.D. BARNES LIMITED
257 WOODLAWN ROAD WEST, UNIT 101
GUELPH, ONTARIO N1H 8J1
PHONE: (519) 822-4031 www.jdarnes.com

ADDITIONAL INFORMATION:

[Section 51(17) of the Planning Act, R.S.O. 1990, c. P.13], as amended to December 01, 2023.
a), b), e), f), g), j) & l) - on plan.
c) - on key plan
d) - see statistics
h) - piped water to be installed by developer
i) - silty sand, sand and silt, and clayey silt
k) - all services to be made available by developer

DEVELOPMENT STATISTICS:

LOTS/BLOCKS	LOTS	AREA
Single Detached Lots (20 m+) [Lots 1-21]:	21	4.204 ha
SWMP [Blk. 22]:		0.365 ha
Environmental Protection Lands [Blk 23]:		17.130 ha
Additional lands [Blk. 24-26]:		0.076 ha
Roads:		1.329 ha
Total:	21	23.104 ha

SCALE

0 80m

WESTON CONSULTING

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Toronto, Ontario M5A 2X1
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REVISIONS LIST

20 DEC 2023	Revise cul-de-sac to R=20 m & lots 3-5.
03 OCT 2023	Remove wetland limits by Colville Sept 20, 2022. Remove original edge of trees & staked limit. Insert Staked Woodlot Surveyed Sept 20, 2022 by Colville Consulting Inc.
20 SEP 2023	Remove old treeline, Regulated Limits. Update using 2023-09-11 topo file
15 SEP 2023	Revise ROW width to 20m & revert back to north-east access
11 APR 2023	Revise per updated survey plan & survey text
23 FEB 2023	Revise per topo plan
14 DEC 2022	Revise St. B per grading plan (Crozier) & revise Lots 17-23
11 NOV 2022	Revise ROW width to 18 metres & design lots (min 0.2 ha)
20 OCT 2022	Update drawing using 2022-10-12 survey

File Number: 10779
Drawn By: SM
Planner: PT
Scale: 1:1500
CAD: 10040 Draft Plan D9 2023-12-20.dgn

Drawing Number: D9

Appendix B

Vascular Plant Checklist

Plant List for 11 Main Street, Morriston, Puslinch Township, Wellington County conducted on August 10, September 24 & 26, 2022, and June 10, 2023

ScientificName	CommonNames	Coeff.Cons.	Coeff.Wet.	GRank	COSEWIC	COSSARO	SRank	LRank	CUM1-1	FOC	FODM11	SWD	WODM5	Notes
Acer negundo	Manitoba Maple	0	-2	G5			S5		X		X	X	X	
Acer platanoides	Norway Maple		5	GNR			SNA		X					
Acer saccharum ssp. saccharum	Sugar Maple	4	3	G5			S5				X		X	
Achillea millefolium ssp. lanulosa	Woolly Yarrow	0	3	G5			S5		X					
Actaea pachypoda	White Baneberry	6	5	G5			S5						X	
Agrimonia gryposepala	Tall Agrimony	2	2	G5			S5						X	
Agrostis stolonifera	Creeping Bent Grass	0	-3	G5			S5			X		X		
Alisma plantago-aquatica	Common Water-plantain	3	-5	G5			S5			X				
Alliaria petiolata	Garlic Mustard	0	0	G?			SE5		X				X	
Alnus glutinosa	Black Alder	0	-2	G?			SE4					X		
Ambrosia artemisiifolia	Common Ragweed	0	3	G5			S5		X					
Antennaria sp	Pussytoes Species								X					
Aquilegia canadensis	Wild Columbine	5	1	G5			S5		X				X	Growing on limestone boulder in FOC4-1
Arisaema triphyllum	Jack-in-the-pulpit	5	-3	G5			S5						X	
Asclepias incarnata ssp. incarnata	Swamp Milkweed	6	-5	G5			S5			X		X		
Asclepias syriaca	Common Milkweed	0	5	G5			S5		X					
Asclepias tuberosa	Butterfly Weed	8	5	G5			S4	R-A	X					Growing in corner of the CUM1-1, near treed hedge-row at the foot of Ochs Street. Likely introduced or escaped
Asparagus officinalis	Garden Asparagus		3	G5?			SNA		X					
Aster cordifolius	Heart-leaved Aster	5	5	G5			S5	R-A					X	
Aster ericoides var. ericoides	Heath Aster	4	4	G5			S5		X					
Aster lanceolatus ssp. lanceolatus	Panicled Aster	3	-3	G5			S5		X	X		X		
Aster novae-angliae	New England Aster	2	-3	G5			S5		X					
Aster pilosus var. pilosus	Hairy Aster	4	2	G5			S5		X					
Aster puniceus var. puniceus	Purple-stem Aster	6	-5	G5			S5			X		X		
Aster urophyllus	Arrow-leaved Aster	6	5	G4			S4		X					
Betula alleghaniensis	Yellow Birch	6	0	G5			S5					X		
Betula papyrifera	White Birch	2	2	G5			S5					X	X	
Bidens tripartita	Three-lobed Beggar-ticks	4	-3	G5			S5			X				
Bromus inermis ssp. inermis	Smooth Brome	0	5	G4G5			SE5		X					
Campanula rapunculoides	European Bellflower	0	5	G?			SE5		X					Growing in corner of the CUM1-1, near treed hedge-row at the foot of Ochs Street. Likely introduced or escaped
Carex gracillima	Graceful Sedge	4	3	G5			S5			X		X		
Carex granularis	Meadow Sedge	3	-4	G5			S5		X					
Carex spp	Sedge Species								X	X		X		
Carex vulpinoidea	Fox Sedge	3	-5	G5			S5						X	
Carya cordiformis	Bitternut Hickory	6	0	G5			S5						X	
Celastrus scandens	Climbing Bittersweet	3	3	G5			S5						X	
Centaurea maculosa	Spotted Knapweed	0	5	G?			SE5		X					
cf. Lespedeza sp	Bush-clover Species								X					Growing in corner of the CUM1-1, near treed hedge-row at the foot of Ochs Street. Likely introduced or escaped. L. hirta is known locally and rare but this could be a Medicago or Trifolium instead
Chelone glabra	Turtlehead	7	-5	G5			S5					X		
Chenopodium album var. album	Lamb's Quarters	0	1	G5			SE5		X					
Cichorium intybus	Chicory	0	5	G?			SE5		X					
Cicuta maculata	Spotted Water-hemlock	6	-5	G5			S5			X				
Circaea canadensis	Broad-leaved Enchanter's Nigh	2	3	G5			S5						X	
Cirsium arvense	Canada Thistle	0	3	G?			SE5		X					
Clinopodium vulgare	Wild Basil	4	5	G?			S5		X					
Coreopsis lanceolata	Lance-leaved Coreopsis	5	3	G5			S4?		X					Growing in corner of the CUM1-1, near treed hedge-row at the foot of Ochs Street. Likely introduced or escaped
Cornus alternifolia	Alternate-leaved Dogwood	6	5	G5			S5					X	X	
Cornus amomum ssp. obliqua	Silky Dogwood	5	-4	G5			S5		X			X		
Cornus foemina ssp. racemosa	Grey Dogwood	2	-2	G5			S5		X				X	
Cornus stolonifera	Red-osier Dogwood	2	-3	G5			S5		X	X	X	X	X	
Crataegus punctata	Dotted Hawthorn	4	5	G5			S5				X		X	
Crataegus sp	Hawthorn Species								X	X	X			
Cucurbita sp	Gourd Species								X					
Dactylis glomerata	Orchard Grass	0	3	G?			SE5		X					
Daucus carota	Wild Carrot	0	5	G?			SE5		X					
Digitaria sp	Crabgrass Species								X					
Draba verna	Spring Draba		5	GNR			SNA		X					
Dryopteris carthusiana	Spinulose Wood Fern	5	-2	G5			S5			X			X	
Echinochloa sp	Barnyard Grass Species								X					
Echium vulgare	Viper's Bugloss	0	5	G?			SE5		X					
Elaeagnus umbellata	Autumn Olive	0	3	G?			SE3		X		X			
Elymus repens	Quack Grass	0	3	G5			SE5		X					

ScientificName	CommonNames	Coeff.Cons.	Coeff.Wet.	GRank	COSEWIC	COSSARO	SRank	LRank	CUM1-1	FOC	FODM11	SWD	WODM5	Notes
Equisetum arvense	Field Horsetail	0	0	G5			S5			X		X	X	
Erigeron annuus	Daisy Fleabane	0	1	G5			S5		X				X	
Euonymus obovatus	Running Strawberry-bush	6	5	G5			S4						X	
Eupatorium maculatum ssp. maculatum	Spotted Joe-pye-weed	3	-5	G5			S5			X		X	X	
Eupatorium perfoliatum	Common Boneset	2	-4	G5			S5			X				
Euthamia graminifolia	Grass-leaved Goldenrod	2	-2	G5			S5		X			X		
Fragaria vesca	Woodland Strawberry	4	3	G5			S5						X	
Fragaria virginiana ssp. virginiana	Common Strawberry	2	1	G5			S5		X				X	
Fraxinus pennsylvanica	Red Ash	3	-3	G5			S5		X	X	X		X	
Galium sp	Bedstraw Species								X					
Geranium robertianum	Herb Robert	0	5	G5			SE5						X	
Geum spp	Avens Species												X	Likely G. cana plus meadow species
Glechoma hederacea	Ground-ivy		3	GNR			SNA		X					
Gleditsia triacanthos	Honey Locust	3	0	G5			S2				X			Planted or escaped
Helianthus annuus ssp. annuus	Common Sunflower	0	1	G5			SE4		X					Growing in pile of yard debris in old field meadow along shrub hedge-row
Hesperis matronalis	Dame's Rocket		3	G4G5			SNA		X					
Hieracium sp	Hawkweed Species								X					
Impatiens capensis	Spotted Touch-me-not	4	-3	G5			S5			X				
Inula helenium	Elecampane	0	5	G?			SE5		X			X		
Juglans cinerea	Butternut	6	2	G4			S4	R-B			X			Location noted on map; 25-50cm dbh tree; healthy with little to no dieback in canopy; growing near a hedge row of 50-100cm dbh Sugar Maples
Juglans nigra	Black Walnut	5	3	G5			S4		X		X			
Juncus articulatus	Jointed Rush	5	-5	G5			S5					X		
Juncus dudleyi	Dudley's Rush	1	0	G5			S5					X		
Juncus sp	Rush Species									X				
Juniperus virginiana	Eastern Red Cedar	4	3	G5			S5		X		X			
Lactuca sp	Lettuce Species								X					
Larix sp	Larch Species											X		
Leersia oryzoides	Rice Cut Grass	3	-5	G5			S5			X		X		
Leonurus cardiaca ssp. cardiaca	Motherwort	0	5	G?			SE5		X					
Lepidium campestre	Field Peppergrass		5	GNR			SNA		X					
Leucanthemum vulgare	Oxeye Daisy		5	GNR			SNA		X					
Ligustrum vulgare	Common Privet	0	1	G?			SE5				X		X	
Linaria vulgaris	Butter-and-eggs		5	GNR			SNA		X					
Lobelia siphilitica	Great Blue Lobelia	6	-4	G5			S5			X		X		Growing in seepage areas
Lonicera morrowii	Morrow's Honeysuckle	0	5	G?			SE3		X				X	
Lonicera sp	Honeysuckle Species										X			
Lonicera tatarica	Tartarian Honeysuckle	0	3	G?			SE5		X				X	
Lotus corniculatus	Bird's-foot Trefoil	0	1	G?					X					
Lupinus polyphyllus	Many-leaved Lupine	0	5	G5			SE4		X					Growing in corner of the CUM1-1, near treed hedge-row at the foot of Ochs Street. Likely introduced or escaped
Lycopus uniflorus	Northern Water-horehound	5	-5	G5			S5			X				
Lythrum salicaria	Purple Loosestrife	0	-5	G5			SE5					X		
Maianthemum canadense	Wild Lily-of-the-valley	5	3	G5			S5						X	
Malus pumila	Common Apple	0	5	G5			SE5		X		X		X	
Malva neglecta	Cheeses	0	5	G?			SE5		X					
Matteuccia struthiopteris	Ostrich Fern	5	0	G5			S5						X	
Medicago lupulina	Black Medick		3	GNR			SNA		X					
Medicago sativa	Alfalfa		5	GNR			SNA		X					
Melilotus alba	White Sweet-clover	0	3	G5			SE5		X					
Moss spp	Moss Species											X		
Myosotis laxa	Small Forget-me-not	6	-5	G5			S5		X	X				
Nasturtium officinale	Water-cress	0	-5	G?			SE			X			X	Forming floating mats on flowing ground water seeps
Onoclea sensibilis	Sensitive Fern	4	-3	G5			S5			X		X		
Ostrya virginiana	Hop Hornbeam	4	4	G5			S5						X	
Oxalis sp	Wood-sorrel Species								X					
Panicum capillare	Witch Panic Grass	0	0	G5			S5		X					
Parthenocissus inserta	Thicket Creeper	3	3	G5			S5		X		X		X	
Phalaris arundinacea	Reed Canary Grass	0	-4	G5			S5		X	X		X		
Phleum pratense	Timothy	0	3	G?			SE5		X					
Phragmites australis	Common Reed	0	-4	G5			S5					X		
Picea glauca	White Spruce	6	3	G5			S5					X		
Pilea sp	Clearweed Species									X		X		Growing in seepage openings, SWT and SWC. Either P. pumila or P. fontana
Pinus strobus	Eastern White Pine	4	3	G5			S5			X	X		X	
Pinus sylvestris	Scots Pine	0	5	G?			SE5					X		
Plantago lanceolata	Ribgrass	0	0	G5			SE5		X					

ScientificName	CommonNames	Coeff.Cons.	Coeff.Wet.	GRank	COSEWIC	COSSARO	SRank	LRank	CUM1-1	FOC	FODM11	SWD	WODM5	Notes
Plantago rugelii	Pale Plantain	1	0	G5			S5		X					
Poa compressa	Canada Blue Grass	0	2	G?			S5		X					
Poa palustris	Fowl Blue Grass	5	-4	G5			S5			X				
Poa pratensis ssp. pratensis	Kentucky Blue Grass	0	1	G?			S5		X					
Podophyllum peltatum	May-apple	5	3	G5			S5		X				X	
Polygonum aviculare	Common Knotweed	0	1	G?			SE5		X					
Polygonum persicaria	Lady's Thumb	0	-3	G?			SE5			X				
Populus grandidentata	Largetooth Aspen	5	3	G5			S5		X		X	X	X	
Populus tremuloides	Trembling Aspen	2	0	G5			S5		X	X		X	X	
Potentilla recta	Sulphur Cinquefoil		5	GNR			SNA		X					
Prunella vulgaris ssp. lanceolata	Heal-all	5	5	G5			S5			X		X		
Prunus avium	Sweet Cherry	0	5	G?			SE4		X		X		X	
Prunus serotina	Black Cherry	3	3	G5			S5			X	X		X	
Prunus virginiana ssp. virginiana	Choke Cherry	2	1	G5			S5		X	X	X		X	
Pyrus communis	Common Pear	0	5	G5			SE4		X			X		
Quercus macrocarpa	Bur Oak	5	3	G5			S5		X					
Quercus macrocarpa	Bur Oak	5	3	G5			S5		X					
Quercus rubra	Red Oak	6	3	G5			S5		X		X			
Ranunculus acris	Tall Buttercup	0	-2	G5			SE5		X				X	
Rhamnus cathartica	Common Buckthorn	0	3	G?			SE5		X	X	X		X	
Rhamnus frangula	Glossy Buckthorn	0	-1	G?			SE5			X		X	X	
Rhus radicans ssp. rydbergii	Western Poison-ivy	0	0	G5			S5		X				X	
Rhus typhina	Staghorn Sumac	1	5	G5			S5		X		X			
Ribes americanum	Wild Black Currant	4	-3	G5			S5					X		
Ribes cynosbati	Prickly Gooseberry	4	5	G5			S5						X	
Ribes sp	Currant Species										X			
Robinia pseudo-acacia	Black Locust	0	4	G5			SE5				X			
Rosa sp	Rose Species								X					
Rubus idaeus ssp. melanolasius	Wild Red Raspberry	0	-2	G5			S5		X				X	
Rubus occidentalis	Black Raspberry	2	5	G5			S5				X			
Rubus pubescens	Dwarf Raspberry	4	-4	G5			S5					X		
Rumex crispus	Curly Dock	0	-1	G?			SE5		X					
Rumex sp	Dock Species									X				
Salix alba var. tristis	Weeping Willow	0	-3	G5			SE4					X		A few very large trees in SWT
Salix bebbiana	Bebb's Willow	4	-4	G5			S5			X		X		
Salix discolor	Pussy Willow	3	-3	G5			S5			X		X		
Salix petiolaris	Slender Willow	3	-4	G5			S5			X		X		
Sanguinaria canadensis	Bloodroot	5	3	G5			S5		X					
Saponaria officinalis	Bouncing Bet	0	3	G?			SE5		X					
Scirpus atrovirens	Black Bulrush	3	-5	G5?			S5			X		X		
Senecio jacobaea	Tansy Ragwort	0	5	G?			SE1		X					Growing in corner of the CUM1-1, near treed hedge-row at the foot of Ochs Street. Likely introduced or escaped
Setaria pumila	Yellow Foxtail	0	0	G?			SE5		X					
Silene latifolia	White Campion		5	GNR			SNA		X					
Silene vulgaris	Bladder Campion		5	GNR			SNA		X					
Sisyrinchium sp	Blue-eyed-grass Species								X					
Solanum dulcamara	Bittersweet Nightshade	0	0	G?			SE5		X	X		X	X	
Solidago altissima var. altissima	Tall Goldenrod	1	3	G?			S5		X			X		
Solidago flexicaulis	Zigzag Goldenrod	6	3	G5			S5						X	
Solidago nemoralis ssp. nemoralis	Gray Goldenrod	2	5	G5			S5		X					
Solidago patula	Rough-leaved Goldenrod	8	-5	G5			S5	R-A				X		In seepy openings of SWC
Solidago rugosa ssp. rugosa	Rough Goldenrod	4	-1	G5			S5					X	X	
Sorbus sp	Mountain-ash Species										X			
Syringa vulgaris	Common Lilac	0	5	G?			SE5		X		X		X	
Taraxacum officinale	Common Dandelion	0	3	G5			SE5		X					
Thelypteris palustris var. pubescens	Marsh Fern	5	-4	G5			S5			X		X	X	
Thuja occidentalis	Eastern White Cedar	4	-3	G5			S5		X	X	X	X	X	
Tilia americana	Basswood	4	3	G5			S5		X		X		X	
Tragopogon dubius	Yellow Goatsbeard		5	GNR			SNA		X					
Trifolium pratense	Red Clover	0	2	G?			SE5		X					
Triosteum aurantiacum	Wild Coffee	7	5	G5			S5		X		X		X	Location noted on map, along open hedge-row in CUM1-1; also on and around limestone boulder in FOC4-1
Tussilago farfara	Coltsfoot	0	3	G?			SE5		X	X		X	X	
Typha angustifolia	Narrow-leaved Cattail	3	-5	G5			S5			X		X		
Ulmus americana	White Elm	3	-2	G5?			S5		X	X		X	X	
Verbascum thapsus	Common Mullein	0	5	G?			SE5		X					
Verbena hastata	Blue Vervain	4	-4	G5			S5					X		
Veronica officinalis	Common Speedwell	0	5	G5			SE5		X				X	

ScientificName	CommonNames	Coeff.Cons.	Coeff.Wet.	GRank	COSEWIC	COSSARO	SRank	LRank	CUM1-1	FOC	FODM11	SWD	WODM5	Notes
Veronica persica	Bird's-eye Speedwell		5	GNR			SNA		X					
Viburnum lentago	Nannyberry	4	-1	G5			S5		X		X	X		
Viburnum opulus	European Highbush Cranberry	0	0	G5			SE4						X	
Viburnum trilobum	Highbush Cranberry	5	-3	G5T5			S5		X			X		
Vicia sp	Vetch Species								X					
Viola sp	Violet Species											X		
Vitis riparia	Riverbank Grape	0	-2	G5			S5		X	X	X		X	
Vicia cracca	Tufted Vetch		5	GNR			SNA		X					

Legend

CoeCons. - Coefficient of Conservatism. Scores for each species range from 0 (low conservatism) to 10 (high conservatism).
A conservatism value of 0 indicates species is widespread. A value of 8, 9 or 10 indicates that a species is a habitat specialist.
CoeWet. - Coefficient of Wetness
5 - Almost always occur in upland areas
4, 3, 2 - Usually occur in upland areas
1, 0, -1 - Found equally in upland and wetland areas
-2, -3, -4 Usually occur in wetlands
-5 Almost always occur in wetlands

Grank - Global Rank G1 — Critically Imperiled, G2 — Imperiled, G3 — Vulnerable, G4 — Apparently Secure, G5 — Secure

COSEWIC - Committee on the Status of Endangered Wildlife in Canada

COSSARO - Committee on the Status of Species at Risk in Ontario

Srank - Subnational Rank
S1 — Critically Imperiled - Critically imperiled in the province because of extreme rarity, (often 5 or fewer occurrences)
S2 — Imperiled - Imperiled in the province because of rarity due to very restricted range, very few populations (often 20 or fewer)
S3 — Vulnerable - Vulnerable in the province due to a restricted range, relatively few populations (often 80 or fewer)
S4 — Apparently Secure - Uncommon but not rare
S5 — Secure - Common, widespread, and abundant in the province
SE — Exotic

Appendix C

ELC Data Cards

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: 11 MAIN STREET, MORRISTON, PUSLINCH			POLYGON:	
SURVEYOR(S): ACG	DATE: Sept 24/??	TIME: start / finish		
UTMZ:	UTMZ:	UTMN:		

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☑ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☑ SURFICIAL DEP. ☐ BEDROCK			☑ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY	4	1	MEL ALBA >> VIT RIPA > SYR VULG > ACE NEGU > THU OCCI > RHU TYPH
3	UNDERSTOREY	5	4	BRO INER > AST ERIC > AST NOVA > SOL ALTI > DAC CARO > DAC GLOM
4	GRD. LAYER	6,7	3	POA PRAT > SOL NEMO > CENT > SAT VULG > FRA VIRI > HIER > CAREX > POA COMP

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	O	< 10	R	10 - 24	R	25 - 50	N	> 50
STANDING SNAGS:	R	< 10	N	10 - 24	N	25 - 50	N	> 50
DEADFALL / LOGS:	R	< 10	N	10 - 24	N	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE:	✓	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS: Plus Some VERY FINE SAND KNOLLS w STONES AND COBBLES

TEXTURE: Silt L, SiVFS	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	DRY - MOIST OLD FIELD MEADOW	CUM1-1
INCLUSION		
COMPLEX		

Notes:

ELC STAND CHARACTERISTICS

SITE:	SE OF BADENOCH STREET / HWY 6
POLYGON:	PUSLINCH TWP, WELLINGTON COUNTY
DATE:	
SURVEYOR(S):	

TREE TALLY BY SPECIES:

PRISM FACTOR

SPECIES	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AVG
TOTAL							100
BASAL AREA (BA)							
DEAD							

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

SUMAC - WALNUT CUT1-1

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	JUG NIGR R
2	SUB-CANOPY	3	2	JUG NIGR >> FRA PENN > MAL PUMI > RHU TYPH
3	UNDERSTOREY	4,3	3	RHU TYPH > VIT RIPA > JUG NIGR = PRU VIRI
4	GRD. LAYER	5-7	4	DAC GLOM > SOL ALTI > PHA ARUN > AST LANC

TREED & SHRUB THDM3 HEDGEROWS FODM11 / FOCM5

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	TIL AMER or ACE NEGU or PRU SERO or ACER
2	SUB-CANOPY	3	3	RHA CATH >> CRAT (MACRO) > ACE NEGU >> PRUNUS SPP
3	UNDERSTOREY	4	4	RHA CATH > VIT RIPA
4	GRD. LAYER	5-7	3	PAR INSE > ASTERS > SOL > GRASSES > VIT RIPA

ELC
PLANT
SPECIES
LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COL.
BRO ININ				D	
DAC GLOM				A	
SOL ALTI				A	
AST NOVA				A	
AST LANC				O	
AST ERIC				A	
POA PRAT				A	
PHL PRAT				A	
ELY REPE				A	
AST PIPI				O	
DAU CARO				A	
VICCIA				O	
CIR ARVE				A	
PLA LANC				O	
SAP OFFI				O	
CHE ALBA				O	
TAR OFFI				O	
PHA ARUN				A	
SAT VULG				O	WILD BASIL
CENT STOEB/MACULOSA				A	
ACH MIMI				O	
ASC SYRI				O	
CIC INTY				O	
RUM CRISP				O	
VER THAP			O		
MEL ALBA			A		
PAN CAPI				O	
ERI CANA				O	
CAMP ~~APART~~ RAPUNC				R	ESCAPED
SOL DULC				R	
LACTUCA			O		
PYR COMM			R		

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COL.
MAL PUMI		R	R		
LEO CACA				O	
OXALIS				O	
AMB ARTE				O	
SET PUMI				O	
LOT CORN				O	
SOL NEMO				R	
TRIF PRAT				O	
ANTENARIA				R	
ECH VULG				O	BUG LOSS
LON TATA			R	R	
LON MORR			R		
PLA RUGI				O	
DIGITARIA				R	GRAM
CAREX (GRAM)				O	
HIER				O	
FRA VIVI				O	
* AST URAPH				O	[illegible]
RUB IDAE				O	
POA COMP				A	
COR FORA			R		
EUT GRAM			R		
VINE				R	
POL (AVIC)					
HEL ANNU			R		SUN FL. ESCAPED
SYR VULG			O	O	
ACE NEGU			O	O	
ECHINOCLOA				O	BARN
MUSK MALLOW? MALVA NEGLECTA				R	
RHA CATH			R		
JUN VIRG		O	O	O	
RHU TYPH		O	O	O	
RAN ACRI				R	

Page .... of .....

ELC
PLANT
SPECIES
LIST

SITE:
POLYGON: OLD FIELD MEADOW & HEDGEROWS
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COL.
ROB. PSUE			R	R	
QUE RUBR	R				
SORBUS		R			
JUG CINE	R				25-50*
* TRI AURA				R	
VIB LENT			R		
POP GRAN	R	R			
FRA PENN		R	O	O	
PIN STRO			R	R	
THU OCCI	R	R	R		
JUN VIRG		O	O		
PRU SERO	R	O	O	O	
COR STOL				R	
ACE SASA	R	R			
MAL PUMI		R			
GLED TRIC		R			ESCAPED
RUB OCCI				O	
RIBES				O	
RHU TYPH		O	O	O	
SYR VULG			O	O	
JUG NIGR		R	O	O	
LIG VULG			O	O	
CRAT (MACR)			O		
ELEA UMBEL			R	R	AUTUMN
PRU VIVI			O	O	
RHA CATH		A	A	A	
VIT RIPA		A	A	A	
PAR INSE			A	A	
PRU AVIU	R	O	O		
CRAT PUNC		O	O		
ACE NEGU	O	A	A	A	
TIL AMER	O	O			
LONICERA SPP			O	O	

TREED & SHRUB HEDGEROWS

* A triple stemed 25-50cm dbh Butternut (Healthy in little to no die back in canopy). Growing along a hedge row of 50-100cm @ sugar maples

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 11 MAIN STREET, MORRISTON		POLYGON:
	SURVEYOR(S): ACG	DATE: Sept. 24/22	TIME: start / finish
	UTMZ:	UTME:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☑ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☑ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☑ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☑ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☑ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☑ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☑ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2,1	2,3	TIL AMER > PRU SERO > PIN STRO > CAR CORD > ACE SASA > POP TREM
2	SUB-CANOPY	3	3,2	RHA CATH > CRAT PUNC > CRAT SPP > VIT RIPA > CAR ALTE > THU OCCI > ULM AMER
3	UNDERSTOREY	4	4,3	RHA CATH > PRU VIVI > VIT RIPA > FRA PENN
4	GRD. LAYER	3,2	5-7	RHA CATH > RUB IDME > FRA PENN > VIT RIPA > RHU RADI

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	O	25 - 50	R	> 50
STANDING SNAGS:	A	< 10	O	10 - 24	O	25 - 50	R	> 50
DEADFALL / LOGS:	A	< 10	R	10 - 24	O	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE:	PIONEER	YOUNG	✓ MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	FRESH - MOIST DECIDUOUS WOODLAND ECOSITE	WODM5
INCLUSION		
COMPLEX		

Notes:

ELC STAND CHARACTERISTICS	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S): LEFT @ 3:00 3.5 field with home @ 4:30 - 7:30

TREE TALLY BY SPECIES:

PRISM FACTOR

SPECIES	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL AVG
TOTAL							100
BASAL AREA (BA)							
DEAD							

FOMM2-3

STAND DESCRIPTION: MATURE STAND ON SLOPES AROUND SEEP

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	1,2	2,1	PIN STRO > TIL AMER > PRU SERO
2	SUB-CANOPY	3	3	CRAT (DEAD) = RHA CATH > OST VIRG
3	UNDERSTOREY	4	4	RHA CATH > PRU VIVI > PRU SERO > ROR ALTE
4	GRD. LAYER	5-7	4	RHA CATH > RUB IDME > FRA PENN

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

ELC PLANT SPECIES LIST

SITE:

POLYGON:

DATE:

SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

WODMS SPECIES CODE YOUNG EDGE	LAYER 1	2	3	4	COL.
RHA CATH		D	A		
PRU SERO	R	O	O		
COR ALTE		O	O		
LON MORR			O		
LON TATA			O		
CAR CORD	R	R	O	D	
MAL PUMI		R			
PRU VIVI			A		
VIT RIPA		O	A	A	
RUB IDME				A	
CRAT PUNC		O	O		
FRA PENS			O	A	
PIN STRO	R	R			
ACE SASA	R	R			
LIG VULG			O	O	
SYR VULG			O	O	
PAR INSE				O	
RHUS RADI				O	
GEUM				A	
FRA VIVI					
PRU AVIUM		R			
ACE NEGU	R	O	O	O	
POP TREM	R	R			
SOL RUGO				O	
AGR GRYP				R	
VER OFFI				O	
ULM AMER	R	O	O	O	
THU OCCI		R	O	O	
VIB OPUL					

FOCMM8-3 SPECIES CODE MATURE BACK	LAYER 1	2	3	4	COL.
PIN STRO	A				
PRU SERO	A				
OST VIRG		O			
BET PAPY	O				
ULM AMER		O	O		
THU OCCI		R	O	O	
TIL AMER	A				
GER ROBE				R	ON LIMESTONE BOULDER
ALL PETI				R	
TRI AURA				R	
TUS FAFA				R	
AQU CANA				R	" "
RIB CYNO				R	
AST CORD				O	
COR FORA					
POP GRAN					

Page ...... of ....

ELC PLANT SPECIES LIST

SITE:

POLYGON: WOOD LAND

DATE:

SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

Many large

10-25 or 25cm + Ø

OPEN GROWN CRATEGUS

ARE STILL STANDING OR

DECLINING AND BEING

FILLED IN AND OVERTOPPED

BY RHA CATH

The same community

occurs under towering

with Pines & Tilia amer & Prusero

BUT I SPENT LITTLE TIME

HERE @ FAR BACK (EAST) OF P.P.

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 11 MAIN STREET, MORRISTON		POLYGON:
	SURVEYOR(S): ACG	DATE: SEPT 26/23	TIME: start / finish
	UTMZ:	UTMZ:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☒ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☒ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☒ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☒ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☒ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2,1	1	POP TREM > PRU SERO > PIN STROB
2	SUB-CANOPY	3	4	THU OCCI
3	UNDERSTOREY	4	1	THU OCCI >> FRA PENN > PRU VIVI
4	GRD. LAYER	5-7	1,2	THU OCCI > PRU VIVI > FRA PENN

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES: 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	A-	25 - 50	R	> 50
STANDING SNAGS:	A	< 10	O	10 - 24	R	25 - 50	R	> 50
DEADFALL / LOGS:	A	< 10	O	10 - 24	R	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE:	PIONEER	YOUNG	MID-AGE	✓	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE: Si Sand ...	DEPTH TO MOTTLES / GLEY g =	G =
MOISTURE:	DEPTH OF ORGANICS:	(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:	(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	FRESH-MOIST WHITE CEDAR CONIFEROUS FOREST	FOC4-1
1 INCLUSION	DRY-FRESH WHITE CEDAR CONIFEROUS FOREST	FOC2-2
1 COMPLEX		MAM3-9

Notes:

ELC STAND CHARACTERISTICS	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

TREE TALLY BY SPECIES:

PRISM FACTOR 2

SPECIES	@ BACK TALLY 1	FURTHER BACK TALLY 2	@ PLAY TALLY 3 HIGH/FLAT	TALLY 4	TALLY 5	TOTAL	REL. AVG
THU OCCI							
PIN STRO	2						
ULM AMER	2						
POP TREM	2						
PRU SERO			3				
TOTAL							
BASAL AREA (BA)							100
DEAD	1	11	!				

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

IN SEEPAGE AREAS: FORB ORGANIC MEADOW MARSH TYPE MAM3-9

	COMPLEX LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY	3	1	SAL SPP > COR STOL
3	UNDERSTOREY	4	4	AST PUNI > AST LANC >> EUP PERF
4	GRD. LAYER	5-7	4	AGR STOL > PHA ARUN > LEE ORYZ > IMP CAPE

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
THU OCCI		D	A	O	
PIN STRO	R				
VIT RIPA		O	O	O	
PRU VIVI			A	O	
DRY CART				O	
FRA PENN		R	D	O	
ULM AMER		R	O		
RHA FRAN			O	O	
SOL DULC				R	
SAL PETI			R		
PRU VULG				O	
CAR GRACILIMA				O	
TUS FAFA				O	
RHA CATH			O	O	
PRU SERO	O	O	O	O	
POP TREM	O	R	R	R	
CRAT SPP		O	O	O	

SPECIES CODE	LAYER 1	2	3	4	COL.

ELC PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
ACI PLAN				R	
LYC UNIF				O	
JUNCUS				O	
TUS FAFA				O	
EQU ARVE				O	
POA PALU				O	
* NAS OFFI				R	IN SEEP
ONO SENS				O	
PILEA				O	
* LOB (SIPH)				O	
LEE ORYZ				A	
IMP CAPE				A	
SCI ATRO				O	
THE PALU				O	
EUP MACU			O		
TYP ANGU			R		
SAL BEBB		R	O		
COR STOL			O		
PHA ARUN				O	
RUMEX				O	
BID TRIP				O	
MYO LAXA				O	
CAREX				O	
POP TREM		O	O	O	
SAL DISC			O		
CIC MACU				O	
EUP PERF			O		
POL PERS				O	
ASC INCA				O	
AGR STOL				D	
AST PUNI			A		
AST LANC			A		

AST PUNI MEADOW

ORGANIC OPEN SEEPS

*

FRESH-MOIST FOC ON UPPER-LOWER SLOPES OF ~~DRO~~ KNOLLS

MOSTLY A STERILE CEDAR FOREST EVEN AGED STAND, BUT OCCASSIONAL OPENINGS SUPPORT POP TREM OR PRU SERO OR HAWTHORN-RHAMNUS THICKETS.

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: 11 MAIN STREET MORRISTON		POLYGON:
	SURVEYOR(S): TCG	DATE: Sept 26	TIME: start finish
	UTMZ:	UTME:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☐ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☐ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			COVER		
☐ OPEN WATER ☐ SHALLOW WATER ☐ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	1	POP TREM > THU OCCI
2	SUB-CANOPY	3	3,2	THU OCCI >> POP TREM >> RHA FRAN
3	UNDERSTOREY	4	2,3	THU OCCI >> RHA FRAN > COR AMOB
4	GRD. LAYER	5-7	4	EQU ARVE >> ONO SENS = RUB PUBE > TUS FAFA > SOL RUGO = ATT PUM > LEE OHZ > THEL PALU

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0 = NONE 1 = 0% < CVR ≤ 10% 2 = 10 < CVR ≤ 25% 3 = 25 < CVR ≤ 60% 4 = CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	O	25 - 50	R	> 50
STANDING SNAGS:	O	< 10	O	10 - 24	R	25 - 50	R	> 50
DEADFALL / LOGS:	O	< 10	O	10 - 24	R	25 - 50	R	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE:	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH

SOIL ANALYSIS:

TEXTURE: ORGANIC	DEPTH TO MOTTLES / GLEY	g =	G =
MOISTURE:	DEPTH OF ORGANICS: 30-40 cm org		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		
COMMUNITY SERIES:		
ECOSITE:		
VEGETATION TYPE:	WHITE CEDAR ORGANIC CONIFEROUS SWAMP	SWC3-1
INCLUSION		
COMPLEX		

Notes:

ELC STAND CHARACTERISTICS	SITE: 3... - Fired Lake ... [illegible]
	POLYGON: SEEPAGE SWAMP
	DATE:
	SURVEYOR(S):

TREE TALLY BY SPECIES:

PRISM FACTOR

SPECIES	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL AVG
TOTAL							
BASAL AREA (BA)							100
DEAD							

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER			

(WITH ORGANIC POCKETS)

RED-OSIER MINERAL THICKET SWAMP

SWT 2-5

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY			
2	SUB-CANOPY	3	2,1	SAL PETI >> SAL BEBB ≥ COR AMOB
3	UNDERSTOREY	4	4	COR STOL > AST PUNI > AST LANC > EUT GRAM > SOL ALTI
4	GRD. LAYER	5-7	3	EQU ARVE > PHAL ARUN > JUNCUS > CAREX > SCI ATRO

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
THU OCCI	D	D			
POP TREM	O				
POP GRAN					
PYR COMM		R			
PIN SYLV		R	R		
ONO SENS				A	
EQU ARVE				D	
AST PUNI				O	
PHA ARUN				O	
SOL RUGO				O	
RUB PUBE					
THE PALU					
MOSS				D	
PICEA (GLAU)		R			
LEE ORYZ				O	
TUS FAFA				O	
LARIX		R			
RHA FRAN			O	O	
PRU VULG				O	
SOL ATRO			O		
COR ALTE		O	O		
PILEA				O	
CAREX GRAC					
BET ALLE	R	R	O	O	
COR AMOM			O	O	
VIB TRIL				R	
RIBES (AMER)				O	NO DENUD.
SOL PATU				R	

SPECIES CODE	LAYER 1	2	3	4	COL.

Page ...... of ....

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
JUN ARTI				O	
BET PAPY		R			
LARIX		R			
CHE GLAB				R	
RHA FRAN			R	R	
PIN SYLV			R		
VIOLA SP				R	
CAREX (HST/LUR)				O	
COR AMOM			R		
SAL DISC		O	O		
LOB SIPH				R	
JUNCUS (TENUIS DUDD)				A	
CAREX SPP				O	
SOL ATRO			O	O	
ULM AMER		R	R		
EQU ARVE				O	
SAL PETI			O		
SOL DULC				O	
EUP MACU			O		
ACE NEGU		O	O	O	
SAL BEBB		O	O		
THU OCCI		R	O	O	
SAL ALBA	R				WEEPING WILLOW
VER HAST				O	
AGR STOL				A	
SOL ALTI				O	
TYP ANGU			O		
LYT SALI				O	
EUT GRAM				O	
AST LANC			A		
AST PUNI			A		
PHA ARUN				A	
COR STOL			O	A	

INU HELE R
ALN GLUT R
VIB LENT O O
SOL RUGO O
PHR AUST R

This cedar swamp has pockets of deep organics ; seepage areas. It grades uphill and then meets a fringe of fresh-moist Thu occi - Pop trem FOD before meadow.

In places its closed canopy and trees 15-20ft tall.
Mostly its open stunted cedars 4-8 ft tall.

col. Sol patula downstream end by circus zone in FOC

Appendix D

Site Photographs

Photo 1: View from CUM1-1 towards Ochs Road

Photo 2: View from northwest corner of property of manicured lawn on adjacent residential property.

Photo 3: View of FODM11 community along northern boundary of Subject Property

Photo 4: Example of CUM1-1 ELC community after cultivation. Viewing southeast.

Photo 5: View or CUM1-1 ELC Community on the Subject Property, viewing east.

Photo 6: View of WODM5 ELC community in background, CUM1-1 ELC community in foreground.

Photo 7: View of WODM5 ELC community on Subject Property.

Photo 8: View of SWT2-5 ELC community on Subject Property, viewing south.

Appendix E

Summary of Bat Acoustic Monitoring Data

KALEIDOSCOPE 4.5.4

Bats of North America		EPTFUS	LASBOR	LASCIN	LASNOC	MYOLEI	MYOLUC	MYOSEP	PERSUB		NOID	NOISE		Presence P	EPTFUS	LASBOR	LASCIN	LASNOC	MYOLEI	MYOLUC	MYOSEP	PERSUB
Unit A	Totals		2	5	1						7	592			1	0.001513	0.0000009	0.985708	1	1	1	1
	20230531				1						1	32			1	1	1	0.1435802	1	1	1	1
	20230601			1							1	50			1	1	0.0409786	1	1	1	1	1
	20230602			1							1	18			1	1	0.0409786	1	1	1	1	1
	20230603			1							1	61			1	1	0.0409786	1	1	1	1	1
	20230604										0	9			1	1	1	1	1	1	1	1
	20230605										1	4			1	1	1	1	1	1	1	1
	20230606										0	1			1	1	1	1	1	1	1	1
	20230607										0	4			1	1	1	1	1	1	1	1
	20230608			2							0	0			1	1	0.0016792	1	1	1	1	1
	20230609		1								2	0			1	0.039036	1	1	1	1	1	1
	20230610		1								0	3			1	0.039036	1	1	1	1	1	1
	20230611										0	410			1	1	1	1	1	1	1	1

KALEIDOSCOPE 4.5.4

Bats of North America		EPTFUS	LASBOR	LASCIN	LASNOC	MYOLEI	MYOLUC	MYOSEP	PERSUB		NOID	NOISE		Presence P	EPTFUS	LASBOR	LASCIN	LASNOC	MYOLEI	MYOLUC	MYOSEP	PERSUB
Unit B	Totals	4	3	87	42		21		2		136	214			1	0.13256	0	0.0000002	1	0	1	0.098868
	20230531	1		13	6		2				16	6			1	1	0	0.1133279	1	0.033687	1	1
	20230601			14	4		2				19	10			1	1	0	0.6597848	1	0.033211	1	1
	20230602			10	4				1		11	6			1	1	0	0.3822535	1	1	1	0.036832
	20230603			4	6		4				9	8			1	1	0.0010079	0.003735	1	0.001103	1	1
	20230604			11	1						10	3			1	1	0	1	1	1	1	1
	20230605	3	1	7	7		3				20	14			0.612312	0.276324	0.0000038	0.009549	1	0.04412	1	1
	20230606			6	1		1				3	10			1	1	0	0.9999839	1	0.18224	1	1
	20230607			3	1		5				12	3			1	1	0.0003903	0.8507304	1	0.000201	1	1
	20230608		1	4	4						6	1			1	0.038895	0.0003477	0.0564665	1	1	1	1
	20230609		1	6	3		3				11	7			1	0.27546	0.0000005	0.3515393	1	0.042865	1	1
	20230610			9	5		1		1		17	12			1	1	0	0.1338887	1	0.229786	1	0.049013
	20230611										2	134			1	1	1	1	1	1	1	1

	EPTFUS	LASBOR	LASCIN	LASNOC	MYOLEI	MYOLUC	MYOSEP	PERSUB	NO ID	
Unit A	0	2	5	1	0	0	0	0	7	15
Unit B	4	3	87	42	0	21	0	2	136	295
Totals	4	5	92	43	0	21	0	2	143	310

Appendix F

NHIC Data

NHIC Data

To work further with this data select the content and copy it into your own word or excel documents.

OGF ID	Element Type	Common Name	Scientific Name	SRank	SARO Status	COSEWIC Status	ATLAS NAD83 IDENT	COMMENTS
977245	SPECIES	Midland Painted Turtle	Chrysemys picta marginata			SC	17NJ7111	
977245	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NJ7111	
977245	SPECIES	Snapping Turtle	Chelydra serpentina		SC	SC	17NJ7111	
977255	SPECIES	Midland Painted Turtle	Chrysemys picta marginata			SC	17NJ7211	
977255	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NJ7211	
977255	SPECIES	Snapping Turtle	Chelydra serpentina		SC	SC	17NJ7211	
977255	SPECIES	Butternut	Juglans cinerea		END	END	17NJ7211	
977244	SPECIES	Midland Painted Turtle	Chrysemys picta marginata			SC	17NJ7110	
977244	SPECIES	Redside Dace	Clinostomus elongatus		END	END	17NJ7110	
977244	SPECIES	Snapping Turtle	Chelydra serpentina		SC	SC	17NJ7110	
977244	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NJ7110	
977244	SPECIES	Bobolink	Dolichonyx oryzivorus		THR	THR	17NJ7110	
977254	SPECIES	Eastern Ribbonsnake	Thamnophis sauritus		SC	SC	17NJ7210	
977254	SPECIES	Redside Dace	Clinostomus elongatus		END	END	17NJ7210	
977254	SPECIES	Snapping Turtle	Chelydra serpentina		SC	SC	17NJ7210	
977254	SPECIES	Eastern Meadowlark	Sturnella magna		THR	THR	17NJ7210	

Appendix G

Significant Wildlife Habitat Table

Assessment of potential Significant Wildlife Habitat for 11 Main Street, Morriston

Significant Wildlife Habitat (SWH) Type	Known or Candidate SWH present/absent	Rationale
SEASONAL CONCENTRATION AREAS OF ANIMALS		
Waterfowl Stopover and Staging Areas	Absent	Suitable habitat is not present on Subject Property.
Shorebird Migratory Stopover Area	Absent	Significant potential habitat is not present on Subject Property.
Raptor Wintering Area	Absent	Suitable habitat is not present on Subject Property.
Bat Hibernacula	Absent	Suitable overwintering habitat is not present on Subject Properties
Bat Maternity Colonies	Absent within development area	Potential roost trees present within portions of WODM5 and FOC4-1 vegetation communities on Subject Property. No development proposed within these communities.
Bat Migratory Stopover Area	Absent within development area	No evidence that development area is providing migratory stopover habitat for bats.
Turtle Wintering Areas	Absent	Potential overwintering habitat not present on Subject Property.
Reptile Hibernaculum	Absent within development area	Suitable overwintering habitat not observed in proposed development area on property. Overwintering habitat may be present in woodland areas near the toe of slopes, but no potential hibernacula identified.
Colonially -Nesting Bird Breeding Habitat (Bank and Cliff)	Absent	Not known to occur on Subject Property.
Colonially -Nesting Bird Breeding Habitat (Tree/Shrubs)	Absent	Not known to occur on Subject Property.
Colonially -Nesting Bird Breeding Habitat (Ground)	Absent	Not known to occur on Subject Property.
Migratory Butterfly Stopover Areas	Absent	Significant potential habitat is not present on Subject Property.

Landbird Migratory Stopover Areas	Absent	Significant potential habitat is not present on Subject Property.
Deer Yarding Areas	Absent	Not known to occur on Subject Property
Deer Winter Congregation Areas	Absent within development area	Not known to occur on Subject Property, but potential habitat is present in White Cedar forest and wetland. The proposed development will not impact these areas or potential function.
RARE VEGETATION COMMUNITIES		
Cliffs and Talus Slopes	Absent	Habitat type not present on Subject Property
Sand Barren	Absent	Habitat type not present on Subject Property
Alvar	Absent	Habitat type not present on Subject Property
Old Growth Forest	Absent	Habitat type not present on Subject Property
Savannah	Absent	Habitat type not present on Subject Property
Tallgrass Prairie	Absent	Habitat type not present on Subject Property
Other Rare Vegetation Communities	Absent	Habitat type not present on Subject Property
SPECIALIZED HABITATS OF WILDLIFE CONSIDERED SWH		
Waterfowl Nesting Area	Absent	Suitable habitat not present on Subject Property
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	Absent	Suitable habitat not present on Subject Property
Woodland Raptor Nesting Habitat	Absent	Suitable habitat not present on Subject Property
Turtle Nesting Areas	Absent	No evidence of turtle nesting observed on Subject Property
Seeps and Springs	Absent within development area	Small and isolated seeps occur along bottom of slope edge in cedar forest. No significant habitat functions noted in association with seeps. No development proposed near these areas.
Amphibian Breeding Habitat (Woodland)	Absent	No Amphibians heard calling from property. No vernal pools or suitable potential breeding habitat observed on Subject Property.

Amphibian Breeding Habitat (Wetlands)	Absent	No Amphibians heard calling from property. No vernal pools or suitable potential breeding habitat observed on Subject Property.
Woodland Area-Sensitive Bird Breeding Habitat	Absent	Suitable habitat not present on Subject Property
HABITATS OF SPECIES OF CONSERVATION CONCERN CONSIDERED SWH		
Marsh Breeding Bird Habitat	Absent	Suitable habitat not present on Subject Property.
Open Country Bird Breeding Habitat	Absent	Indicator species not present on Subject Property
Shrub/Early Successional Bird Breeding Habitat	Absent	Indicator species not present on Subject Property
Terrestrial Crayfish	Absent	Suitable habitat not present on Subject Property
Special Concern and Rare Wildlife Species	Present	Eastern Wood-pewee assumed to be breeding in woodland on east side of property. No development proposed within or near potential habitat for this species.
ANIMAL MOVEMENT CORRIDORS		
Amphibian Movement Corridors	Absent	Amphibian use of the property is limited. This property does not serve as a link between suitable upland and wetland habitats.

Please note the above SWH criteria are based on guidance provided by the Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E and modified to be specific for the Subject Property.

January 8th, 2024

Faisal Hamadi
WDD International
499 Brant Street
Burlington, ON. L7R 2G5

Attention Mr. Faisal Hamadi

RE: **Updated Tree Preservation Plan for 11 Main Street, Villag of Morriston**

This Tree Preservation Plan (TPP) has been prepared in association with the Updated Scoped Environmental Impact Study (EIS) prepared by Colville Consulting Inc. dated January 2024, for a proposed residential development located at 11 Main Street, Village of Morriston, Wellington County. A TPP has been requested by County of Wellington staff to inventory trees on and adjacent to the Subject Property, with the intention of protecting and preserving trees where possible. As the majority of trees on the Subject Property are located within woodland and wetland features which are not proposed for development, the focus of this TPP is for trees within and adjacent to the development footprint that may be impacted during construction and grading of the Subject Property. A summary of our assessment is provided below.

PROPOSED DEVELOPMENT

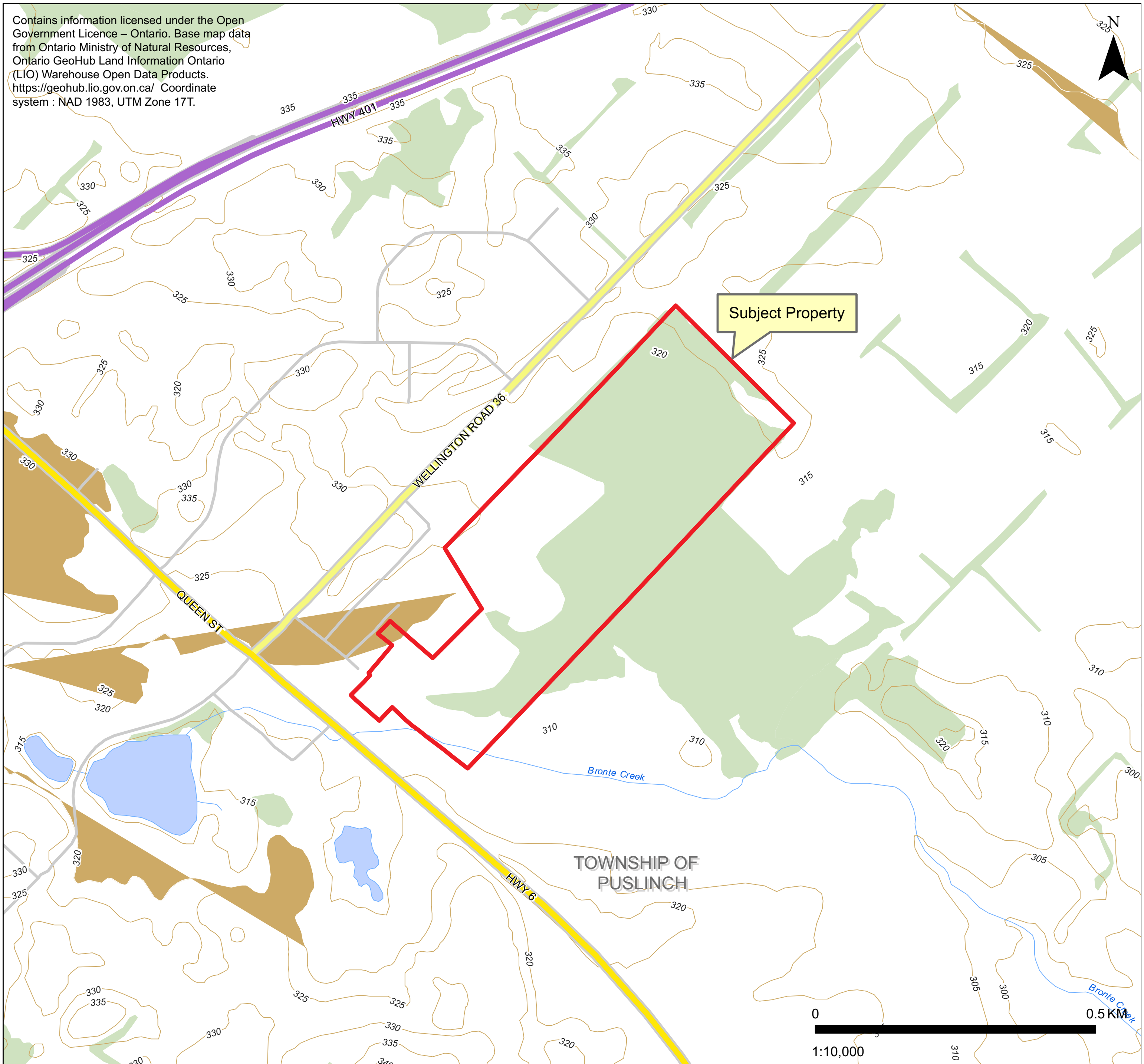
It is our understanding that the proposed development includes 21 single detached lots along the northwestern portion of the Subject Property and a Storm Water Management Pond. All proposed residential lots are approximately 0.20ha in size and will front onto new streets to be constructed as part of the development. Development adjacent to the Subject Property will also include the extension of an existing street (Ochs Street) along the northern boundary of the Subject Property to provide access to the property. The proposed development plan is provided in Appendix A.

METHODS

This Tree Preservation Plan has been prepared with the goal of retaining and protecting as many trees as possible on the Subject Property and is intended to be read in conjunction with the Scoped Environmental Impact Study (EIS) report prepared for the property (January 2024).

It is our understanding that Wellington County does not have a Tree Preservation Plan Guideline. This TPP has been completed in general compliance with the Cty of Toronto's "Tree Protection Policy and Specifications for Construction Near Trees" and also includes components of the County of Wellington Woodland Conservation By-Law 5115-09, hereafter referred to as the By-Law.

The general intent of this assessment is to determine the extent and composition of trees on and immediately adjacent the development footprint on the Subject Property and identify mitigation measures for trees to be retained. For the purposes of this assessment and to be consistent with By-Law 5115-09, a tree in this assessment means a specimen of any species of woody perennial vegetation that has or has the potential grow to a height of at least 4.5 metres from the ground at physiological maturity and has a diameter at breast height (DBH) of at least 10 cm.



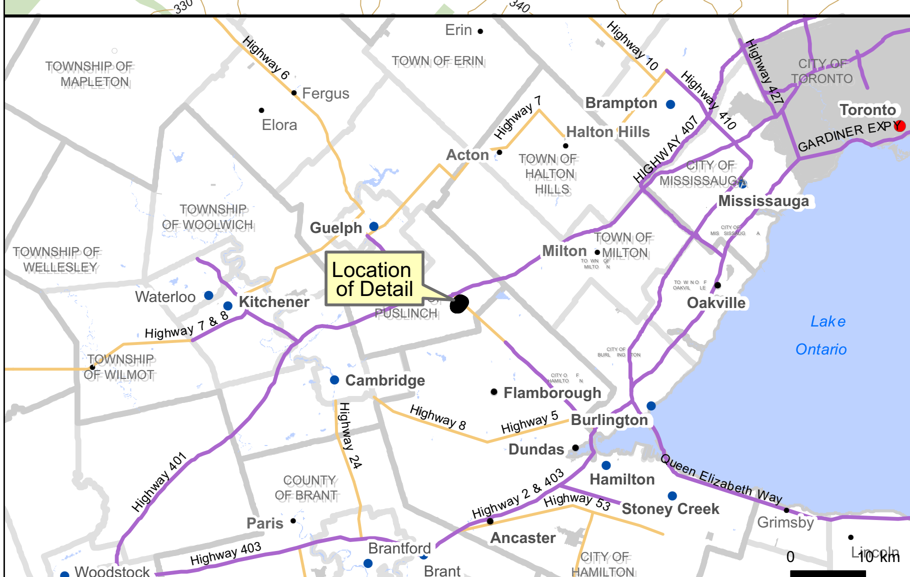


Figure 1
Location of Subject Property

Tree Preservation Plan for
11 Main Street, Morriston

Prepared for: WDD International

Prepared by: COLVILLE CONSULTING INC.

DATE: January 2024

FILE: C22059

The work plan for this study included the following components:

1. Inventory all live trees greater than 10cm in diameter on and adjacent to proposed development on the Subject Property, including location, size, species, distribution, and health. An individual identification tag was affixed to each tree for future reference;
2. Prepare a figure illustrating the location of live trees on and adjacent to the Subject Property;
3. Prepare a summary report to provide all relevant information for trees on the Subject Property, including recommendations for each tree and appropriate mitigative measures.

Information collected as part of the EIS completed on the Subject Property was reviewed as part of background data collection for this report. This report contains the results of an inventory and data collection that was completed over four days on November 23rd & 24th, 2022 and January 10th and May 31st, 2023. The following parameters were assessed as part of our inventory:

Species – common and botanical names provided in the inventory table.

DBH – diameter at breast height (cm), measured at 1.4 m above the ground.

Dripline – measurement of the outermost circumference of the tree branches

Condition – condition of tree considering trunk integrity, crown structure and crown vigor. Condition ratings include Good, Fair, and Poor.

Location – UTM coordinates of the tagged tree.

The inventory of trees on this property was limited to trees 10 cm in DBH and larger, which were situated within the development footprint and surrounding area. All live trees greater than 10cm in diameter were tagged. A summary of tree tally information is provided in Appendix B.

EXISTING CONDITIONS

A total of 14 vegetation communities were identified on and adjacent to the Subject Property. These vegetation communities were classified and mapped according to the Ecological Land Classification (ELC) System for Southern Ontario. The Subject Property generally occurs on rolling uplands composed of silt or silty very fine sand. In places, the soils are stoney and limestone boulders or cobbles are mixed in with the tills. In the intervening lowlands, large wetland areas support seepage swamps with organic deposits that often exceed 40cm in depth. Although 14 vegetation communities were identified on the Subject Property and mapped on Figure 2, only those directly impacted by the proposed tree removal are discussed below.

Dry - Moist Old Field Meadow Type (CUM1-1)

A large portion of the Subject Property supports an old field meadow. This former agricultural field has been left fallow for some time and now supports an abundance (60-100% vegetation cover) of Smooth Brome, Orchard Grass, Timothy Grass, Kentucky Bluegrass, Quack Grass, Tall Goldenrod, New England Aster, Heath Aster, Spotted Knapweed, Wild Carrot, Canada Thistle, and White Sweet Clover. To facilitate archaeological work on the site, the entirety of the CUM1-1 community was tilled in October 2022, after botanical inventories were conducted.

Sumac Cultural Thicket Type (CUT1-1)

The southwestern edge of the old field meadow supports a cultural thicket which slopes down to a thicket swamp below. Orchard Grass, Tall Goldenrod, Reed-canary Grass and Panicled Aster cover 60 to 100% of the ground layer. Staghorn Sumac forms a 25 to 60% cover of tall shrubs, 1 to 2m + in height. An abundance of Riverbank Grape, Black Walnut saplings and Chokecherry shrubs also occur in this layer.

In the 2 to 10m + height layer is an abundance of young to mature Black Walnut trees, almost forming a Black Walnut Savanna, along with some Red\Green Ash, Common Apple and Staghorn Sumac trees provide between 10 to 25% cover.

Dry - Fresh Deciduous Hedgerow Thicket Ecosite (THDM3)

Separating the old field meadow from the adjacent residential properties of mowed lawns and a parkland, is a very dense thicket of tall Common Buckthorn shrubs, along with a few trees (often Manitoba Maple or Basswood) and Hawthorns forming a shrub hedge-row.

Naturalized Deciduous Hedge-row Ecosite (FODM11)

Hedge-rows of mature (greater than 10m tall) Basswood and Manitoba Maple or Sugar Maple and rarely Black Cherry trees are associated with the old field meadow. The dense sub canopy (2 to 10m in height) and understory layers (1 to 2m in height) are often dominated by Common Buckthorn, Hawthorn species, Riverbank Grape and young Manitoba maple or Cherry species. Thicket Creeper, Asters, Goldenrods, Grasses and Riverbank Grape are abundant in the ground layer.

Some of these hedge-row support mature and large diameter Sugar Maple trees. Noted on the vegetation community map is a former hedge-row or fence line which has now been surrounded and infilled by Fresh - Moist Deciduous Woodland.

Fresh - Moist Deciduous Woodland Ecosite (WODM5)

In places, the old field meadow is bordered by a Fresh - Moist Deciduous Woodland. The open canopy layer (greater than 10 to 25m + in height) is formed by a 10 to 25% cover (in places it is more dense with up to 25 to 60% cover) of mature Basswood, Black Cherry, White Pine, Bitternut Hickory, Sugar Maple or Trembling Aspen trees.

Common Buckthorn, Hawthorn species, vines of Riverbank Grape, Alternate-leaved Dogwood, White Cedar and White Elm form a denser cover (25 to 60% cover or occasional less) in the 2 to 10m height layer. Many large (10-25cm or 25cm + dbh) and open-grown Hawthorns are still standing, forming part of the original woodland cover. However, many are now declining as they are being shaded out or over-topped by Common Buckthorn.

Dry - Fresh White Cedar Coniferous Forest Type (FOC2-2)

Along the rim and upper slopes, adjacent to a coniferous swamp, is a linear stand (possibly a former hedge-row bordering the old field meadow) of Dry - Fresh White Cedar Coniferous Forest. Limestone boulders, likely removed when the adjacent agricultural field was first cleared and plowed, are piled here. Along this pile of stones is an open grown, contorted, and multi trunked White Cedar tree, perhaps a marker tree. This tree is now surrounded by an even aged stand (25-50cm dbh) of White Cedar and occasionally Trembling Aspen, forming a fringe of coniferous forest between the conifer swamp and old field meadow.

Legend

Subject Property

ELC Community

CUM1-1	Dry-Moist Old Field Meadow
CUT1-1	Sumac Cultural Thicket
THDM3	Dry-Fresh Deciduous Hedge-row Ecosite
FODM11	Naturalize Deciduous Hedge-row Ecosite
FOCM5	Naturalized Coniferous Hedge-row Ecosite
WODM5	Fresh-Moist Deciduous Woodland Ecosite
FOMM2-3	Dry-Fresh White Pine - Hardwood Mixed Forest Type
FOC4-1	Fresh-Moist White Cedar Coniferous Forest Type
MAM3-9	Forb Organic Meadow Marsh Type
FOC2-2	Dry-Fresh White Cedar Coniferous Forest Type
SWC3-1	White Cedar Organic Coniferous Swamp Type
SWT2-5	Red-osier Mineral Thicket Swamp Type
MAM2-2	Reed-canary Grass Mineral Meadow Marsh Type
MAMM1-12	Common Reed Graminoid Mineral Meadow Marsh

Figure 2
Extent of Vegetation Communities on the Subject Property

Tree Preservation Plan for 11 Main Street, Morriston

Prepared for: **WDD International**

Prepared by: Colville Consulting Inc.

DATE: January 2024

FILE: C22059

RESULTS

Our inventory indicates that a total of 264 trees greater than 10cm in diameter are located within and adjacent the development footprint on the Subject Property (see Figure 3). Trees inventoried were comprised predominantly of Hawthorn sp. (20%), Eastern White Cedar (13%), American Basswood (11%), Black Cherry (11%), and Sugar Maple (11%) with 17 other species comprising the remaining 34%. Details of the tree inventory are provided in Appendix B and representative site photographs are provided in Appendix C.

Based on the locations of trees on and adjacent the property, it is expected a total of 116 trees will need to be removed to facilitate grading and future construction of the proposed development. Of these 116 trees, eighteen are conditionally recommended for removal due to being boundary trees or located on Public Property immediately adjacent the Subject Property. These trees are located within the hedgerow along the Old Morriston Baseball diamond and cannot be removed without consultation and consent from the Township. Pending the results of this consultation, additional tree removal in the hedgerow may be considered to facilitate future landscaping along the boundary of these properties. Further assessment may be required pending the results of consultation.

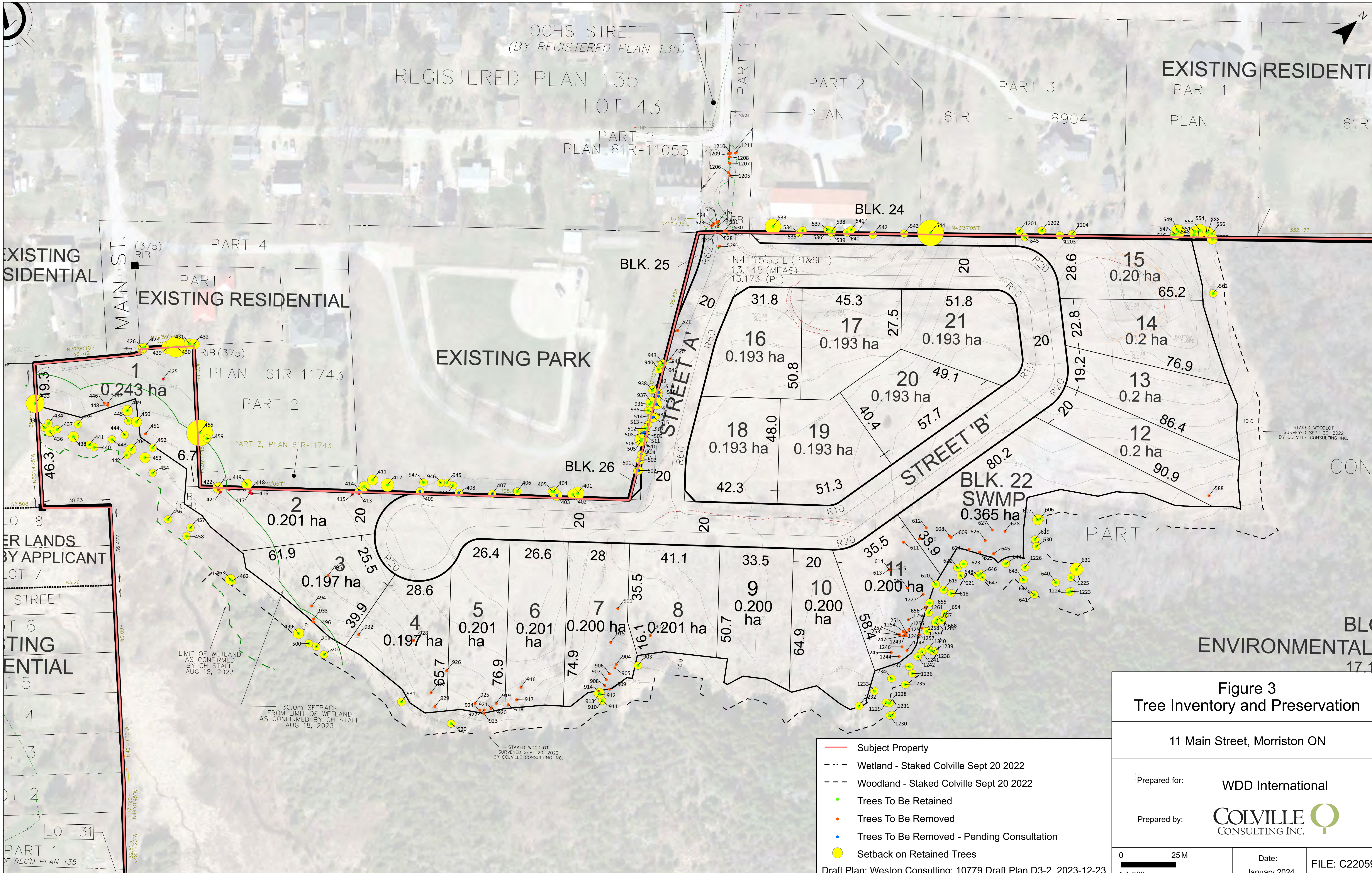
Survey data was initially collected by Colville Consulting Inc and later refined by JD Barnes Ltd. surveying was reviewed to determine if these trees were boundary trees. Information collected by J.D Barnes Ltd. was used in the final determination of boundary trees where inconsistencies in mapping data were observed.

A total of thirteen trees within the road allowance are recommended for removal to allow for the proposed construction of the Ochs Street extension. Removal of these trees will also require consultation with the municipality prior to removal.

A total of 148 trees inventoried are recommended to be retained. These are a mix of publicly and privately owned trees, and also includes trees on the Subject Property located within the buffer zone of the woodland and wetland features to be retained. Minimum Tree Protection Zones (TPZ) for trees to be retained have been mapped on Figure 3 and provided in Appendix B. Additional information on tree protection zone requirements are provided in the mitigation section below.

During the tree inventory, one botanical Species at Risk (SAR) was observed adjacent the Subject Property. A single Butternut was observed adjacent the northwestern corner of the property on private property. An assessment of this tree was conducted twice during the 2023 leaf-on season and it was determined that this tree exhibited external characteristics typical of Butternut hybrids. Because of the location of this tree off-property and visible hybrid characteristics, no further genetic assessment was conducted to determine purity. Additional buffering from this tree is not recommend, however adequate setbacks based on DBH should be adhered to prevent potential injury.

There was a significant range in tree diameters on the property with several large >100cm DBH Sugar Maples and Red Oaks present within the Woodlands on the Subject Property. The average DBH of trees inventoried was 22cm.



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Significant Wildlife Habitat Assessment - Bats

Assessments of potential bat roosting habitat were conducted on November 23, 2022 and May 31, 2023. Our assessment indicates that it is possible that scattered trees in the woodland are providing potential roosting habitat for bats. As no trees in the woodland areas will be removed to facilitate development on the property, potential bat roosting habitat on this property will not be impacted. Further information is provided in the EIS.

SUMMARY AND RECOMMENDATIONS

This report was completed to inventory trees on and adjacent to the proposed development footprint on the property located at 11 Main Street and assess potential impacts the development may have on these trees. From our assessment it is anticipated that 116 trees greater than 10cm in diameter will need to be removed from the Subject Property to facilitate the construction of the proposed development. Of the 116 trees to be removed, 18 are either boundary trees or located entirely on public property. These trees cannot be removed until consultation with the Township and permission for removal has been obtained.

Please note that the assessment and recommendations above are based on the proposed Draft Plan of Subdivision provided by WDD International and illustrated in Figure 3. Should any changes to this plan be required, including changes to grading, an update to this TPP should be completed to address these changes and assess impacts.

MITIGATION MEASURES

To assist in maintaining the health of trees to remain on and adjacent to the Subject Property, it is recommended that the following mitigation measures be implemented.

- A limit of work fence should be erected on the Subject Property where anticipated works are to occur in close proximity to trees. A minimum TPZ as outlined in Appendix B should be installed for trees to be retained prior to the start of construction.
- Equipment use in close proximity to trees to be retained should be minimized where possible. No equipment use should occur within the Tree Protection Zone.
- Construction materials, equipment, soil, construction waste or debris shall not to be stored within the Tree Protection Zone or within the dripline of any trees identified for protection.
- Any trees located adjacent to the development area which are to be retained should be clearly marked with high visibility marking paint.
- Consultation with adjacent landowners is required prior to the removal of boundary trees. It is strongly encouraged that written consent be obtained through this process. Compensation or replacement plantings may be required where boundary trees are removed.
- Compensation for trees removed from the Subject property to facilitate development should be considered to offset any potential negative ecological impacts. It is recommended this tree compensation be incorporated into the landscape planting plan through the planting of native tree species.

- Any tree roots encountered outside of the recommended tree hoarding limit of work fence during excavation should be flush-cut to promote new root growth. Work should be conducted following current arboricultural industry standards and under the supervision of a qualified arborist. If the root damage is extensive and determined to be critical, tree replacement should be discussed with Township.
- A tree risk assessment should be completed where root cutting is required within the Tree Protection Zone to facilitate the installation of underground utilities. Alternative techniques such as boring or hydro excavating are recommended to be employed where possible.
- Any required vegetation removal should be conducted in a manner to avoid impacts to nesting birds and wildlife that may be utilizing habitats on the Subject Property. Any required tree removal is recommended to occur between October 1st and May 31st to avoid the active bird season and prevent negative impacts to bats that may be utilizing trees for roosting on the Subject Property.
- It is recommended that tree and vegetation removal on the Subject Property be completed by a reputable tree clearing contractor to help avoid impacts to trees remaining on the site.
- All areas of disturbed soil should be seeded and vegetated following construction to help minimize soil erosion on the site.

LIMITATIONS OF ASSESSMENT

It is our policy to attach the following clause regarding limitations. We do this to ensure that all interested parties are aware of what is technically and professionally realistic in retaining trees.

The assessment of trees presented in this report has been made using accepted arboricultural techniques. Specifically, we conducted a visual examination of all the above ground parts of the tree for structural defects, external indications of decay such as fungal fruiting bodies and evidence of attack by insects. We also noted the general condition of trees, but did not complete any risk assessments or assessment of hazard potential. Trees were not cored, probed, or climbed and there was no detailed inspection of the root crowns involving excavations.

The observations and recommendations within this document are true for the period that staff were on site and therefore do not include any other activities and/or change in overall condition or health to any trees occurring on site before or after our site visit. The existence of any and all trees on site represent a certain inherent degree of risk and our evaluation and recommendation does not preclude all potential risk of failure. Inspection of trees was conducted using visual examination and limited to information gathered through visual observation.

Notwithstanding the recommendations and conclusions made in this report, it must be recognized that trees are living organisms, and their health and vigour constantly change over time. They are not immune to changes in site conditions or seasonal variations in the weather conditions.

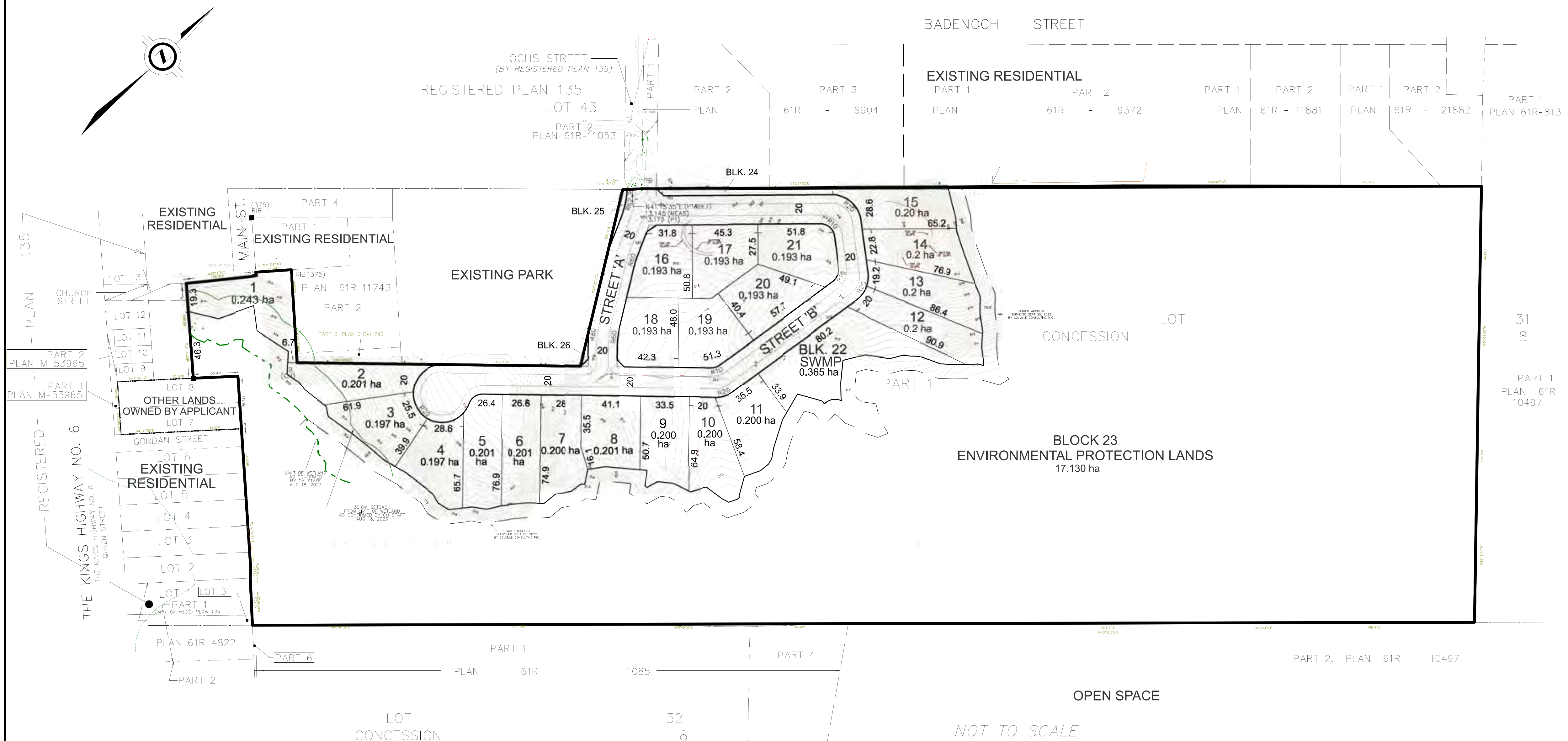
Please do not hesitate to contact the undersigned should you have any questions regarding the results of this report.

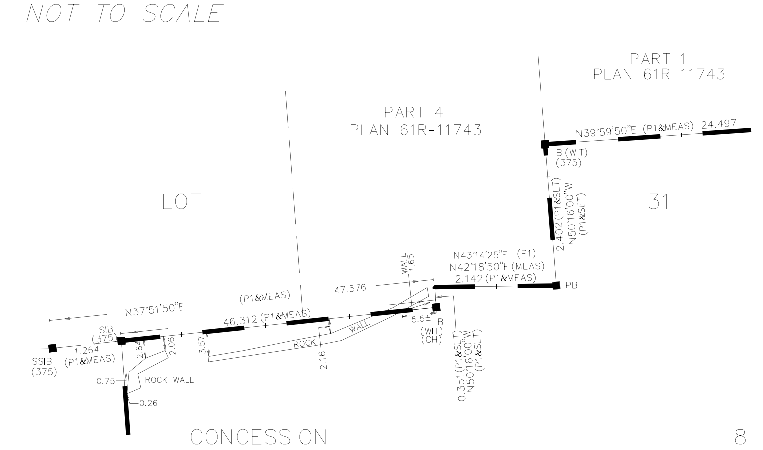
Respectively submitted by:

[redacted]

Brett Espensen, B.A (Hons.), EP.
I.S.A. Certified Arborist (ID: ON-2656A)
Colville Consulting Inc.

Appendix A
Development Plan

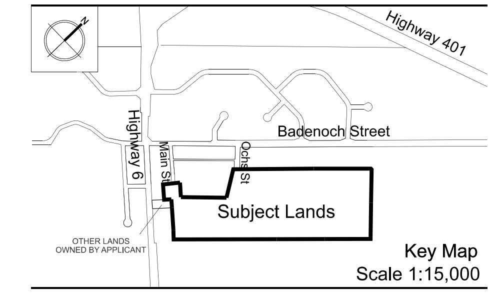




DRAFT PLAN OF SUBDIVISION

PART OF LOTS 7 & 8
NORTH OF QUEEN STREET
REGISTERED PLAN 135

AND PART OF LOT 31
CONCESSION 8
TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON



Key Map
Scale 1:15,000

OWNER'S CERTIFICATE:

I authorize Weston Consulting Group Inc. to prepare and submit this plan for draft approval.

Date:

WDD MAIN STREET Inc. c/o FAISAL HAMADI
499 BRANT STREET
BURLINGTON, ONTARIO L7R 2G5
PHONE: 905-483-7399
info@wddinternational.com

SURVEYOR'S CERTIFICATE:

I hereby certify that the boundaries of the lands being subdivided and their correct relationship to the adjacent lands are accurately and correctly shown on this plan.

Date:

RAYMOND J. SIBTHORP, OLS
J.D. BARNES LIMITED
257 WOODLAWN ROAD WEST, UNIT 101
GUELPH, ONTARIO N1H 8J1
PHONE: (519) 822-4031 www.jdarnes.com

ADDITIONAL INFORMATION:

[Section 51(17) of the Planning Act, R.S.O. 1990, c. P.13], as amended to December 01, 2023.
a), b), e), f), g), j) & l) - on plan.
c) - on key plan
d) - see statistics
h) - piped water to be installed by developer
i) - silty sand, sand and silt, and clayey silt
k) - all services to be made available by developer

DEVELOPMENT STATISTICS:

LOTS/BLOCKS	LOTS	AREA
Single Detached Lots (20 m+) [Lots 1-21]:	21	4.204 ha
SWMP [Blk. 22]:		0.365 ha
Environmental Protection Lands [Blk 23]:		17.130 ha
Additional lands [Blk. 24-26]:		0.076 ha
Roads:		1.329 ha
Total:	21	23.104 ha

SCALE
0 80m

WESTON CONSULTING
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Vaughan, Ontario L4K 5K8
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Toronto, Ontario M5A 2X1
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REVISIONS LIST

20 DEC 2023	Revise cul-de-sac to R=20 m & lots 3-5.
03 OCT 2023	Remove wetland limits by Colville Sept 20, 2022. Remove original edge of trees & staked limit. Insert Staked Woodlot Surveyed Sept 20, 2022 by Colville Consulting Inc.
20 SEP 2023	Remove old treeline, Regulated Limits. Update using 2023-09-11 topo file
15 SEP 2023	Revise ROW width to 20m & revert back to north-east access
11 APR 2023	Revise per updated survey plan & survey text
23 FEB 2023	Revise per topo plan
14 DEC 2022	Revise St. B per grading plan (Crozier) & revise Lots 17-23
11 NOV 2022	Revise ROW width to 18 metres & design lots (min 0.2 ha)
20 OCT 2022	Update drawing using 2022-10-12 survey

File Number:	10779
Drawn By:	SM
Planner:	PT
Scale:	1:1500
CAD:	10040 Draft Plan D9 2023-12-20.dgn

Drawing Number:
D9

INTEGRATION DATA

OBSERVED REFERENCE POINTS (ORPs): UTM ZONE 17, NAD83 (CSRS) (2010.0).
COORDINATES TO URBAN ACCURACY PER SECTION 14 (2) OF O.REG 216/10.

POINT ID	EASTING	NORTHING
ORP (A)	571 819.11	4 810 772.76
ORP (B)	572 189.46	4 811 593.30

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

THE RESULTANT TIE BETWEEN ORP (A) AND ORP (B) IS 900.588 N24°17'31"E

Appendix B

Tree Inventory Data

Tag #	Species		DBH (cm)	Dripline	Setback Required (m)	Health	Location	Remove Or Retain	Other comments
204	Common Apple	*Malus pumila*	32,40,22	5	2.4	Fair	Subject Property	Retain	Coppice, vine growth, water sprouts
206	Eastern White Cedar	*Thuja occidentalis*	20,18,16,18	3	1.8	Good	Subject Property	Retain	
207	Eastern White Cedar	*Thuja occidentalis*	16	2	1.8	Good	Subject Property	Retain	Coppice
401	Manitoba Maple	*Acer negundo*	30,48	5	3.0	Good	Public Property	Retain	Coppice, lots of suckers
402	Manitoba Maple	*Acer negundo*	12,30	4	2.4	Good	Public Property	Retain	
403	Red Oak	*Quercus rubra*	24,40,22,38	5	2.4	Good	Boundary Tree - Public Property	Remove - Pending Consultation	4 large steams, coppice
404	Red Oak	*Quercus rubra*	36	5	2.4	Good	Public Property	Retain	
405	American Basswood	*Tilia americana*	16	4	1.8	Good	Public Property	Retain	Coppice
406	Sweet Cherry	*Prunus avium*	16,16	2	1.8	Good	Public Property	Retain	
407	Black Cherry	*Prunus serotina*	10	2	1.8	Good	Boundary Tree - Public Property	Remove - Pending Consultation	
408	Black Cherry	*Prunus serotina*	14	3	1.8	Fair	Boundary Tree - Public Property	Remove - Pending Consultation	3 stems, two damaged
409	Sugar Maple	*Acer saccharum*	22	3	1.8	Good	Boundary Tree - Public Property	Remove - Pending Consultation	
410	Red Oak	*Quercus rubra*	38	4	2.4	Good	Public Property	Retain	Coppice at 2m
411	Black Locust	*Robinia pseudo-acacia*	32	3	2.4	Good	Public Property	Retain	
412	Red Oak	*Quercus rubra*	40	4	3.0	Good	Public Property	Retain	
413	Black Walnut	*Juglans nigra*	10	4	1.8	Good	Subject Property	Remove	
414	Hawthorn sp.	*Crataegus sp*	14	3	1.8	Fair/Poor	Boundary Tree - Public Property	Retain	
415	Common Apple	*Malus pumila*	26	4	1.8	Good	Subject Property	Remove	
416	Black Walnut	*Juglans nigra*	22	5	1.8	Good	Subject Property	Remove	
417	Black Walnut	*Juglans nigra*	26	5	1.8	Good	Subject Property	Remove	
418	Hawthorn sp.	*Crataegus sp.*	14,14	4	1.8	Good	Subject Property	Remove	
419	Black Walnut	*Juglans nigra*	36	4	2.4	Good	Private Property	Retain	
420	Black Walnut	*Juglans nigra*	36	5	2.4	Good	Subject Property	Remove	
421	Black Walnut	*Juglans nigra*	26	4	1.8	Good	Subject Property	Remove	
422	Black Walnut	*Juglans nigra*	38	5	2.4	Good	Subject Property	Remove	
423	Black Walnut	*Juglans nigra*	36	6	2.4	Good	Boundary Tree -Private Property	Retain	
424	Black Walnut	*Juglans nigra*	18	4	1.8	Good	Subject Property	Retain	
425	Black Cherry	*Prunus serotina*	50	5	3.0	Good	Subject Property	Remove	
426	Sugar Maple	*Acer saccharum*	30	4	2.4	Good	Boundary Tree -Private Property	Retain	Sweep at 1m
427	Sugar Maple	*Acer saccharum*	12	5	1.8	Good	Boundary Tree -Private Property	Retain	
428	Sugar Maple	*Acer saccharum*	22	5	1.8	Good	Boundary Tree -Private Property	Retain	Sweep
429	Sugar Maple	*Acer saccharum*	48,48	5	3.0	Good	Boundary Tree -Private Property	Retain	Coppice, weak union at 1m
430	Sugar Maple	*Acer saccharum*	72	6	4.8	Good	Boundary Tree -Private Property	Retain	
431	Sugar Maple	*Acer saccharum*	30	5	2.4	Good	Boundary Tree -Private Property	Retain	
432	Sugar Maple	*Acer saccharum*	32	5	2.4	Good	Private Property	Retain	
433	Black Walnut	*Juglans nigra*	62,46	6	4.2	Fair	Private Property	Retain	
434	Black Walnut	*Juglans nigra*	20	4	1.8	Good	Subject Property	Retain	
435	Black Walnut	*Juglans nigra*	12	2	1.8	Good	Subject Property	Retain	
436	Weeping Willow	*Salix alba var. tristis*	36,38,26	4	2.4	Fair	Subject Property	Retain	
437	Manitoba Maple	*Acer negundo*	28	3	1.8	Poor	Subject Property	Retain	
438	Manitoba Maple	*Acer negundo*	30	1	2.4	Poor	Subject Property	Retain	
439	Hawthorn sp.	*Crataegus sp.*	12	2	1.8	Fair	Subject Property	Retain	
440	Common Apple	*Malus pumila*	12	3	1.8	Good	Subject Property	Retain	
441	Common Apple	*Malus pumila*	28,26,16	4	1.8	Good	Subject Property	Retain	
442	Common Apple	*Malus pumila*	28,30,16	4	1.8	Good	Subject Property	Retain	
443	Common Apple	*Malus pumila*	12	3	1.8	Good	Subject Property	Retain	
444	Black Walnut	*Juglans nigra*	10	3	1.8	Good	Subject Property	Retain	
445	Black Walnut	*Juglans nigra*	10	3	1.8	Good	Subject Property	Retain	
446	Common Apple	*Malus pumila*	28,16	3	1.8	Fair	Subject Property	Remove	
447	Common Apple	*Malus pumila*	16	2	1.8	Fair	Subject Property	Remove	
448	Black Walnut	*Juglans nigra*	10	3	1.8	Good	Subject Property	Remove	
449	Common Apple	*Malus pumila*	38,20,34	5	2.4	Fair/Good	Subject Property	Retain	
450	Common Apple	*Malus pumila*	26,32,30	5	2.4	Good	Subject Property	Retain	
451	Black Walnut	*Juglans nigra*	28,32	5	2.4	Good	Subject Property	Remove	
452	Black Walnut	*Juglans nigra*	14	2	1.8	Good	Subject Property	Retain	
453	Common Apple	*Malus pumila*	36,38	5	2.4	Fair	Subject Property	Retain	
454	Common Apple	*Malus pumila*	10,10	3	1.8	Good	Subject Property	Retain	
455	Common Apple	*Malus pumila*	90	5	6.0	Fair	Private Property	Retain	

Tag #	Species		DBH (cm)	Dripline	Setback Required (m)	Health	Location	Remove Or Retain	Other comments
456	Common Apple	*Malus pumila*	18,18,16	3	1.8	Fair	Subject Property	Retain	
457	Red Ash	*Fraxinus pennsylvanica*	26	5	1.8	Fair	Subject Property	Retain	
458	Red Ash	*Fraxinus pennsylvanica*	26	4	1.8	Fair/Good	Subject Property	Retain	
459	Common Apple	*Malus pumila*	18	2	1.8	Good	Private Property	Retain	Same as adjacent Tre
462	Eastern White Cedar	*Thuja occidentalis*	22	3	1.8	Good	Subject Property	Retain	
463	Eastern White Cedar	*Thuja occidentalis*	30,28	3	2.4	Good	Subject Property	Retain	Coppice
494	Scots Pine	*Pinus sylvestris*	20	3	1.8	Good	Subject Property	Remove	Surrounded by young cedar
495	Eastern White Pine	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Remove	
496	Eastern White Cedar	*Thuja occidentalis*	12	2	1.8	Good	Subject Property	Remove	
499	Eastern White Cedar	*Thuja occidentalis*	18,28,32,28	4	2.4	Good	Subject Property	Retain	Coppice
500	Eastern White Cedar	*Thuja occidentalis*	22,24	3	1.8	Good	Subject Property	Retain	Coppice
501	American Basswood	*Tilia americana*	22,10	5	1.8	Good	Boundary Tree - Public Property	Remove - Pending Consultation	Coppice, two dead trees adjacent
502	American Basswood	*Tilia americana*	14	1	1.8	Fair	Boundary Tree - Public Property	Remove - Pending Consultation	Moderate branch dieback
503	American Basswood	*Tilia americana*	10	2	1.8	Good	Boundary Tree - Public Property	Remove - Pending Consultation	surrounded by buckthorn
504	American Basswood	*Tilia americana*	18	4	1.8	Good	Public Property	Remove - Pending Consultation	
505	American Basswood	*Tilia americana*	24,16,30	6	2.4	Good	Public Property	Remove - Pending Consultation	Coppice
506	American Basswood	*Tilia americana*	22,48,20	5	3.0	Good	Public Property	Retain	Coppice
507	American Basswood	*Tilia americana*	20	4	1.8	Fair	Public Property	Remove - Pending Consultation	Sweep at 3m, leaning toward ball diamond
508	American Basswood	*Tilia americana*	30	5	2.4	Fair	Public Property	Remove - Pending Consultation	Sweep at 3m, leaning toward ball diamond
509	American Basswood	*Tilia americana*	22	5	1.8	Good	Boundary Tree - Public Property	Remove - Pending Consultation	
510	American Basswood	*Tilia americana*	30,24	5	2.4	Good	Public Property	Retain	Coppice
511	American Basswood	*Tilia americana*	16	4	1.8	Good	Public Property	Retain	
512	American Basswood	*Tilia americana*	22	5	1.8	Good	Public Property	Retain	
513	American Basswood	*Tilia americana*	24	5	1.8	Fair	Boundary Tree - Public Property	Remove - Pending Consultation	Lots of vine growth
514	American Basswood	*Tilia americana*	36	5	2.4	Good	Boundary Tree - Public Property	Remove - Pending Consultation	
515	American Basswood	*Tilia americana*	38	5	2.4	Good/Fair	Boundary Tree - Public Property	Remove - Pending Consultation	branch dieback,
516	American Basswood	*Tilia americana*	16,38	5	2.4	Good	Boundary Tree - Public Property	Remove - Pending Consultation	Coppice, growing against fence
517	American Basswood	*Tilia americana*	14	2	1.8	Fair	Boundary Tree - Public Property	Remove - Pending Consultation	branch dieback, sweep
518	American Basswood	*Tilia americana*	22	4	1.8	Good	Boundary Tree - Public Property	Remove - Pending Consultation	Growing adjacent fence
519	American Basswood	*Tilia americana*	12	3	1.8	Good	Subject Property	Remove	
520	White Elm	Ulmus americana	30	5	2.4	Good	Subject Property	Remove	
521	Sweet Cherry	*Prunus avium*	16	1	1.8	Poor	Subject Property	Remove	
522	Hawthorn sp.	*Crataegus sp.*	12,12	4	1.8	Good	Road Allowance	Remove	
523	Manitoba Maple	*Acer negundo*	14	4	1.8	Good	Road Allowance	Remove	
524	Black Cherry	*Prunus serotina*	54	5	3.6	Good	Road Allowance	Remove	
525	Manitoba Maple	*Acer negundo*	30,10	5	2.4	Good	Road Allowance	Remove	
526	Black Cherry	*Prunus serotina*	10	3	1.8	Good	Road Allowance	Remove	
527	Black Cherry	*Prunus serotina*	10	3	1.8	Good	Road Allowance	Remove	
528	Hawthorn sp.	*Crataegus sp.*	14	4	1.8	Good	Subject Property	Remove	
529	Staghorn Sumac	*Rhus typhina*	12	3	1.8	Good	Subject Property	Remove	
530	Hawthorn sp.	*Crataegus sp.*	16	3	1.8	Good	Subject Property	Remove	
531	Hawthorn sp.	*Crataegus sp.*	16	4	1.8	Good	Subject Property	Remove	
532	Hawthorn sp.	*Crataegus sp.*	12,16	3	1.8	Good	Subject Property	Remove	
533	Sugar Maple	*Acer saccharum*	54	5	3.6	Good	Private Property	Retain	
534	Common Buckthorn	*Rhamnus cathartica*	12,12	4	1.8	Good	Boundary Tree - Private Property	Retain	
535	Manitoba Maple	*Acer negundo*	24	4	1.8	Good	Private Property	Retain	
536	Manitoba Maple	*Acer negundo*	12,14	4	1.8	Good	Private Property	Retain	
537	Manitoba Maple	*Acer negundo*	16,16	4	1.8	Good	Private Property	Retain	
538	Manitoba Maple	*Acer negundo*	20	4	1.8	Good	Private Property	Retain	
539	Manitoba Maple	*Acer negundo*	22	4	1.8	Good	Subject Property	Retain	
540	Common Buckthorn	*Rhamnus cathartica*	14	4	1.8	Fair	Boundary Tree - Private Property	Retain	
541	Manitoba Maple	*Acer negundo*	18	5	1.8	Good	Private Property	Retain	
542	Hawthorn sp.	*Crataegus sp.*	14,14,10,10	4	1.8	Fair	Subject Property	Remove	
543	Manitoba Maple	*Acer negundo*	14	3	1.8	Good	Boundary Tree - Private Property	Retain	
544	Sugar Maple	*Acer saccharum*	98	10	6.0	Good/Fair	Private Property	Retain	
545	Common Apple	*Malus pumila*	22	5	1.8	Good	Boundary Tree - Private Property	Retain	
546	Common Apple	*Malus pumila*	28	4	1.8	Fair	Private Property	Retain	
547	Sugar Maple	*Acer saccharum*	32	4	2.4	Good	Private Property	Retain	

Tag #	Species		DBH (cm)	Dripline	Setback Required (m)	Health	Location	Remove Or Retain	Other comments
548	Sugar Maple	*Acer saccharum*	48	4	3.0	Good	Private Property	Retain	
549	Sugar Maple	*Acer saccharum*	30	5	2.4	Good	Private Property	Retain	
550	Sugar Maple	*Acer saccharum*	16	4	1.8	Good	Private Property	Retain	Coppice, bark dieback
551	Sugar Maple	*Acer saccharum*	30	5	2.4	Good	Private Property	Retain	
552	Sugar Maple	*Acer saccharum*	12	3	1.8	Good	Private Property	Retain	
553	Sugar Maple	*Acer saccharum*	44	5	3.0	Good	Private Property	Retain	
554	Sugar Maple	*Acer saccharum*	14	4	1.8	Good	Private Property	Retain	
555	Sugar Maple	*Acer saccharum*	38	5	2.4	Good	Private Property	Retain	
556	Sugar Maple	*Acer saccharum*	18	4	1.8	Good	Private Property	Retain	
557	Sugar Maple	*Acer saccharum*	30,24	1	2.4	Poor	Subject Property	Retain	Coppice, bark dieback
562	White Cedar	*Thuja occidentalis*	16	2	1.8	Good	Subject Property	Retain	
588	American Basswood	*Tilia americana*	18,14	4	1.8	Good	Subject Property	Remove	Coppice
606	Hawthorn sp.	*Crataegus sp.*	10,10	3	1.8	Good	Subject Property	Retain	
607	Black Cherry	*Prunus serotina*	38,40	4	2.4	Fair	Subject Property	Retain	Dieback, coppice
608	Black Cherry	*Prunus serotina*	22	4	1.8	Good	Subject Property	Remove	
609	Black Cherry	*Prunus serotina*	20	3	1.8	Fair	Subject Property	Remove	some minor dieback
610	Manitoba Maple	*Acer negundo*	34	5	2.4	Fair/Good	Subject Property	Remove	
611	Sugar Maple	*Acer saccharum*	44	5	3.0	Good	Subject Property	Remove	Vine growth
612	Sweet Cherry	*Prunus avium*	10	3	1.8	Good	Subject Property	Remove	
613	Hawthorn sp.	*Crataegus sp.*	18	3	1.8	Good	Subject Property	Remove	
614	Hawthorn sp.	*Crataegus sp.*	18	3	1.8	Good	Subject Property	Remove	
615	Hawthorn sp.	*Crataegus sp.*	20	3	1.8	Good	Subject Property	Remove	
616	Black Cherry	*Prunus serotina*	22	4	1.8	Good	Subject Property	Remove	
618	Hawthorn sp.	*Crataegus sp.*	10,10,12	4	1.8	Good	Subject Property	Retain	
619	Hawthorn sp.	*Crataegus sp.*	20,24	5	1.8	Good	Subject Property	Retain	Coppice, some dieback
620	Black Cherry	*Prunus serotina*	20	4	1.8	Good	Subject Property	Retain	Multi-stem
621	Red Ash	*Fraxinus pennsylvanica*	10	3	1.8	Poor	Subject Property	Retain	Ash borer
622	Hawthorn sp.	*Crataegus sp.*	12	3	1.8	Poor	Subject Property	Retain	dieback, borken limbs
623	Common Buckthorn	Rhamnus cathartica	10,10,10	4	1.8	Fair	Subject Property	Retain	coppice, dieback
624	Black Cherry	*Prunus serotina*	24	4	1.8	Good	Subject Property	Remove	
625	Hawthorn sp.	*Crataegus sp.*	12	3	1.8	Fair	Subject Property	Remove	Coppice
626	Hawthorn sp.	*Crataegus sp.*	14	4	1.8	Good	Subject Property	Remove	
627	Black Cherry	*Prunus serotina*	16	4	1.8	Good	Subject Property	Remove	
628	Black Cherry	*Prunus serotina*	24	4	1.8	Good	Subject Property	Remove	
629	Hawthorn sp.	*Crataegus sp.*	16	4	1.8	Good	Subject Property	Retain	
630	Hawthorn sp.	*Crataegus sp.*	10,10,12	4	1.8	Good	Subject Property	Retain	Coppice
631	Black Cherry	*Prunus serotina*	28,34	4	3.0	Fair	Subject Property	Retain	Coppice, broken stem
640	Hawthorn sp.	*Crataegus sp.*	22,10	3	1.8	Good	Subject Property	Retain	Coppice
641	Eastern White Cedar	*Thuja occidentalis*	12	3	1.8	Good	Subject Property	Retain	
642	Eastern White Cedar	*Thuja occidentalis*	18	3	1.8	Good	Subject Property	Retain	
643	Eastern White Cedar	*Thuja occidentalis*	18	3	1.8	Good	Subject Property	Retain	
644	Common Pear	*Pyrus communis*	26,24	4	1.8	Good	Subject Property	Retain	Coppice
645	Black Cherry	*Prunus serotina*	20	3	1.8	Good	Subject Property	Remove	
646	Black Cherry	*Prunus serotina*	24	3	1.8	Good	Subject Property	Retain	
647	Black Cherry	*Prunus serotina*	18	3	1.8	Good	Subject Property	Retain	
648	Black Cherry	*Prunus serotina*	16	4	1.8	Good	Subject Property	Retain	
654	Hawthorn sp.	*Crataegus sp.*	10,10,12	3	1.8	Good	Subject Property	Retain	Coppice
655	Black Cherry	*Prunus serotina*	22	4	1.8	Good	Subject Property	Retain	
656	Red Ash	*Fraxinus pennsylvanica*	30	2	2.4	Poor/Dead	Subject Property	Remove	Ash borer
657	Sweet Cherry	*Prunus avium*	18	3	1.8	Fair/Poor	Subject Property	Retain	heavy dieback
658	Hawthorn sp.	*Crataegus sp.*	16	4	1.8	Good	Subject Property	Retain	
901	White Elm	Ulmus americana	10	2	1.8	Good	Subject Property	Remove	Rocks placed at trunk base
902	White Elm	Ulmus americana	14	2	1.8	Poor	Subject Property	Remove	lots of vine growth, nearly dead, loose bark
903	Black Cherry	*Prunus serotina*	22	4	1.8	Good	Subject Property	Retain	
904	Black Cherry	*Prunus serotina*	26	4	1.8	Good	Subject Property	Remove	
905	Black Cherry	*Prunus serotina*	24	4	1.8	Good	Subject Property	Remove	
906	American Beech	Fagus grandifolia	26	4	1.8	Fair	Subject Property	Remove	vine growht, peeling bark, sapsucker damage
907	American Beech	Fagus grandifolia	18	4	1.8	Good	Subject Property	Remove	vine growth

Tag #	Species		DBH (cm)	Dripline	Setback Required (m)	Health	Location	Remove Or Retain	Other comments
908	American Beech	Fagus grandifolia	14	3	1.8	Good	Subject Property	Remove	
909	Eastern White Cedar	*Thuja occidentalis*	52	4	3.6	Good	Subject Property	Remove	branch dieback, rocks at trunk base
910	Eastern White Cedar	*Thuja occidentalis*	26	3	1.8	Good	Subject Property	Retain	
911	Black Cherry	*Prunus serotina*	16	1	1.8	Poor	Subject Property	Retain	Near death, some suckers
912	American Beech	Fagus grandifolia	16	3	1.8	Good	Subject Property	Retain	sweep, vine growth
913	Black Cherry	*Prunus serotina*	40	4	2.4	Fair/Good	Subject Property	Retain	branch dieback
914	Black Cherry	*Prunus serotina*	14	3	1.8	Good	Subject Property	Remove	Large, coppice at 2m, minor brnach dieback
915	Black Cherry	*Prunus serotina*	62	3	4.2	Fair/Good	Subject Property	Remove	
916	Eastern White Cedar	*Thuja occidentalis*	12	2	1.8	Good	Subject Property	Remove	
917	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Remove	
918	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Remove	
919	Eastern White Cedar	*Thuja occidentalis*	12	2	1.8	Good	Subject Property	Remove	
920	Eastern White Cedar	*Thuja occidentalis*	14	2	1.8	Good	Subject Property	Remove	
921	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Remove	
922	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Remove	
923	Eastern White Cedar	*Thuja occidentalis*	12	2	1.8	Good	Subject Property	Remove	
924	Eastern White Cedar	*Thuja occidentalis*	12	2	1.8	Good	Subject Property	Remove	
925	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Remove	
926	Eastern White Cedar	*Thuja occidentalis*	12	2	1.8	Good	Subject Property	Remove	
927	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Remove	
928	Scots Pine	Pinus sylvestris	18	2	1.8	Good	Subject Property	Remove	
929	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Remove	
930	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Retain	
931	Eastern White Cedar	*Thuja occidentalis*	10	2	1.8	Good	Subject Property	Retain	
932	Eastern White Cedar	*Thuja occidentalis*	12	2	1.8	Good	Subject Property	Remove	
933	Eastern White Cedar	*Thuja occidentalis*	14	2	1.8	Good	Subject Property	Remove	
934	American Basswood	*Tilia americana*	10	4	1.8	Good	Public Property	Retain	
935	American Basswood	*Tilia americana*	16	4	1.8	Good	Public Property	Retain	
936	American Basswood	*Tilia americana*	12	4	1.8	Good	Public Property	Retain	
937	American Basswood	*Tilia americana*	30	4	2.4	Good	Public Property	Retain	
938	Manitoba Maple	*Acer negundo*	10	3	1.8	Good	Public Property	Retain	leaning, moderate
939	Manitoba Maple	*Acer negundo*	12	4	1.8	Good	Public Property	Retain	deadfall leaning on stem, sweep
940	Sweet Cherry	*Prunus avium*	26,24	5	1.8	Fair/Good	Public Property	Retain	coppice, at 1m, minor branch dieback
941	American Basswood	*Tilia americana*	14	3	1.8	Good	Public Property	Retain	
942	American Basswood	*Tilia americana*	12	3	1.8	Good	Public Property	Retain	
943	American Basswood	*Tilia americana*	12	3	1.8	Good	Public Property	Retain	
944	Red Ash	*Fraxinus pennsylvanica*	12	3	1.8	Poor	Public Property	Retain	ash borer signs, bark peeling
945	American Basswood	*Tilia americana*	16	3	1.8	Good	Public Property	Retain	
946	American Basswood	*Tilia americana*	16	3	1.8	Good	Public Property	Retain	
947	Red Ash	*Fraxinus pennsylvanica*	16	3	1.8	Poor	Public Property	Retain	ash borer signs, bark peeling
1201	Conifer species	*Coniferae sp.*	18	2	1.8	Poor	Private Property	Retain	
1202	Conifer species	*Coniferae sp.*	12	2	1.8	Good	Private Property	Retain	
1203	Conifer species	*Coniferae sp.*	12	2	1.8	Good	Private Property	Retain	
1204	Conifer species	*Coniferae sp.*	12	2	1.8	Good	Private Property	Retain	
1205	Sugar Maple	*Acer saccharum*	40	5	2.4	Fair	Road Allowance	Remove	some branch dieback, vine growth
1206	Sugar Maple	*Acer saccharum*	30	5	2.4	Good	Road Allowance	Remove	good central lead, some branch dieback
1207	Sugar Maple	*Acer saccharum*	38,30	6	2.4	Good	Road Allowance	Remove	coppice, bark wound
1208	Sugar Maple	*Acer saccharum*	10,12	3	1.8	Fair	Road Allowance	Remove	Coppice
1209	Sugar Maple	*Acer saccharum*	12	4	1.8	Good	Road Allowance	Remove	
1210	Sugar Maple	*Acer saccharum*	30,12	4	2.4	Good	Road Allowance	Remove	Coppice
1211	Sugar Maple	*Acer saccharum*	44	5	3.0	Good	Road Allowance	Remove	
1223	Hawthorn sp.	*Crataegus sp.*	14,12	3	1.8	Good	Subject Property	Retain	
1224	White Elm	Ulmus americana	12	1	1.8	Fair	Subject Property	Retain	Branch dieback
1225	Hawthorn sp.	*Crataegus sp.*	12	3	1.8	Good	Subject Property	Retain	
1226	Hawthorn sp.	*Crataegus sp.*	12	3	1.8	Good	Subject Property	Retain	
1227	Hawthorn sp.	*Crataegus sp.*	20,20,14	4	1.8	Fair	Subject Property	Remove	moderate dieback
1228	Hawthorn sp.	*Crataegus sp.*	14	2	1.8	Good	Subject Property	Retain	
1229	Hawthorn sp.	*Crataegus sp.*	12,14	2	1.8	Good	Subject Property	Retain	

Tag #	Species		DBH (cm)	Dripline	Setback Required (m)	Health	Location	Remove Or Retain	Other comments
1230	Hawthorn sp.	*Crataegus sp.*	12	2	1.8	Good	Subject Property	Retain	
1231	Hawthorn sp.	*Crataegus sp.*	10	2	1.8	Good	Subject Property	Retain	
1232	Eastern White Cedar	*Thuja occidentalis*	12	2	1.8	Good	Subject Property	Retain	
1233	Black Cherry	*Prunus serotina*	26	5	1.8	Good	Subject Property	Retain	
1234	Common Pear	*Pyrus communis*	10,24	4	1.8	Good	Subject Property	Retain	
1235	Eastern White Cedar	*Thuja occidentalis*	16	2	1.8	Good	Subject Property	Retain	
1236	Hawthorn sp.	*Crataegus sp.*	10,12,10	2	1.8	Good	Subject Property	Retain	
1237	Hawthorn sp.	*Crataegus sp.*	14,14	3	1.8	Good	Subject Property	Retain	
1238	Hawthorn sp.	*Crataegus sp.*	14,10	2	1.8	Good	Subject Property	Retain	
1239	Hawthorn sp.	*Crataegus sp.*	10	2	1.8	Good	Subject Property	Retain	
1240	Hawthorn sp.	*Crataegus sp.*	10,14	3	1.8	Good	Subject Property	Retain	
1241	Hawthorn sp.	*Crataegus sp.*	12,12	3	1.8	Good	Subject Property	Retain	
1242	Hawthorn sp.	*Crataegus sp.*	12,10,10	2	1.8	Good	Subject Property	Retain	Coppice
1243	Hawthorn sp.	*Crataegus sp.*	14,12,10	3	1.8	Good	Subject Property	Remove	Coppice
1244	Hawthorn sp.	*Crataegus sp.*	10,10,12	3	1.8	Good	Subject Property	Remove	Coppice
1245	Hawthorn sp.	*Crataegus sp.*	10,10	2	1.8	Good	Subject Property	Remove	Coppice
1246	Hawthorn sp.	*Crataegus sp.*	14,10,10	3	1.8	Good	Subject Property	Remove	Coppice
1247	Hawthorn sp.	*Crataegus sp.*	12,10	3	1.8	Good	Subject Property	Remove	Coppice
1248	Hawthorn sp.	*Crataegus sp.*	16,12	3	1.8	Good	Subject Property	Remove	Coppice
1249	Hawthorn sp.	*Crataegus sp.*	12	3	1.8	Good	Subject Property	Remove	
1250	Hawthorn sp.	*Crataegus sp.*	12,12	3	1.8	Good	Subject Property	Remove	Coppice
1251	Hawthorn sp.	*Crataegus sp.*	14	3	1.8	Good	Subject Property	Remove	
1252	Hawthorn sp.	*Crataegus sp.*	12	2	1.8	Good	Subject Property	Remove	
1253	Hawthorn sp.	*Crataegus sp.*	16	3	1.8	Good	Subject Property	Remove	
1254	Hawthorn sp.	*Crataegus sp.*	10,14	3	1.8	Good	Subject Property	Remove	Coppice
1255	Hawthorn sp.	*Crataegus sp.*	10,12,14	3	1.8	Good	Subject Property	Remove	Coppice
1256	Hawthorn sp.	*Crataegus sp.*	12,14	3	1.8	Good	Subject Property	Remove	Coppice
1257	Eastern White Cedar	*Thuja occidentalis*	20	2	1.8	Good	Subject Property	Remove	
1258	Eastern White Cedar	*Thuja occidentalis*	20	2	1.8	Good	Subject Property	Remove	
1259	Hawthorn sp.	*Crataegus sp.*	12,12	3	1.8	Good	Subject Property	Retain	Coppice
1260	Eastern White Cedar	*Thuja occidentalis*	20	2	1.8	Good	Subject Property	Retain	
1261	Hawthorn sp.	*Crataegus sp.*	14,10	3	1.8	Good	Subject Property	Retain	Coppice

Appendix C
Site Photographs

Photo 1: View of wetland buffer area on western portion of Subject Property

Photo 2: Manicured lawn adjacent western portion of Subject Property viewing north towards Main St.

Photo 3: Viewing south at FODM11 hedgerow along Subject Property and Old Morriston Baseball Diamond

Photo 4: Viewing north at FODM11 hedgerow along Subject Property and Old Morriston Baseball Diamond

Photo 5: View of sparse tree growth within CUM1-1 community on Subject Property

Photo 6: View of FODM11 ELC community on centre of Subject Property.

Photo 7: Example of Eastern White Cedars growing on edge of FOC2-2 ELC Community.

Photo 8: Viewing southeast towards unopened Road allowance to Subject Property from intersection of Back St. and Ochs St.

Photo 9: Example of vegetation in unopened road allowance at Ochs St.

Photo 10: Viewing northeast from Ochs St. road allowance towards FODMll community.

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December 21, 2023

Weston Consulting
286 Berkeley Street
Toronto, ON M5A 2X5

Attention: Paul Tobia, BURPL, MCIP, RPP
Senior Planner

Re: Bronte Creek Meander Belt Width Delineation – Updated Draft Plan
11 Main Street
Township of Puslinch, Ontario
GEO Morphix Project No. PN22099

GEO Morphix Ltd. was retained to complete a meander belt width assessment for two tributaries of Bronte Creek to support the proposed residential development at 11 Main Street in the Township of Puslinch, Ontario. One tributary was located within the western portion of the subject lands and flowed generally from northwest to southeast. A second tributary was situated in the eastern portion of the subject lands and flowed generally north to south. The tributary located within the eastern portion of the subject lands was determined to be a low order stream based on field investigations and aerial imagery and therefore, a meander belt width was not required.

Our finalized meander belt width report was submitted to Weston Consulting on February 17, 2023. A 38 m meander belt width based on the Toronto Region Conservation Authority (TRCA, 2004) empirical model was recommended for the reach within the western portion of the subject lands. We understand that the Draft Plan has been updated since our report submission. The updated draft plan does not result in any changes to our meander belt width assessment and a revised report is not required.

We trust this letter meets your requirements at this time. Should you have any questions, please contact the undersigned.

Respectfully submitted,

[redacted], CAN-CISEC, EP, CERP
Director, Principal Geomorphologist

[redacted]
Manager of Watershed Studies

Fluvial Geomorphological and Meander Belt Width Assessment

11 Main Street
Puslinch, Ontario

Prepared for:
Kayly Robbins
Weston Consulting
268 Berkeley St.
Toronto, ON

February 17th, 2023

GEO Morphix Project No. 22099

GEO MORPHIX
Geomorphology
Earth Science
Observations

Report Prepared by:	GEO Morphix Ltd. 36 Main Street North, PO Box 205 Campbellville, Ontario L0P 1B0
Report Title:	Fluvial Geomorphological and Meander Belt Width Assessment, 11 Main Street, Puslinch, Ontario
Project Number:	PN22099
Status:	Draft
First Submission Date:	February 17, 2023 (to consultant team)
Written by:	Kat Woodrow, M.Sc. Lucy Lu, M.Sc., G.I.T.
Approved by:	Paul Villard, Ph.D., P.Geo., CAN-CISEC
Approval Date:	February 17, 2023

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List of Tables

Appendices

1 Introduction

GEO Morphix Ltd. was retained to complete a meander belt width assessment for two unnamed tributaries of Bronte Creek to support natural constraints delineation for the proposed development at 11 Main Street in the Town of Puslinch, Ontario. The property, herein referred to as the "subject site", contains two tributaries of Bronte Creek which flow north to south. Two environmental areas have been identified within the subject site, a wetland within the western portion of the subject site and a wooded area within the eastern portion of the subject site, both staked by North-South Environmental. The two tributaries of Bronte Creek flow through these environmental areas. We understand that Conservation Halton has requested a fluvial geomorphological assessment and meander belt width delineation to identify the potential erosion hazard limits related to the watercourses within the subject site.

To address Conservation Halton's concerns related to natural hazards, and identify the meander belt width associated with the subject site, the following activities were completed:

- Review available background reports and mapping (e.g., watershed/subwatershed reporting, geology, and topography) related to channel form and function and controlling factors related to fluvial geomorphology
- Delineate watercourse reaches based on a desktop assessment (to be confirmed during field reconnaissance)
- Review recent and historical aerial photographs of the site to understand historical changes in channel form and function, and measure meander amplitude and determine the limits of the meander belt width, where possible
- Complete rapid geomorphological field assessments such as Rapid Geomorphological Assessments (RGA) and Rapid Stream Assessment Protocol (RSAT) to characterize the watercourse and confirm reach delineation results of the desktop analysis

2 Watershed Characteristics

The subject site is located within the Bronte Creek watershed, the second largest watershed within Conservation Halton's jurisdiction. Within the subject site, the two tributaries of Bronte Creek flows from north to south. The tributary located within the eastern side of the subject site flows through a natural wooded area, whereas the tributary located within the western side of the subject site flows through a wetland. Both of these tributaries flow through identified environmental areas and converge south of the subject site. The dominant land use of the watershed is agricultural and rural residential, followed by approximately 29% forested land cover as determined by using the Ontario Watershed Information Tool (OWIT, 2022). The subject site is currently used as agriculture, directly adjacent to residential housing and a local park.

2.1 Geology and Physiography

Published mapping indicates the subject site is contained within two physiographic regions, where the contact of the two regions bisects the subject site in a southwest to northeast direction. The northern half of the subject site is contained within the Horseshoe Moraines, dominated by Till Moraine landforms. The subject site to the south is contained within the Flamborough Plains, dominated by limestone plains. Drumlin landforms are mapped directly south of the subject site (Chapman and Putnam, 2007). The quaternary geology of the entire subject site is dominated by Pleistocene Wentworth Till, which consist of highly calcareous clasts in a sandy silt to silt matrix (OGS, 2010). The eastern tributary of Bronte Creek flows parallel to the contact between the two physiographic regions for approximately 400 m through subject site. Contacts between different surficial bedrocks are more easily erodible and tend to form low points in the topography, where water may tend to collect and flow. Thus, it is possible the observed low-grade channel and online wetland system within the study site are a result of this geological contact.

3 Study Area History

A series of historical aerial photographs were reviewed to determine changes to the channel and surrounding land use and land cover. This information, in part, provides an understanding of the historical factors that have contributed to current channel morphodynamics. Historical aerial photographs were obtained from the National Air Photo Library for the years 1945 (scale 1:25,000), 1965 (1:25,000), and 1972 (1:25,000), as well as recent digital imagery from Google Earth Pro (2004 through to 2018). Historical imagery is provided in **Appendix A** for reference.

In 1945, the predominant land use upstream and within the subject site is agriculture and rural residential. A small community of residential properties are adjacent to the subject site in the northwestern corner. The eastern wooded area is sparse and non-continuous, indicating possible forest clearing practices, perhaps for agricultural access or lumber. No tributary or watercourse is visible in the eastern wooded area, but any drainage feature there would be affected by the sparse riparian vegetation. Lands adjacent to the western tributary of Bronte Creek appear to be cultivated to the edges of the watercourse, with no evidence of natural woody riparian vegetation along the tributary within and upstream of the subject site. The lack of riparian vegetation for both western and eastern tributaries likely had a negative impact on channel form, water quality, and instream temperatures.

By 1965, the predominant land use within and adjacent to the subject site remains agricultural and rural residential. Construction of the baseball diamond began prior to 1965 in the northwestern section of the subject site. Riparian lands immediately adjacent to the western tributary of Bronte Creek remain cultivated to the edge of watercourse whereas the vegetation within the wooded area to the east has been permitted to grow and naturalize, enhancing the riparian vegetation along the eastern tributary.

There is little change in the land use, channel planform, or riparian vegetation of the subject site between 1965 and 1972. Between 1972 and 2004, the land use upstream of both tributaries becomes increasingly more residential, with the development of the lands north of Badenoch Street; however, agriculture is still the dominant land use in the area. The lands directly adjacent to the western tributary are no longer cultivated and grassy wetland vegetation is visible in the aerial imagery. By 1972, the wooded area appears as densely vegetated as it appears in aerial images from 2018. From 1945 to 2004, there has been no discernable change in planform of the western tributary while the eastern tributary remains non-visible in the aerial imagery.

In summary, there was limited change to land use within and upstream of the subject site over the period examined, with the exception of increasing residential development upstream of the tributaries in addition to the completion of a public park on the subject site. From a geomorphological perspective, the form and function of the Bronte Creek tributaries has been primarily impacted by agricultural practices, including riparian vegetation removal prior to 1945, but also the increased naturalization of riparian vegetation adjacent to both eastern and western tributaries post 1965. Throughout the period examined, the eastern tributaries remain non-visible in aerial imagery, while there has been no discernable change to the channel planform or size of the western tributary.

4 Reach Delineation

Reaches are homogeneous segments of channel used in geomorphological investigations. Reaches are studied semi-independently as each is expected to function in a manner that is at least slightly different from adjoining reaches. This method allows for a meaningful characterization of a watercourse as the aggregate of reaches, or an understanding of a particular reach, for example, as it relates to a proposed activity.

Reaches are typically delineated based on changes in the following:

- Channel planform
- Channel gradient
- Physiography
- Land cover (land use or vegetation)
- Flow, due to tributary inputs
- Soil type and surficial geology
- Historical channel modifications

Reach delineation follows scientifically defensible methodology proposed by Montgomery and Buffington (1997), Richards et al. (1997), and the Toronto and Region Conservation Authority (2004) as well as others. Prior to the field assessment, four reaches were delineated for the subject site using a mapping stream layer provided by the project team. The reach delineation exercise was then confirmed in the field. Reach **TCB1** is located within the western portion of the study site and three reaches, **TCB3, TCB3a,** and **TCB2**, are located within the eastern portion of the study site. Reach breaks were determined based on changes in surficial geology and flow inputs from tributary confluences. Reach delineation is graphically defined in **Appendix B**.

5 Field Observations

Site observations of **Reaches TBC-1, TBC-2, TBC-3** and **TBC-3a** were collected on November 17th, 2022. Photographs are provided in **Appendix C** and field observations are provided in **Appendix D**.

Reach TBC-1 is located within the western portion of the subject site, oriented in a roughly north – south direction. The reach originates at Highway 6 where the watercourse is conveyed through an oblique concrete box culvert. Upstream (west) of the Highway 6 Road Culvert is a residential yard. At the time of assessment, there was no flowing water, but isolated pools of standing water were present within the subject site except for an area directly downstream of the Highway 6 road culvert. In general, the channels are poorly defined, with soft depressions and pools of water to indicate the flow pathway in some locations. Where discernable, the bankfull width ranged from 1.0 m to 2.0 m, and depth ranged from 0.2 m to 0.3 m. In some locations, multiple soft depressions and pools of water were observed, possibly indicating a multiple channel planform. However, for the majority of its length, the reach is an unconfined channel with no defined banks and heavy vegetation encroachment of wetland grasses. The bed and banks consist of silt and clay, except in the channel directly downstream of the road culvert, where fine gravel was observed in addition to silt and clay material.

Reach TBC-2 is located within the eastern portion of the subject site, along the southern property boundary. Field observations indicate that the portion of **Reach TBC-2** within the subject site contains no defined channel and is instead a swamp consisting of pools of water intermixed with trees, grassy hummocks, and woody debris.

Reach TBC-3 is also located within the eastern woodlot on the subject site. The drainage area for this feature consists of residential land use. This reach eventually converges with **Reach TBC-2** at the downstream extent of the subject site. The reach contains no defined channel or evidence of flow, with no discernable change in the landscape to indicate previous drainage. In several locations where the reach was located via GPS, isolated wetland pockets consisting of shallow pools of water were observed.

Reach TBC-3a is a tributary of **TBC-3** which flows through the wooded area located on the eastern portion of the subject site. The drainage area for this tributary includes residential land use. Field observations indicate this reach contains no channel definition or flow, with no discernable change observed in the landscape.

Reaches TBC-2, **TBC-3**, and **TBC-3a** are all low-order streams with limited upstream drainage areas. As such, the reaches are likely ephemeral in nature and more indicative of a headwater drainage features rather than perennial watercourses. The reaches are graphically shown in **Appendix B**, for reference.

5.1 Rapid Geomorphological Assessments

Rapid geomorphological assessments were completed to identify dominant geomorphic processes, document stream health, and to identify any areas of concern regarding erosion or instability for watercourse features identified on site (**Reach TBC-1**). Channel instability was objectively quantified through the application of the Ontario Ministry of the Environment's (2003) Rapid Geomorphic Assessment (RGA). Observations were quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planimetric adjustment. The index produces values that indicate whether a channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40), or adjusting (score >0.41).

Typically, the Rapid Stream Assessment Technique (RSAT) is also applied to provide a broader view of the system as it considers the ecological function of the watercourse (Galli, 1996). Observations are made of channel stability, channel scouring or sediment deposition, instream and riparian habitats, and water quality. The RSAT score ranks the channel as maintaining a poor (<13), fair (13-24), good (25-34), or excellent (35-42) degree of stream health. A summary of the results of the rapid geomorphological assessments has been provided in **Table 1**. Given the poorly defined channel and limited presence of water or flow, the RSAT could not be applied to **Reach TBC-1**.

Table 1: Rapid Geomorphological Assessment Results for Reach TBC-1

Reach	RGA (MOE, 2003)			RSAT (Galli, 1996)*		
	Score	Condition	Dominant Systematic Adjustment	Score	Condition	Limiting Feature(s)
TBC-1	0.14	In regime	Aggradation, planimetric adjustment	N/A	N/A	N/A

**Limited presence of water or flow in Reach TBC-1 was observed at the time of rapid field assessments. RSAT is not fully applicable.*

The RGA score for **Reach TBC-1** was 0.14, indicating that the channel was in regime. The dominant systematic adjustments were equally aggradation and planimetric adjustment, namely due to deposition in the overbank zone and formation of multiple channels through the wetland riparian zone. However, the presence of these adjustment signs was extremely minor. The overall RGA score still indicates the channel is in a stable state, which is supported by additional field observations. There are no signs of erosion, either historical or active, or other geomorphological processes which could indicate potential system adjustments. The reach is also heavily encroached by grassy vegetation in the active channel which provides an additional control to potential erosion.

6 Meander Belt Width and Erosion Hazard Assessment

Most drainage features in southern Ontario have a natural tendency to develop and maintain a meandering planform, provided there are no spatial constraints. A meander belt width or erosion hazard assessment estimates the lateral extent that a watercourse has historically occupied and will likely occupy in the future. This assessment is therefore useful for determining the potential hazard to proposed activities in the vicinity of a watercourse.

Channel planform is affected by a number of factors such as vegetation, gradient, and stream power. In the case of the western tributary within the study site, the channel is poorly defined and highly vegetated. The gradient is low, reducing the capacity of the drainage feature to develop single defined meanders. Within the eastern portion of the study site, there is no erosion, channel definition, or indicators of previous flow, making the formation of single defined meanders unlikely. The eastern features are ephemeral in nature with no potential for erosion. As such, a meander belt width is not applicable for the eastern features.

When defining the erosion hazard for a watercourse, the Ministry of Natural Resources and Forestry treat unconfined and confined systems differently. Unconfined systems are those with poorly defined valleys or slopes well outside where the channel could realistically migrate. Confined systems are those where the watercourse is contained within a defined valley, where valley wall contact is possible. Within the study site, **Reach TBC-1** is situated within an unconfined valley system.

In unconfined systems, the meander belt width can be determined through a detailed geomorphological study that examines the largest channel meanders observed through historical and recent aerial photo interpretation, to determine the meander migration rate within 100 years. The limit of the erosion hazard and migration potential can also be delineated based on the meander amplitude. Meander amplitude is defined by Leopold et al. (1964) as the lateral distance between tangential lines drawn to the center channel of two successive meander bends. This differs from meander belt, which is measured for a reach between lines drawn tangentially to the outside bends of the laterally extreme meander bends (TRCA, 2004). The meander migration rate, meander belt width, and amplitude quantify the lateral extent of a river's occupation on the floodplain (TRCA, 2004).

Reach TBC-1 was identified as unconfined and poorly defined, with no available reference reach to provide measurable meander amplitudes. Given these conditions, the reach was not traceable through aerial photo interpretation, and the calculation of the 100-year erosion rate was not possible. Instead, empirically based meander belt widths models were reviewed for the reach on the subject lands. These models are scientifically defensible and have been verified in past projects as suitable for use in Southern Ontario. The meander belt width was calculated using a suite of empirical models, outlined below, with a summary of the results outlined in **Table 2.**

The empirical relations from Williams (1986) were modified to include channel area and width, and applied using the bankfull channel dimensions such that:

$$B_w = 18A^{0.65} + W_b \qquad \text{[Eq. 1]}$$

$$B_w = 4.3{W_b}^{1.12} + W_b \qquad \text{[Eq. 2]}$$

where B_w is meander belt width (m), A is bankfull cross-sectional area (m^2), and Wb is bankfull channel width (m). An additional 20% buffer, or factor of safety, was applied to the computed belt width values. This addresses issues of under prediction and provides a factor of safety. The bankfull channel dimensions observed during field reconnaissance were used to inform both the Williams Area and Width (1986) models. As noted in the field observations, the reach is poorly defined, so the geometries collected are based on several spot measurements where a defined channel could be observed. As such, the geometries used for modelling are conservative compared to average conditions where there is poor channel definition.

A meander belt width was also calculated based on TRCA's (2004) empirical model:

$$B_w = -14.827 + 8.319\ln(\rho gQS * DA) \quad \text{[Eq. 3]}$$

where ρ is water density (1000 kg/m^3), g is acceleration due to gravity (9.8 m/s^2), Q is discharge (m^3/s), S is channel slope (m/m), and DA is drainage area (km^2). The TRCA meander belt width values were determined using a drainage area of 1.35 km^2 for **TCB-1** as well as a 2-year discharge of 1.39 m^3/s. These values were based on information provided from the Ontario Watershed Information Tool (OWIT) and GEO Morphix's own flow modelling software. A channel gradient for each reach was also determined based on available elevation/contour data and OWIT. Results of the empirical modelling exercise are outlined in **Table 2**.

Table 2: Meander Belt Width Modelling Results for Reach TBC-1

Reach	Meander Belt Width (m)			Recommended Meander Belt Width (m)
	TRCA* (2004)	Modified Williams – Area** (1986)	Modified Williams – Width** (1986)	
TCB-1	38	10	9	38

**One standard deviation is included as a factor of safety in the TRCA meander belt width value*
***A 20% factor of safety has been included in the modified Williams (area and width) meander belt width value*

The Williams Area and Width models resulted in meander belt widths of 10 m and 9 m. Note that these models are based on bankfull channel geometries collected during field reconnaissance. The average bankfull channel geometries were collected in localized area where a defined channel could be discerned. However, this is not representative of average conditions along the reach given that the channel is generally poorly defined.

For **Reach TCB-1,** we recommend applying a meander belt width of 38 m, following the Toronto Region Conservation Agency (TRCA) model. The TRCA model considers contributing drainage area, flows, and local gradients rather than relying on bankfull channel geometry alone. The 38 m meander belt width is conservative in nature given that there is limited channel definition and very limited erosion potential along this reach. The recommended meander belt width also falls within the current staked wetland boundary and is therefore not a limiting constraint for the proposed development. A map of the meander belt width delineation is provided in **Appendix E**.

7 Summary and Recommendations

Two tributaries of Bronte Creek flow through the western and eastern portion of the subject site at 11 Main Street in Puslinch, Ontario. A desktop assessment was completed which included a review of existing watershed data and historical and recent aerial photographs. Field reconnaissance was also completed to document existing conditions, confirm results of the desktop assessment, and support erosion hazard delineation. This information, in part, will be used in the overall constraint plan to define the limit of development for proposed activities on site.

It was found that the drainage features to the east of the subject site are low-order streams that contain isolated and interspersed wetland pockets within a natural wooded area. No continuous defined stream could be located along each reach within the eastern staked wooded area. As such, there is no potential for erosion and a meander belt width is not applicable.

For **Reach TCB-1,** the watercourse flowing through the western portion of the subject site, a meander belt width of 38 m is recommended. The meander belt width was determined through an empirical modelling exercise. The final meander belt width is conservative given that the channel is small, poorly defined, and shows limited evidence of erosion or adjustment. It should be noted that the meander belt width also sits within an existing staked wetland boundary and is not a limiting constraint on the proposed development.

We trust this report meets your requirements. Should you have any questions, please contact the undersigned.

Respectfully submitted,

[redacted]

Paul Villard, Ph.D., P.Geo., CAN-CISEC, EP, CERP
Director, Principal Geomorphologist

[redacted]

Kat Woodrow, M.Sc.
Manager of Watershed Studies

[redacted]

Lucy Lu, M.Sc., G.I.T.
River Scientist

8 References

Chapman, L.J. and Putnam, D.F. 2007. Physiography of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228.

Galli, J. 1996. Rapid Stream Assessment Technique, Field Methods. Metropolitan Washington Council of Governments.

Montgomery, D.R. and J.M. Buffington. 1997. Channel-reach morphology in mountain drainage basins. Geological Society of America Bulletin, 109 (5): 596-611.

Ontario Geological Survey (OGS). 2010. Surficial geology of Southern Ontario. Ontario Geological Survey. Miscellaneous Release – Data 128-REV.

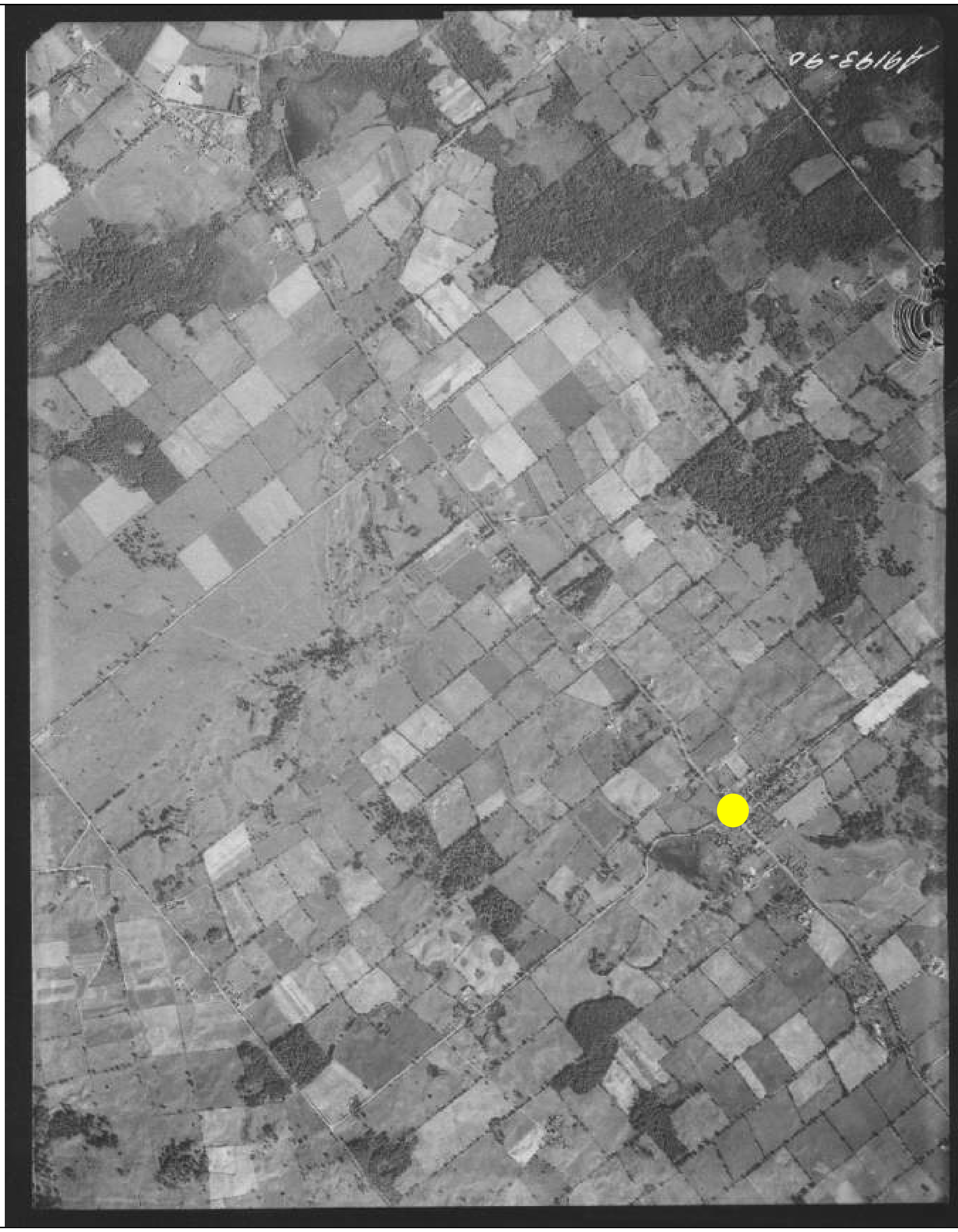
Ontario Ministry of Environment. 2003. Ontario Ministry of Environment. Stormwater Management Guidelines.

Richards, C., Haro, R.J., Johnson, L.B. and Host, G.E. 1997. Catchment and reach-scale properties as indicators of macroinvertebrate species traits. Freshwater Biology, 37: 219-230.

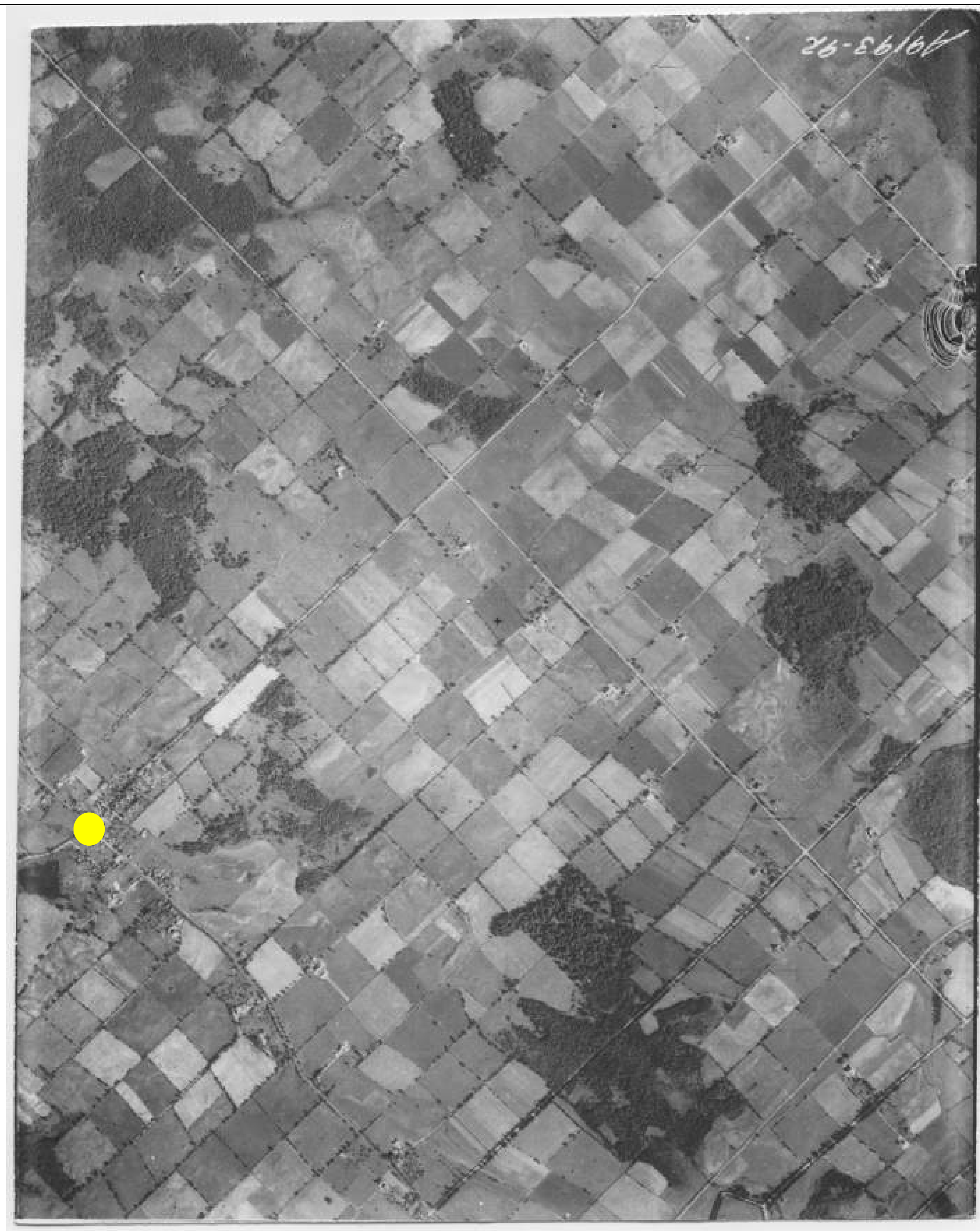
Toronto and Region Conservation Authority (TRCA). 2004. Belt Width Delineation Procedures.

Williams, G.P. 1986. River meanders and channel size. Journal of Hydrology, 88 (1-2): 147-164.

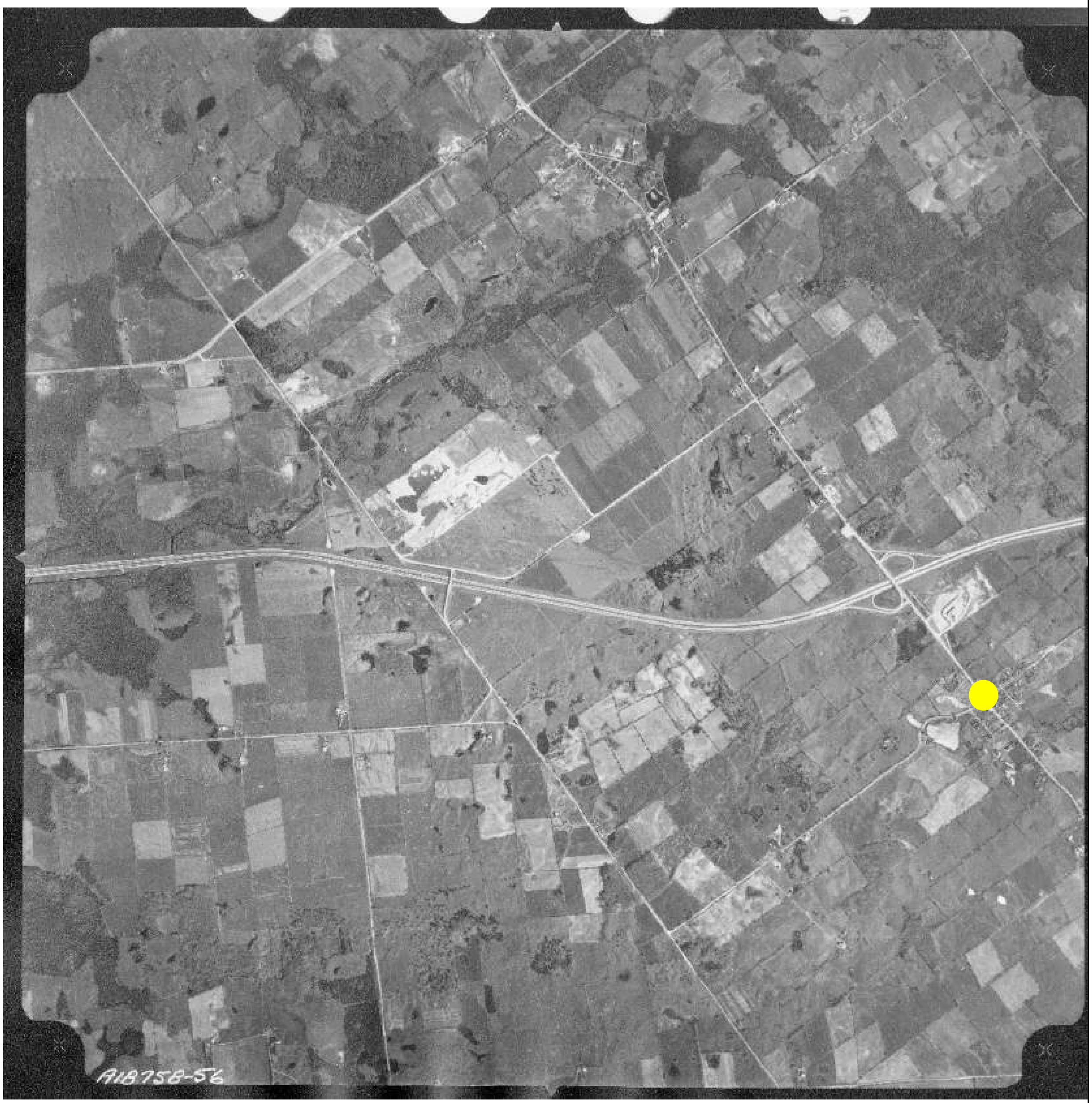
Appendix A
Historical Aerial Photographs



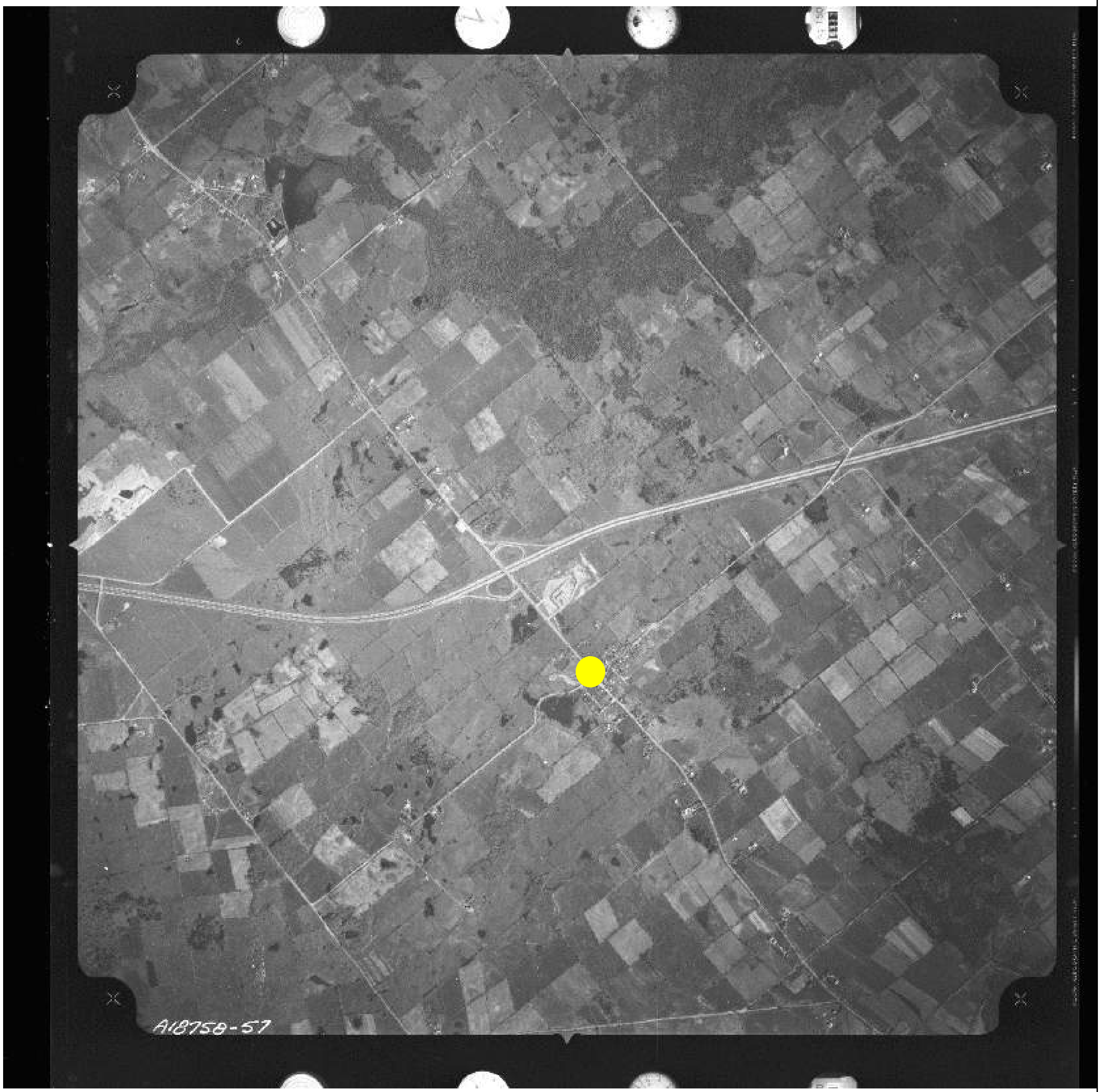
Location: Queen Street and Calfass Road, Town of Puslinch (Yellow Dot)
Year: 1945
Scale: 1:20,000
Source: National Air Photo Library



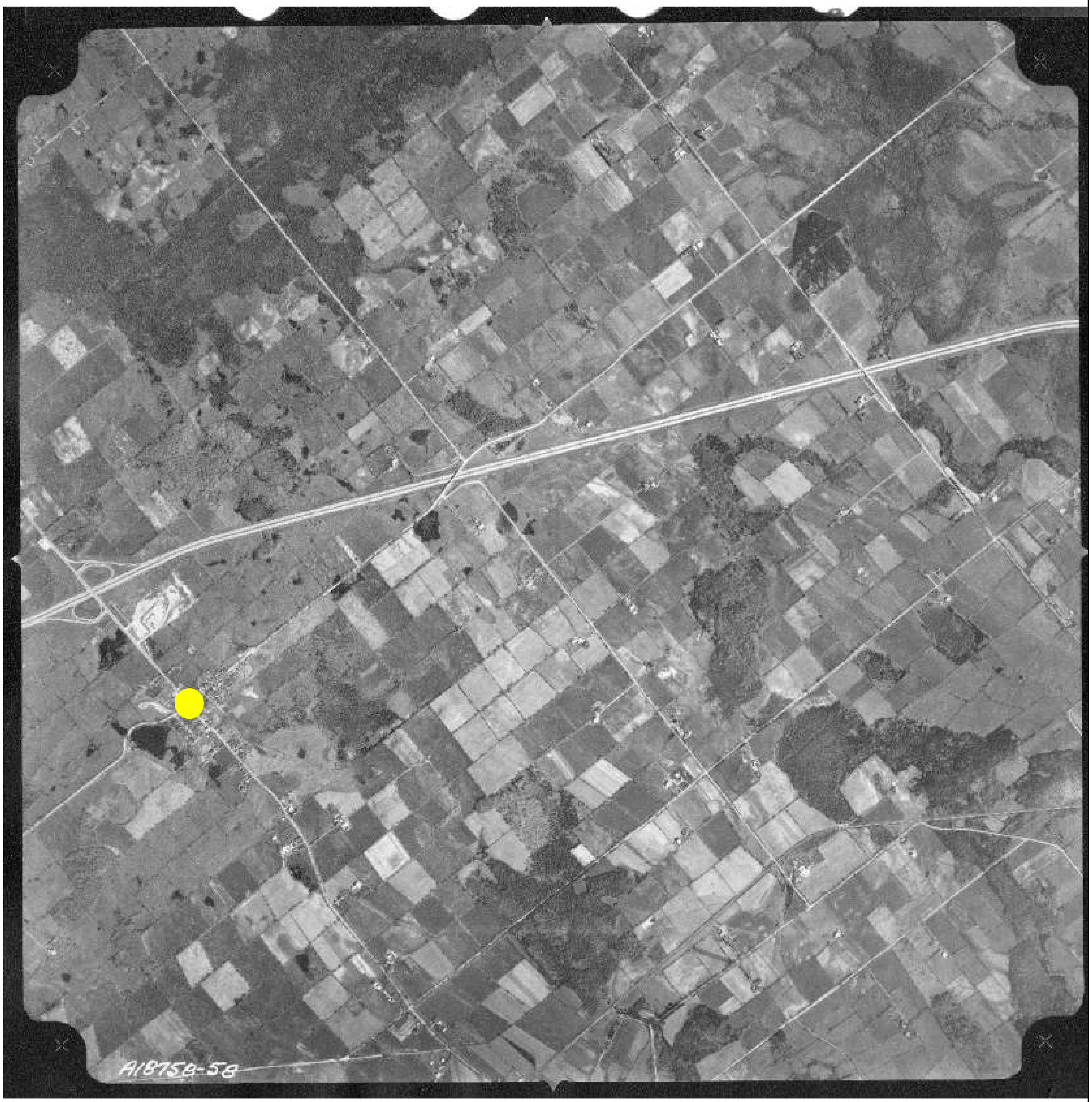
Location: Queen Street and Calfass Road, Town of Puslinch (Yellow Dot)
Year: 1945
Scale: 1:20,000
Source: National Air Photo Library



Location: Queen Street and Calfass Road, Town of Puslinch (Yellow Dot)
Year: 1965
Scale: 1:25,000
Source: National Air Photo Library



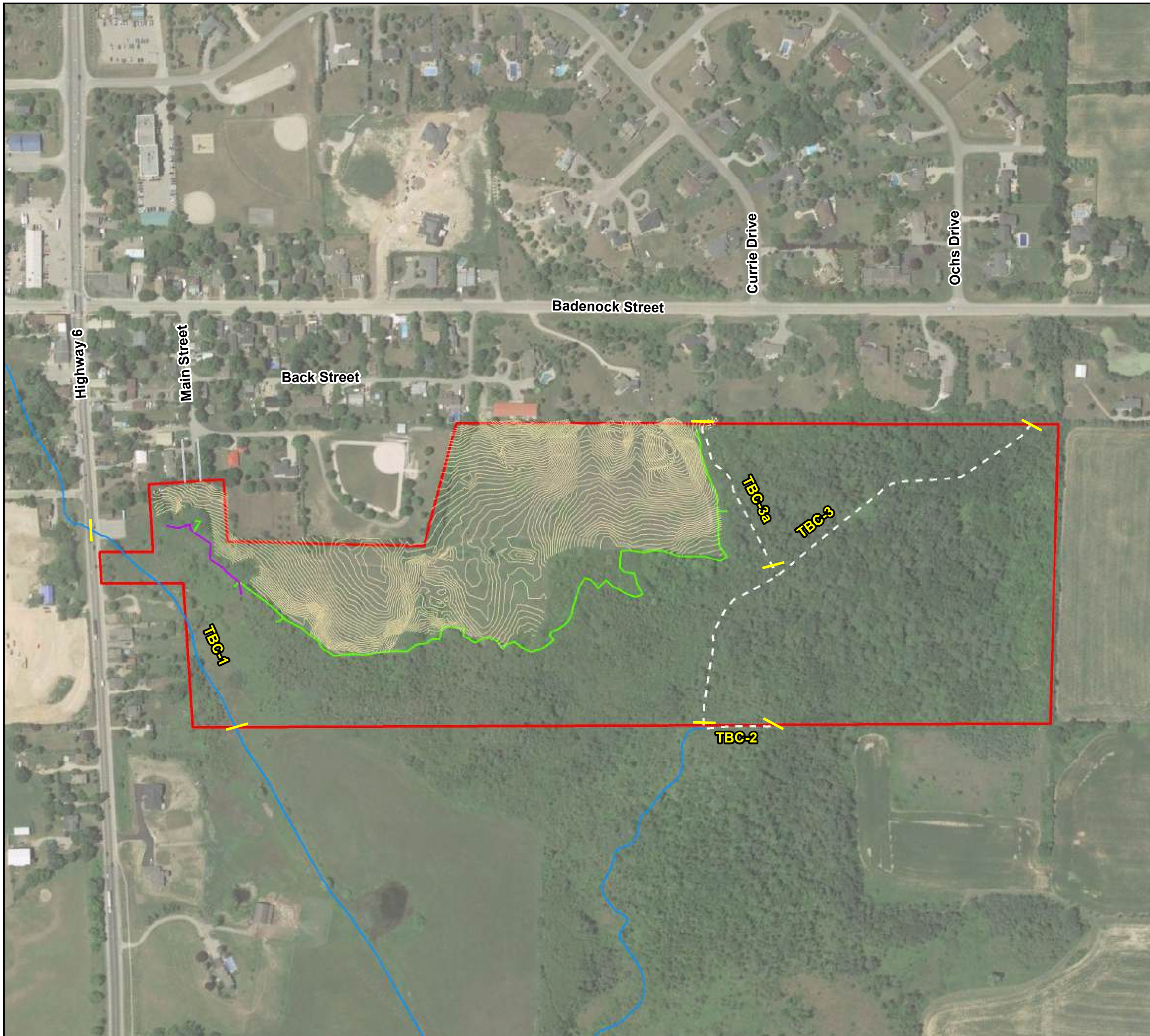
Location: Queen Street and Calfass Road, Town of Puslinch Yellow Dot)
Year: 1965
Scale: 1:25,000
Source: National Air Photo Library



Location: Queen Street and Calfass Road, Town of Puslinch (Yellow Dot)
Year: 1965
Scale: 1:25,000
Source: National Air Photo Library

Location: Queen Street and Calfass Road, Town of Puslinch (Yellow Dot)
Year: 1972
Scale: 1:25,000
Source: National Air Photo Library

Appendix B
Reach Mapping



GEO MORPHIX™

Study Area

Bronte Creek

Puslinch, Ontario

Legend

- Reach Breaks and ID
- Watercourse
- Channel observed in field as ephemeral drainage features
- 0.25 m Contour
- Staked Wetland
- Staked Woodland
- Study Boundary

0 75 150

Metres

Imagery: Google Earth, 2018. Watercourse and Study Boundary: Weston Consulting, 2022. 0.25 m Contour: J.D. Barnes, 2022. Staked Wetland, Staked Woodland: Colville Consulting Inc., 2022. PN22099. Print Date: December 2022.Drawn By: L.L., M.O.

Appendix C
Field Sheets

GEO | MORPHIX
Geomorphology
Earth Science
Observations

General Site Characteristics   Project Code: 22099

Date:	OCT 17th, 2022	**Stream/Reach:**	TBC-1
Weather:	overcast	**Location:**	PUSLINCH
Field Staff:	MK, LL	**Watershed/Subwatershed:**	BRONTE CREEK

Features

- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Medial bar
- Eroded bank
- Undercut bank
- Rip rap/stabilization/gabion
- Leaning tree
- Fence
- Culvert/outfall
- Swamp/wetland
- Grasses
- Tree
- Instream log/tree
- Woody debris
- Station location
- Vegetated island

oblique Box culvert
h: 0.6m
W: 2.7 m
U/S wetland, private development, box culvert

Flow Type

H1	Standing water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall

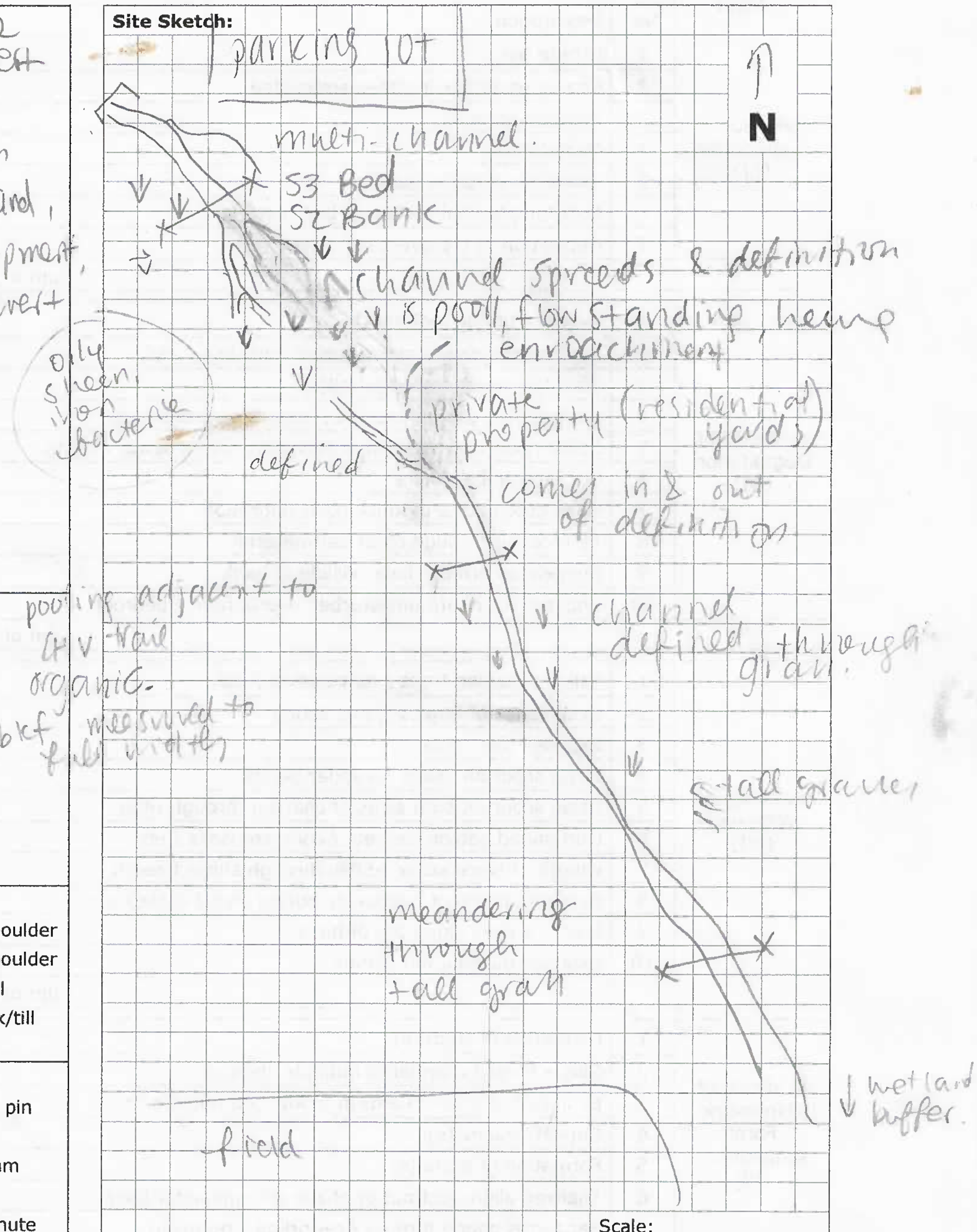
Substrate

S1	Silt	**S6**	Small boulder
S2	Sand	**S7**	Large boulder
S3	Gravel	**S8**	Bimodal
S4	Small cobble	**S9**	Bedrock/till
S5	Large cobble		

Other

BM	Benchmark	**EP**	Erosion pin
BS	Backsight	**RB**	Rebar
DS	Downstream	**US**	Upstream
WDJ	Woody debris jam	**TR**	Terrace
VWC	Valley wall contact	**FC**	Flood chute
BOS	Bottom of slope	**FP**	Flood plain
TOS	Top of slope	**KP**	Knick point

Site Sketch:



Scale:

Additional Notes:

Completed by: LL   Checked by: ________

GEO | MORPHIX

Rapid Geomorphic Assessment **Project Code:** PN22099

Date:	2022-10-17	**Stream/Reach:**	TCB-1
Weather:	OVERCAST	**Location:**	PUSLINCH
Field Staff:	MK LL	**Watershed/Subwatershed:**	BRONTE

Process	No.	Description (Geomorphic Indicator)	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	2/7
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools	✓		
	4	Medial bars		✓	
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone	✓		
		Sum of indices =			0.29
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	N/A		0/7
	2	Exposed sanitary / storm sewer / pipeline / etc.	N/A		
	3	Elevated storm sewer outfall(s)	N/A	✓	
	4	Undermined gabion baskets / concrete aprons / etc.	N/A		
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
		Sum of indices =			0
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.		✓	0/7
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends		✓	
	5	Basal scour on both sides of channel through riffle		✓	
	6	Outflanked gabion baskets / concrete walls / etc.	NA		
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.		✓	
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation	NA		
		Sum of indices =			0
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	2/7
	2	Single thread channel to multiple channel	✓		
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase with meander form		✓	
	7	Bar forms poorly formed / reworked / removed	✓		
		Sum of indices =			0.29

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 =	0.14		
Condition	**In Regime**	**In Transition/Stress**	**In Adjustment**
SI score =	☐ **0.00 - 0.20**	☐ **0.21 - 0.40**	☐ **0.41**

Completed by: LL Checked by: ________

GEO | MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: PN22099

Date:	2022-10-17	**Stream/Reach:**	TCB-1
Weather:	OVERCAST	**Location:**	PUSLINCH
Field staff:	MK LL	**Watershed/Subwatershed:**	BRONTE
UTM (Upstream)		**UTM (Downstream)**	

Land Use (Table 1): 7 | **Valley Type** (Table 2): 1 | **Channel Type** (Table 3): 12 | **Channel Zone** (Table 4): 1 | **Flow Type** (Table 5): 1 | ☐ Groundwater * | Evidence: ______

Riparian Vegetation

Dominant Type: (Table 6) 3/4
Species: ______

Coverage:
- ☐ None
- ☐ Fragmented
- ☒ Continuous

Channel widths
- ☐ 1-4
- ☐ 4-10
- ☒ > 10

Age Class (yrs):
- ☐ Immature (<5)
- ☒ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7) 3-4

Aquatic/Instream Vegetation

Type (Table8): 1 | Coverage of Reach (%): 20

Woody Debris
- ☐ Present in Cutbank
- ☐ Present in Channel
- ☒ Not Present

Density of WD: N/A
- ☐ Low
- ☐ Moderate
- ☐ High

WDJ/50m: 0

Water Quality

Odour (Table 16): 6 organic
Turbidity (Table 17): 3/5

Channel Characteristics

Sinuosity (Type) (Table 9): 2 | **Sinuosity (Degree)** (Table 10): 1 | **Gradient** (Table 11): 1 | **Number of Channels** (Table 12): 2

Entrenchment (Table 13): 1 | **Type of Bank Failure** (Table 14): 1/N/A | **Downs's Classification** (Table 15): D

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☐	☒	☐	☐	☐	☐	☒
Pool Substrate	☒	☐	☐	☐	☐	☐	☐
Bank Material	☒	☐	☐	☐	☐	☐	☒

Bankfull Width (m)	1.0	*POOL 2.00	1.00
Bankfull Depth (m)	0.30	0.20	0.10
Wetted Width (m)	0.62	*pool 0.75	0.48
Wetted Depth (m)	0.105	0.15	0.15

Riffle/Pool Spacing (m) poor R/P structure: / | **% Riffles:** / | **% Pools:** / | **Meander Amplitude:** 0

Pool Depth (m): 0.10 | **Riffle Length (m):** N/a | **Undercuts (m):** Ø | **Comments:**

Velocity (m/s): 0.013 | Ø standing water? | 0.1 | Wiffle ball / ADV / Estimated

Bank Angle
- ☒ 0 – 30
- ☐ 30 – 60
- ☐ 60 – 90
- ☐ Undercut

Bank Erosion
- ☒ < 5%
- ☐ 5 – 30%
- ☐ 30 – 60%
- ☐ 60 – 100%

Notes: WETLAND channel, goes in & out of definition, residential on one side, ~~on~~ park on other

Completed by: LL + MK   Checked by: ______

GEO | MORPHIX
Geomorphology
Earth Science
Observations

General Site Characteristics

Project Code: PN21100

Date:	2022-10-17	**Stream/Reach:**	TBC-2
Weather:	OVERCAST	**Location:**	PUSLINCH
Field Staff:	MK LL	**Watershed/Subwatershed:**	BRONTE

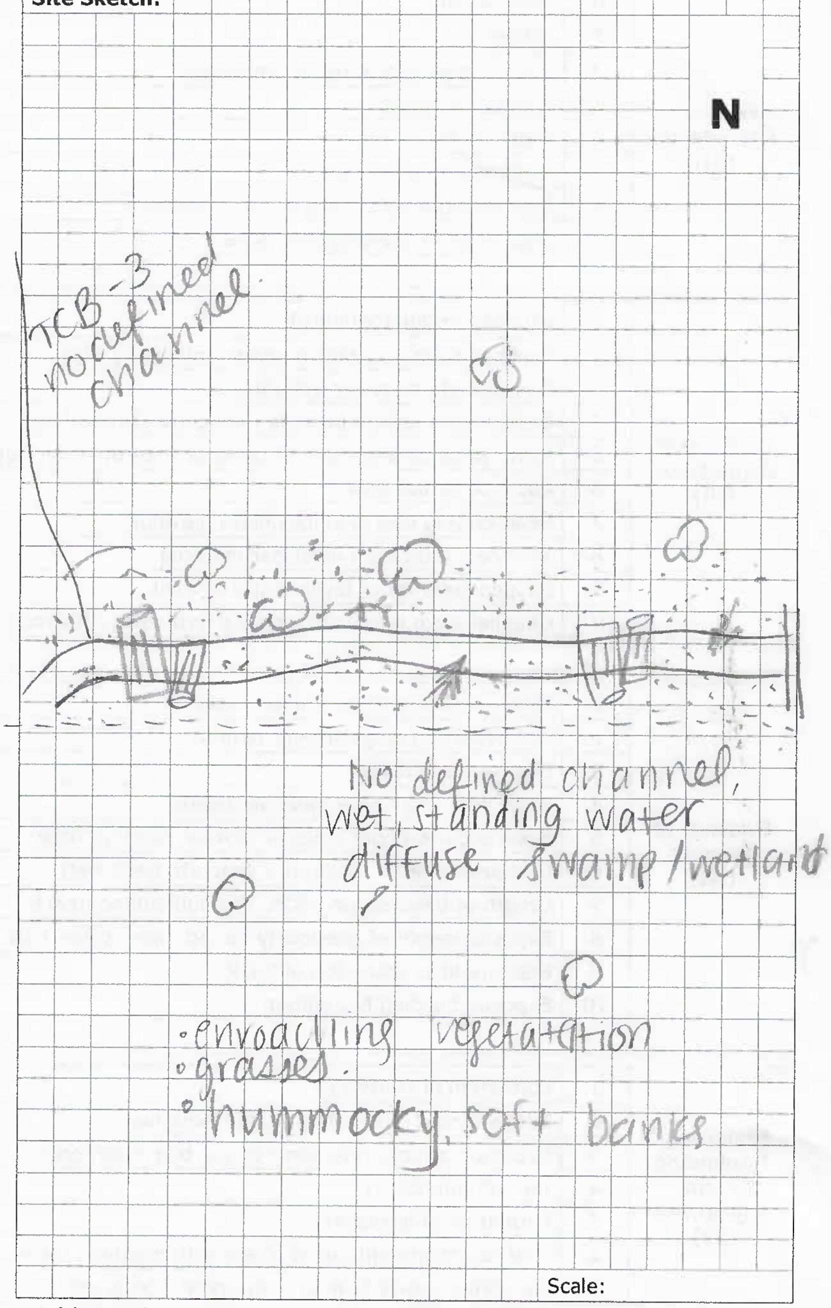
Features
- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Medial bar
- Eroded bank
- Undercut bank
- Rip rap/stabilization/gabion
- Leaning tree
- Fence
- Culvert/outfall
- Swamp/wetland
- Grasses
- Tree
- Instream log/tree
- Woody debris
- Station location
- Vegetated island

Flow Type
- **H1** Standing water
- **H2** Scarcely perceptible flow
- **H3** Smooth surface flow
- **H4** Upwelling
- **H5** Rippled
- **H6** Unbroken standing wave
- **H7** Broken standing wave
- **H8** Chute
- **H9** Free fall

Substrate
- **S1** Silt
- **S2** Sand
- **S3** Gravel
- **S4** Small cobble
- **S5** Large cobble
- **S6** Small boulder
- **S7** Large boulder
- **S8** Bimodal
- **S9** Bedrock/till

Other
- **BM** Benchmark
- **BS** Backsight
- **DS** Downstream
- **WDJ** Woody debris jam
- **VWC** Valley wall contact
- **BOS** Bottom of slope
- **TOS** Top of slope
- **EP** Erosion pin
- **RB** Rebar
- **US** Upstream
- **TR** Terrace
- **FC** Flood chute
- **FP** Flood plain
- **KP** Knick point

Site Sketch:



property line

Scale:

Additional Notes:

Completed by: LL Checked by: ________

GEO | MORPHIX
Geomorphology Earth Science Observations

General Site Characteristics

Project Code: PN22099

Date:	2022-10-17	**Stream/Reach:**	TBC-3
Weather:	OVERCAST	**Location:**	PUSLINCH
Field Staff:	MK LL	**Watershed/Subwatershed:**	BRONTE

Features
- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Medial bar
- Eroded bank
- Undercut bank
- Rip rap/stabilization/gabion
- Leaning tree
- Fence
- Culvert/outfall
- Swamp/wetland
- Grasses
- Tree
- Instream log/tree
- Woody debris
- Station location
- Vegetated island

Flow Type

H1	Standing water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall

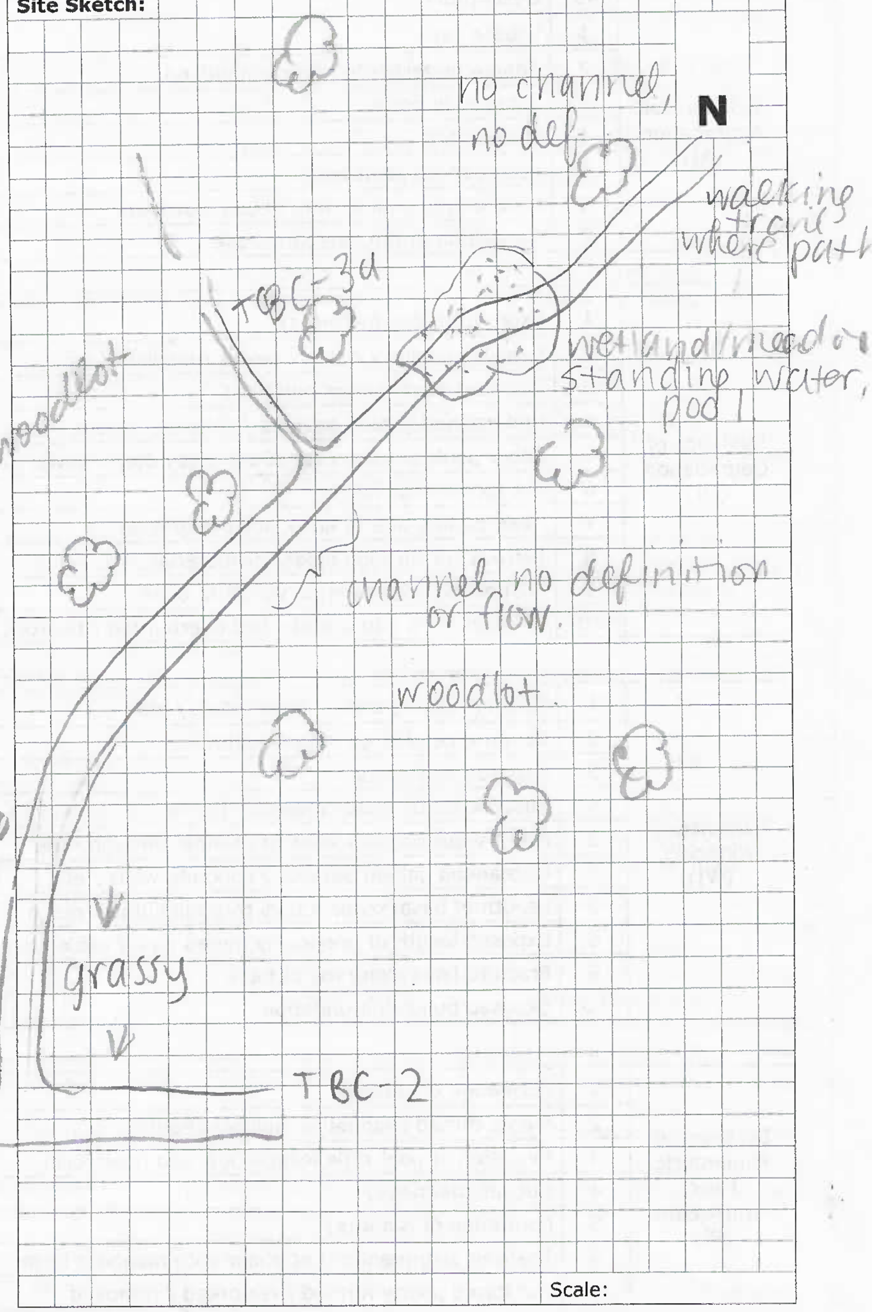
Substrate

S1	Silt	S6	Small boulder
S2	Sand	S7	Large boulder
S3	Gravel	S8	Bimodal
S4	Small cobble	S9	Bedrock/till
S5	Large cobble		

Other

BM	Benchmark	EP	Erosion pin
BS	Backsight	RB	Rebar
DS	Downstream	US	Upstream
WDJ	Woody debris jam	TR	Terrace
VWC	Valley wall contact	FC	Flood chute
BOS	Bottom of slope	FP	Flood plain
TOS	Top of slope	KP	Knick point

Site Sketch:



Scale:

Additional Notes:

Completed by: LL Checked by: ______

GEO | MORPHIX
Geomorphology Earth Science Observations

General Site Characteristics

Project Code: PN22099

Date:	OCT 17th	**Stream/Reach:**	TBC-3a
Weather:	OVERCAST	**Location:**	PUSLINCH
Field Staff:	MK LL	**Watershed/Subwatershed:**	BRONTE

Features
- Reach break
- Cross-section
- Flow direction
- Riffle
- Pool
- Medial bar
- Eroded bank
- Undercut bank
- Rip rap/stabilization/gabion
- Leaning tree
- Fence
- Culvert/outfall
- Swamp/wetland
- Grasses
- Tree
- Instream log/tree
- Woody debris
- Station location
- Vegetated island

Flow Type

H1	Standing water
H2	Scarcely perceptible flow
H3	Smooth surface flow
H4	Upwelling
H5	Rippled
H6	Unbroken standing wave
H7	Broken standing wave
H8	Chute
H9	Free fall

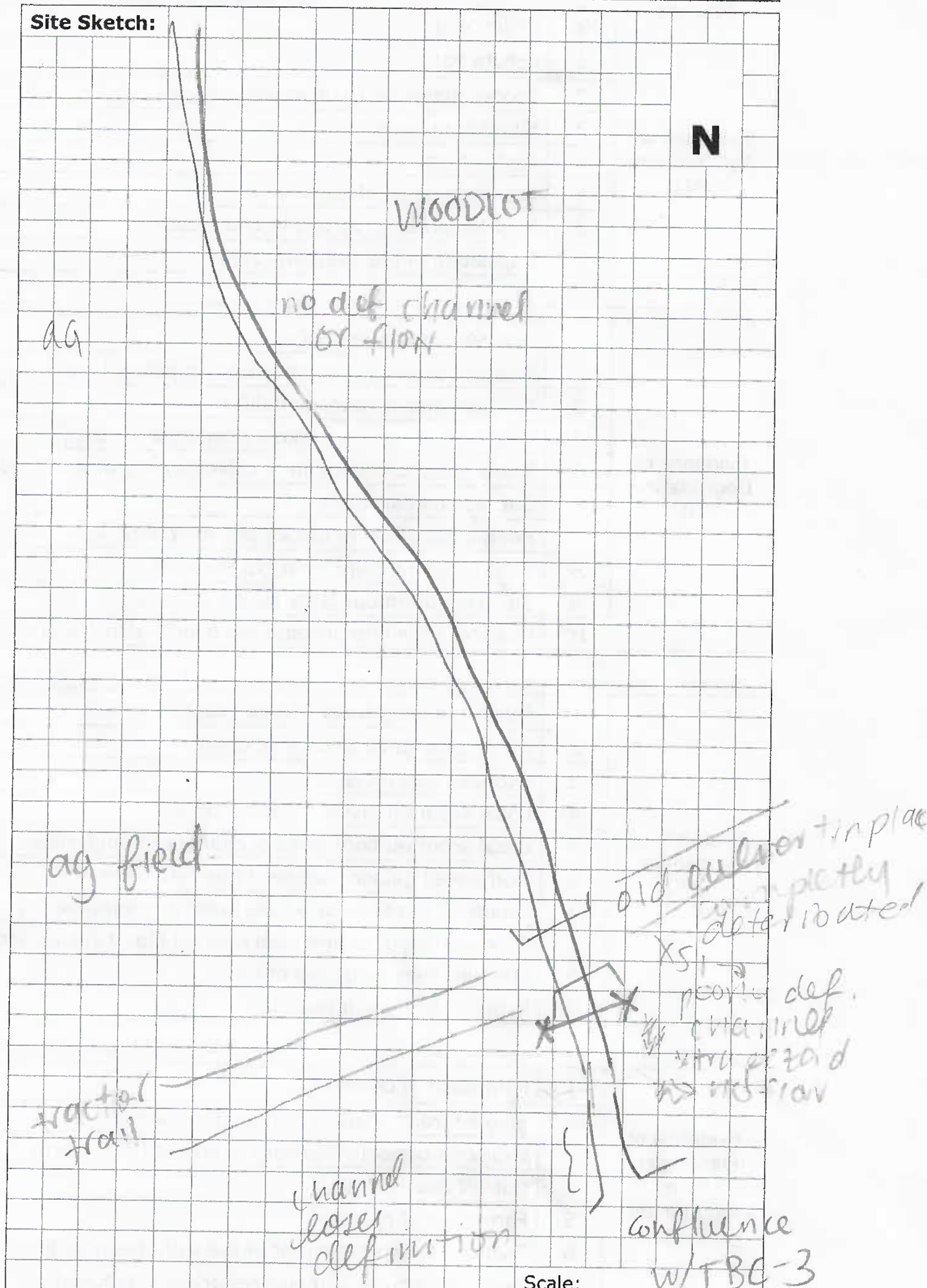
Substrate

S1	Silt	S6	Small boulder
S2	Sand	S7	Large boulder
S3	Gravel	S8	Bimodal
S4	Small cobble	S9	Bedrock/till
S5	Large cobble		

Other

BM	Benchmark	EP	Erosion pin
BS	Backsight	RB	Rebar
DS	Downstream	US	Upstream
WDJ	Woody debris jam	TR	Terrace
VWC	Valley wall contact	FC	Flood chute
BOS	Bottom of slope	FP	Flood plain
TOS	Top of slope	KP	Knick point

Site Sketch:



Scale:

Additional Notes:

Completed by: LL Checked by: ________

Appendix D
Photo Observations

Tributary of Bronte Creek Reach TBC-1 Photo 1	 Highway 6 Concrete box culvert at the upstream extent of TBC-1
Tributary of Bronte Creek Reach TBC-1 Photo 2	 Defined bankfull conditions downstream of culvert. Metre stick for scale.

Tributary of Bronte Creek Reach TBC-1 Photo 3	 The riparian area consisted mainly of tall grasses with sparse herbaceous shrubs and trees. Bankfull channel was poorly defined throughout.
Tributary of Bronte Creek Reach TBC-1 Photo 4	 Downstream of reach as it continues to flow off property boundaries. Outside of pictured grassy riparian area is agricultural field.

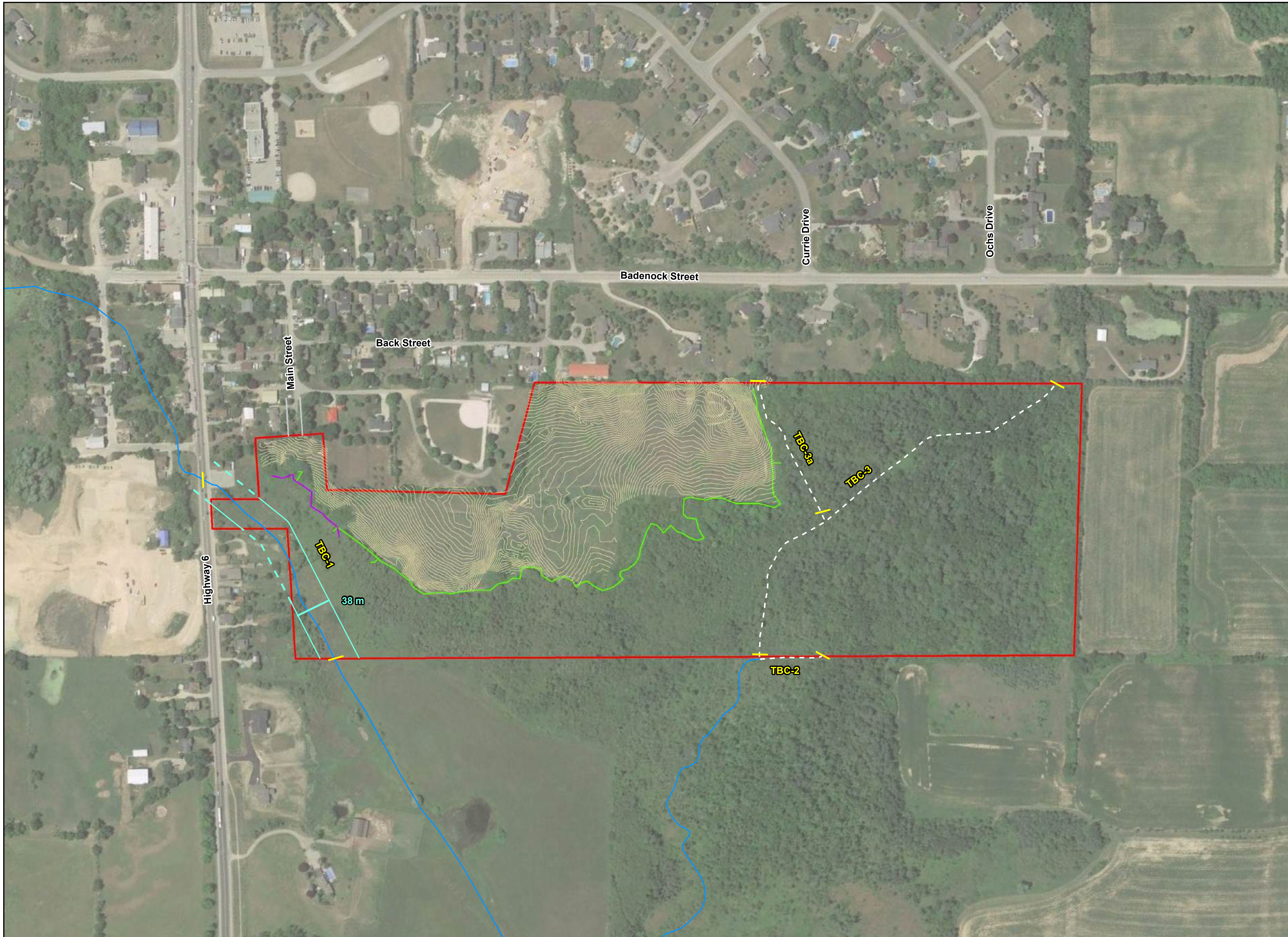
Tributary of Bronte Creek Reach TBC-2 Photo 5	 Hummocky areas with instream grasses and pooled, standing water is typical condition along Reach TBC-2
Tributary of Bronte Creek Reach TBC-2 Photo 6	 Grassy hummocks and trees throughout pools of water. No defined bankfull channel present along Reach TBC-2

Tributary of Bronte Creek Reach TBC-3 Photo 7		
	The riparian zone of Reach TBC-3 contained wooded area. No bankfull channel or flow paths observed in the upstream sections.	
Tributary of Bronte Creek Reach TBC-3 Photo 8		
	A minor flow path was observed in the very downstream extent of the study site, presumed to be associated with mapped stream Reach TBC-3.	

Tributary of Bronte Creek
Reach TBC-3a
Photo 9

The riparian area consisted of wooded area. No defined flow path observed in association with mapped stream Reach TBC-3a

Appendix E
Meander Belt Width Delineation



GEO MORPHIX™

Meander Belt Width Delineation

Bronte Creek

Puslinch, Ontario

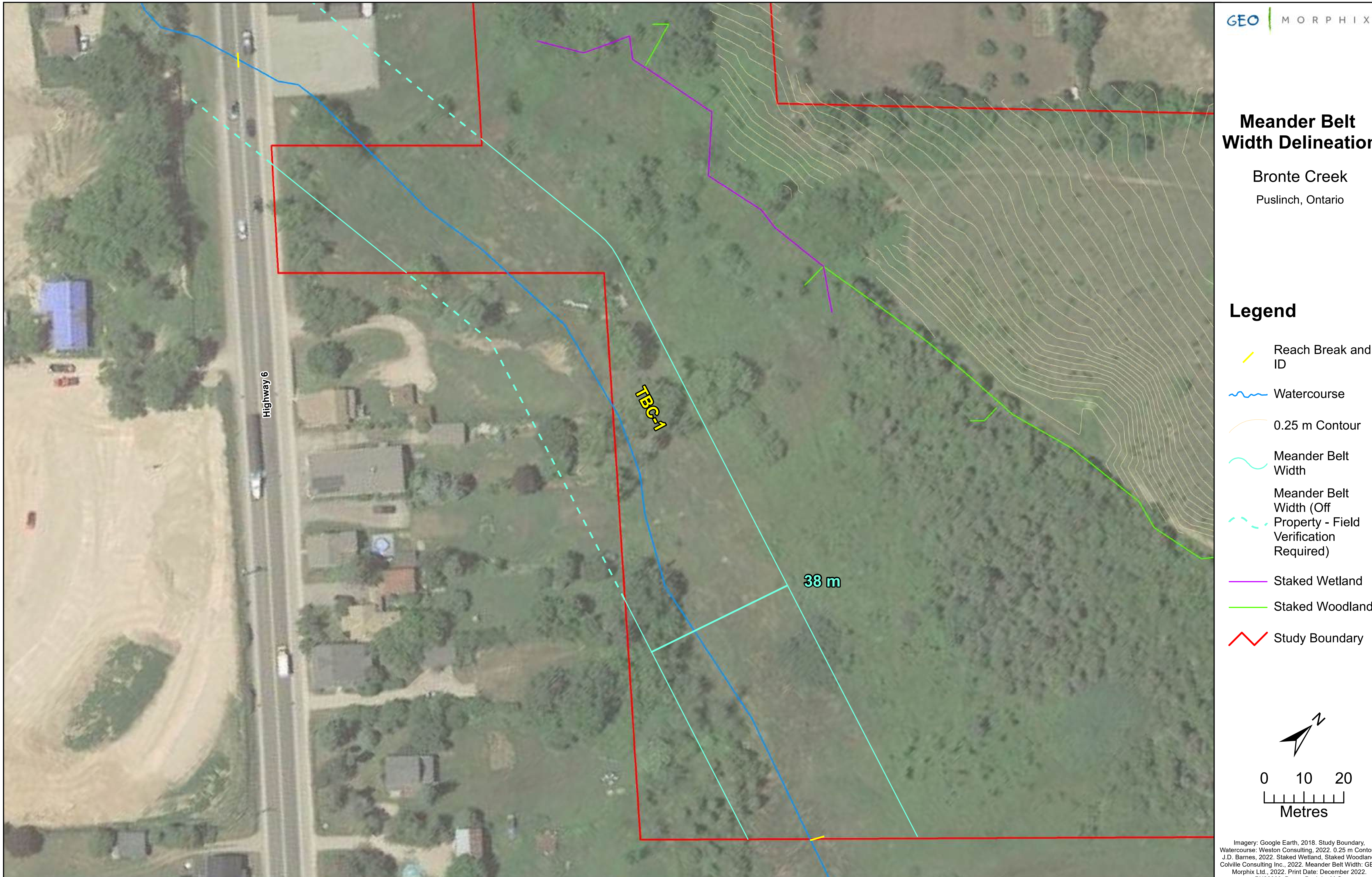
Legend

- Reach Break and ID
- Watercourse
- Channel observed in field as ephemeral drainage features
- 0.25 m Contour
- Meander Belt Width
- Meander Belt Width (Off Property - Field Verification Required)
- Staked Wetland
- Staked Woodland
- Study Boundary

0 75 150

Metres

Imagery: Google Earth, 2018. Study Boundary, Watercourse: Weston Consulting, 2022. 0.25 m Contour: J.D. Barnes, 2022. Staked Wetland, Staked Woodland: Colville Consulting Inc., 2022. Meander Belt Width: GEO Morphix Ltd., 2022. Print Date: February 2023. PN22099. Drawn By: L.L., M.O.


GEO MORPHIX™
Meander Belt Width Delineation
Bronte Creek
Puslinch, Ontario
Legend
Reach Break and ID
Watercourse
0.25 m Contour
Meander Belt Width
Meander Belt Width (Off Property - Field Verification Required)
Staked Wetland
Staked Woodland
Study Boundary
N
0 10 20
Metres
Imagery: Google Earth, 2018. Study Boundary, Watercourse: Weston Consulting, 2022. 0.25 m Contour: J.D. Barnes, 2022. Staked Wetland, Staked Woodland: Colville Consulting Inc., 2022. Meander Belt Width: GEO Morphix Ltd., 2022. Print Date: December 2022. PN22099. Drawn By: L.L., M.O.
Highway 6
TBC-1
38 m

FUNCTIONAL SERVICING & PRELIMINARY STORMWATER MANAGEMENT REPORT

11 MAIN STREET
ESTATE RESIDENTIAL DEVELOPMENT

TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON

PREPARED FOR:

WDD MAIN STREET

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
2800 HIGH POINT DRIVE, SUITE 100
MILTON, ON L9T 6P4

DECEMBER 2023

CFCA FILE NO. 2366-6537

CROZIER
CONSULTING ENGINEERS

Revision Number	**Date**	**Comments**
Rev. 0	February 2023	Issued for First Submission (ZBA)
Rev. 1	December 2023	Issued for Second Submission (ZBA)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

LIST OF FIGURES

1.0 Introduction

C.F. Crozier & Associates Inc. (Crozier) was retained by WDD Main Street (Owner) to prepare a Functional Servicing and Preliminary Stormwater Management Report in support of the Zoning By-Law Amendment Application for the estate residential development located at 11 Main Street in the Township of Puslinch (the site). The purpose of this report is to demonstrate the proposed development is feasible from a functional servicing and stormwater management perspective and conforms with the requirements of the Township of Puslinch (Town), County of Wellington (County), and Conservation Halton (Conservation Authority).

This report has been completed in accordance with the appropriate design guidelines and Township of Puslinch Pre-consultation Comment Summary dated October 21, 2022. The relevant background studies and reports used in preparation of this report include:

- Conservation Halton Guidelines for Stormwater Management Engineering Submissions (November 2021)
- Fluvial Geomorphological and Meander Belt Width Assessment (February 13, 2023)
- Geotechnical Investigation (Terraprobe Inc., October 3, 2023)
- Hydrogeological Assessment (Terraprobe Inc., February 23, 2023)
- Ministry of the Environment Design Guidelines for Drinking-Water Systems (2008)
- Ministry of Environment Stormwater Management Planning and Design Manual (March 2003)
- The Ontario Geologic Survey (OGS) database, accessed February 2023
- The Ontario Building Code (OBC) 2012
- The Township of Puslinch Municipal Development Standards (September 2019)
- Well Record Database, Ministry of the Environment, Conservation and Parks, accessed February 2023

This report has been prepared to address the first submission comments received from the reviewing agencies (April 24, 2023) and to support the second submission of the Zoning By-Law Amendment Application for the proposed development.

2.0 Site Description

The site encompasses an area of approximately 23.60 ha and currently consists of vacant agricultural fields and forested areas. Most of the site is designated as woodlot and wetlands which leaves approximately 5.98 ha of developable area. The site, located in a residential and agricultural area, is bounded by residential dwellings to the north and west, agricultural lands to the east, and forested and agricultural lands to the south.

According to the Development Concept prepared by Weston Consulting dated October 3, 2023, the proposed estate residential development will consist of the following elements:

- Twenty-one (21) estate residential lots with lot sizes ranging from 0.19 ha to 0.24 ha
- A 20.0 m wide urban municipal right-of-way with road access to Ochs Street
- Associated forest, landscaped, stormwater management and amenity areas

The proposed development limits for the proposed development were established based on the following environmental constraints:

- South-western channel 38 m meander belt per the Meander Belt Assessment prepared by Geo Morphix Ltd.
- 10 m offset from the woodlot, staked, and surveyed by Colville Consulting Inc. (September 20, 2022)
- 15 m offset from Regional Floodplain Limits per Conservation Halton HEC-RAS Modelling (BronteReach5, May 14, 2012)

3.0 Soil and Groundwater Conditions

Terraprobe Inc. (Terraprobe) was retained by the Owner to complete a hydrogeological assessment for the proposed residential development. Five (5) boreholes were advanced across the site in August 2022. The boreholes were drilled to depths between 6.1 m and 8.1 m below ground surface (mbgs).

As reported by Terraprobe, the soils encountered consisted of earth fill materials, comprised of sand, with some gravel and trace amounts of rootlets to a depth of 0.8 mbgs.

Underlying the earth fill, silty sand to sand and silt deposits, with trace amounts of clay and gravel was encountered and extended to depths ranging from 0.8 mbgs to the full depth of the borehole. In BH1, a clayey silt deposit with trace amounts of sand was encountered beneath the silty sand to sand and silt layer between 6.1 and 6.6 mbgs. Refer to the Geotechnical Investigation (Terraprobe Inc., October 3, 2023) for the borehole logs and locations.

Referring to Supplementary Standard SB-6 of the 2012 Ontario Building Code (OBC) and the results of the grain size distribution analysis for the soil samples obtained from BH41, BH3, and BH5, the predominant soil is classified as SM-ML soil as described by the Unified Soil Classification System. An SM-ML soil is a silty sand, or sand silt mix with a percolation rate ranging from 8 min/cm to 50 min/cm. Based on the percentage of silt and clay in the soil samples, Crozier assigned a percolation rate of 30 min/cm for this sewage system design.

Monitoring wells were installed in four (4) of the five (5) borehole locations (BH1, BH2, BH3 and BH5) to allow for the measurement of the groundwater levels. Groundwater levels were measured between August 24, 2022, and September 19, 2022. The stabilized groundwater levels ranged from approximately 5.21 m to 6.76 mbgs (311.82 m to 311.42 m above sea level). Refer to the Hydrogeological Assessment (Terraprobe Inc., February 23, 2023) for additional details.

4.0 Water Servicing

4.1 Water Supply

As the property is in a rural area, there is no municipal water infrastructure available to service the proposed development. The water servicing needs for the proposed development will be provided via private drilled drinking water wells. The depth, size, and locations of the wells will be determined during the detailed design of each individual lot. It should be noted that the groundwater in the area is mostly used by privately drilled groundwater wells.

4.2 Fire Flow Calculations

Preliminary calculations were completed to estimate the required fire storage volume for the proposed development, as there is no municipal water supply for firefighting purposes. The fire storage volume was calculated using the Ontario Fire Marshalls Fire Protection Water Supply Guideline (1999), as is required in Part 3 of the Ontario Building Code.

The fire storage volume was calculated assuming a maximum house footprint of 360 m^2, appropriate separation distances, and assuming a Group C (residential) occupancy. The largest calculated fire storage volume will be provided on-site. Table 1 below summarizes the preliminary fire storage volumes calculated for the proposed development.

Table 1: Fire Storage Volume Requirements

Lot	Total Area[1] (m^2)	Height (m)	Volume (m^3)	K[1]	S_{side}[2]	Required Fire Storage Volume, Q (L)
Lot 19	360	6.0	5,400	23	1.8	89,400

1. K values for the proposed residential dwellings are assumed based on past similar residential projects.
2. S_{side} values determined from distance to other structures using Figure 1 in Section 6.3 of the Ontario Fire Marshalls Guidelines.

As can be seen from Table 1, a storage volume of 89,400 L is the required minimum fire storage volume, and it must be supplied at a rate of 45 L/s for a duration of 0.5 hours. Refer to Appendix A for preliminary fire storage volume calculations.

It should be noted the fire flows determined from the Ontario Building Code fire flow method is a conservative estimate for comparison purposes only. The Mechanical Engineer for the development will complete the required analysis for fire protection and the Architect will design fire separation methods per the determined fire flow rate at the Site Plan Approval and Building Permit stage.

A Fire cistern has been provided at this preliminary stage to meet the required fire storage volumes for the proposed development. The location and size of the fire cisterns can be refined throughout the design process through consultation with the Fire Chief and the Township.

5.0 Sanitary Servicing

The site located in a rural area that does not currently have municipal sanitary services available and the Township of Puslinch does not anticipate municipal sanitary servicing for this area in the near future. Therefore, the proposed development will be serviced by individual onsite sewage systems.

5.1 Sanitary Design Calculations

Referring to the Concept Plan prepared by Weston Consulting (October 3, 2023), it is understood the proposed development will consist of twenty-one (21) residential lots with private servicing. It is Crozier's understanding that the proposed residential dwellings will be three (3) to four (4) bedrooms. For the purpose of this assessment, preliminary sewage system design flows were calculated for a typical four (4) bedroom dwelling with 360 m^2 of finished floor area, three (3) bathroom groups and additional fixtures for a total of 45 fixture units.

The preliminary sewage system design flows were calculated in accordance with the Ontario Building Code, Part 8 and are presented below in Table 2. Detailed calculations are found in Appendix B.

Table 2: Preliminary Sewage System Design Flows

Unit Type	**Number of Bedrooms**	**Floor Area** (m^2)	**Number of Fixture Units**	**Base Flow** (L/day)	**Additional Flow – Floor Area** (L/day)	**Additional Flow – Fixture Units** (L/day)	**Total Flow Per Unit** (L/day)
360 m^2 Residential Dwelling	4	360	45	2,000	1,600	1,250	3,600

As shown, the preliminary sewage system design flow for a typical unit will be approximately 3,600 L/day. These flows were calculated based on the information available at the time of this report. If details of the proposed dwellings change (e.g., number of bedrooms, fixtures, and floor area) during detailed design, the sewage system design flows might change, which may affect the size of the onsite sewage systems and the serviceability of the development.

The detailed design of the onsite sewage systems will be confirmed during the building permit stage and building permits will be required for each sewage system prior to construction. Properties with a total daily design sanitary sewage flow exceeding 10,000 L/day are subject to Section 53 of the Ontario Water Resources Act and require an Environmental Compliance Approval (ECA) issued by the Ministry of Environment, Conservation and Parks. Given the preliminary sewage system design flow is less than 10,000 L/day per individual lot, an ECA is not required.

5.2 Proposed Individual Sanitary Servicing Strategy

Sanitary servicing for the proposed development will be provided through individual Class 4 onsite sewage systems. The onsite sewage system will consist of an advanced treatment unit discharging to a leaching bed constructed as a Type A dispersal bed.

5.3 Proposed Sewage System

Nitrate loading calculations were prepared by Terraprobe to determine the effluent concentration of nitrate-nitrogen each sewage system must achieve for the proposed development to meet MECP Guideline D-5-4. Terraprobe has indicated that at least a 62.5% reduction of nitrate-nitrogen (effluent concentration of 15 mg/L) is required. A typical conventional onsite sewage system produces an effluent concentration of nitrate-nitrogen of approximately 40 mg/L. This is insufficient to meet D-5-4 requirements, therefore, advanced treatment with denitrification will be required.

The proposed sewage system will consist of a Level IV treatment unit meeting the CAN/BNQ 3680-600 standard with 62.5% nitrate-nitrogen reduction, discharging treated effluent to a Type A dispersal bed. A Waterloo Biofilter system (or equivalent) with recirculation is proposed. Sewage will flow from the dwelling to a Waterloo Biofilter anaerobic digester tank. Effluent from the digester tank is pumped to the Waterloo Biofilter basket tank, which is equipped with a patented foam media that effectively treats wastewater prior to discharge to the leaching bed. A portion of the treated effluent is recirculated to the anaerobic digester, effecting 62.5% nitrate-nitrogen reduction. Refer to Appendix C for additional information and testing results for this technology.

Treated effluent from the Waterloo Biofilter will be discharged to a Type A dispersal bed sized in accordance with Section 8.7.7. of the OBC. The Type A dispersal bed consists of a stone layer equipped with perforated distribution pipe, underlain by a sand layer. Table 3 summarizes the preliminary sizing of the Type A Dispersal Bed.

Table 3: Preliminary Type A Dispersal Bed Sizing

Unit Type	Total Flow Per Unit (L/day)	Minimum Stone Area (m^2)	Provided Stone Area (m^2)	Minimum Sand Area (m^2)	Provided Sand Area (m^2)
360 m^2 Residential Dwelling	3,600	72	72	240	368

The Preliminary Site Servicing Plans (Figure 1 and Figure 2) illustrate the proposed onsite sewage servicing for the proposed development. The conceptual figure illustrates a Waterloo Biofilter configuration; however, it is noted that any treatment unit meeting CAN/BNQ certification requirements with 62.5% nitrate-nitrogen removal may be considered. The details, size, and location of the onsite sewage systems will be determined once individual home designs and building permit applications are prepared.

6.0 Drainage Conditions

The drainage conditions for the site in both pre-development and post-development conditions are outlined in the following sections.

6.1 Existing Drainage Conditions

According to the topographic survey (J.D. Barnes Limited, September 16, 2022) and site reconnaissance, the site currently consists of vacant agricultural fields and forested areas. The site has a drainage split which divides the site into an eastern and western catchment based on this topographic survey.

The western catchment (Catchment 101) consists primarily of vacant agricultural lands and generally slopes northeast to southwest. Runoff from Catchment 101 is directed via sheet flow to a tributary of Bronte Creek located along the western development limits of the site.

The eastern catchment (Catchment 102) consists primarily of vacant agricultural lands and generally slopes northwest to southeast. Runoff from Catchment 101 is directed via sheet flow to the eastern drainage feature. Correspondence with Geo Morphix (November 23, 2022) indicated the eastern drainage feature does not exhibit a defined channel and outlets to the Bronte Creek tributary located along the southern portion of the site.

There are two external catchments that drain towards the site via overland flow from the north (Catchment EX1 and EX2). Catchment EX1 and EX2 consist of existing residential properties, roadways, landscaped areas, and Old Morriston Baseball Diamond (Catchment EX1 exclusively). Based on existing LiDAR contour mapping and a site visit complete on January 11, 2023, runoff from Catchment EX1 flows from north to south and is directed to a low lying depression area located in the eastern corner of the Old Morriston Baseball Diamond. An earth berm along the south and east property limits of the baseball diamond allows stormwater to pond within the park limits. If the storage limits are reached, stormwater will drain southwest towards the Bronte Creek tributary via sheet flow.

Runoff from Catchment EX2 flows from north to south and is directed to the eastern drainage feature via sheet flow through Catchment 102, ultimately outletting to the Bronte Creek tributary.

Table 4 summarizes the pre-development catchment areas and Figure 6 illustrates the Pre-Development Drainage Plan.

Table 4: Pre-Development Catchment Areas and Percent Impervious

Catchment ID	**Land-Use Description**	**Impervious Area[1]** (ha)	**Pervious Area** (ha)	**Total Area** (ha)	**Percent Impervious** (%)	**Outlet**
101	Vacant agricultural land and forested area	-	2.02	2.02	0	Bronte Creek Tributary
102		-	3.96	3.96	0	
	Site Total	**-**	**5.98**	**5.98**	**0**	
EX1	Residential properties, roadways, landscaped areas, and a baseball diamond	1.55	3.62	5.17	30.0	Bronte Creek Tributary
EX2	Residential properties, roadways, and landscaped areas	0.52	0.89	1.41	37.2	
	External Total	**2.07**	**4.51**	**6.58**	**31.5**	

Note: 1. Impervious area measurements based on Google Earth aerial imaging and is approximate only.

6.2 Proposed Drainage Conditions

Based on the Development Concept prepared by Weston Consulting (October 3, 2023), the proposed development will consist of twenty-one (21) estate residential lots, associated paved internal roadway, and landscaped areas. Access to the proposed development will be provided from the proposed entrance on Ochs Street.

The proposed site grading divides the site into two (2) internal and two (2) external post-development drainage catchment areas as shown on the Post-Development Drainage Plan (Figure 7). Details of each drainage catchment is provided in the following section.

- Catchment 201 (A = 3.50 ha) consists of drainage from the proposed building footprints, front yards fronting Street B, landscaped areas and the internal roadways (Street A and Street B). Storm events up to and including the 5-year event (minor storm events) will be collected and conveyed by the internal storm sewer system to the proposed stormwater management facility. Storm events greater than the 5-year event (major storm events) will be conveyed overland within the internal roadways (Street A and Street B) to the proposed stormwater management facility. The proposed stormwater management facility will provide quantity, quality, and erosion controls for the stormwater runoff from Catchment 201 prior to outletting to the Bronte Creek Tributary, consistent with existing conditions.

- Catchment 202 (A = 2.48 ha) consists of uncontrolled drainage from the proposed building footprints and rear yards along Street B. All storm events from this catchment are proposed to be conveyed uncontrolled via overland flow towards the Bronte Creek tributary south of the site, consistent with existing conditions.

- Catchment EX1 (A = 5.17 ha) consists of uncontrolled external drainage from the existing residential properties, roadways, landscaped areas, and a baseball diamond north of the site. All storm events from this catchment are directed to a low-lying depression area located in the eastern corner of the Old Morriston Baseball Diamond. An earth berm along the south and east property limits of the baseball diamond allows stormwater to pond within the park limits. If the storage limits are reached, stormwater will drain southwest between Lot 1 and Lot 2 towards the Bronte Creek tributary via sheet flow, consistent with existing conditions.

- Catchment EX2 (A = 1.41 ha) consists of uncontrolled external drainage from the existing residential properties, roadways, and landscaped areas north of the site. All storm events from this catchment are conveyed by the proposed storm sewer infrastructure and internal roadway within the development towards the proposed stormwater management facility, ultimately outletting to the Bronte Creek tributary.

Under the proposed drainage conditions, all storm events up to the 100-year storm from Catchment 201 will be conveyed to the proposed stormwater management facility. Following quantity and quality control, stormwater be conveyed to the Bronte Creek Tributary.

Table 5 provides details of the catchment areas and percent imperviousness for the post-development conditions.

Table 5: Post-Development Catchment Areas and Percent Impervious

Catchment ID	Description	Impervious Area (ha)	Pervious Area (ha)	Total Area (ha)	Percent Impervious (%)	Outlet
201	Building footprints, front yards, and internal roadway.	1.93	1.57	3.50	55.1	Bronte Creek Tributary
202	Building footprints and rear yards	0.80	1.68	2.48	32.3	
	Site Total	**2.73**	**3.25**	**5.98**	**45.6**	
EX1	Residential properties, roadways, landscaped areas, and a baseball diamond	1.55	3.62	5.17	30.0	Bronte Creek Tributary
EX2	Residential properties, roadways, and landscaped areas	0.52	0.89	1.41	37.2	
	External Total	**2.07**	**4.51**	**6.58**	**31.5**	

Refer to the Post-Development Drainage Plan (Figure 7) for proposed drainage conditions and the Preliminary Site Servicing and Preliminary Site Grading Plans (Figure 1-4) that illustrates the proposed site servicing and drainage.

7.0 Stormwater Management

Stormwater management and site drainage for the proposed development must adhere to the policies and standards of the Township of Puslinch, Conservation Halton, and Ministry of Environment, Conservation, and Parks (MECP).

The stormwater management criteria for the development have been summarized below:

Water Quantity Control

According to the Township of Puslinch Municipal Development Standards (September 2019), water quantity controls are required for the site. The water quantity requirements include controlling the post-development peak runoff rates to the pre-development peak runoff rates for storms up to and including the 100-year event (i.e., 2, 5, 10, 50, 100-year return period).

Water Quality Control

At least 80% removal of Total Suspended Solids will be provided with "Enhanced Protection" as outlined in the Ministry of Environment Stormwater Management Planning and Design Manual (2003).

Water Balance

Infiltration facilities shall be designed to ensure that under post-development conditions, infiltration volumes match the pre-development condition.

Erosion Control

According to Conservation Halton Guidelines for Stormwater Management Engineering Submissions (November 2021) erosion control is recommended such that the 25 mm design storm is retained or detained over at least a 24-hour period.

7.1 Stormwater Modelling Parameters

The Township of Puslinch stormwater management guidelines were referenced to determine the hydrologic parameters for the various catchment areas within the site. The topographic survey prepared by J.D. Barnes Limited (September 16, 2022) and the Hydrogeological Assessment prepared by Terraprobe Inc. (February 23, 2023) were referenced to confirm the land cover, drainage pattern, and on-site soil conditions.

Based on these sources, the hydrologic parameters for pre-development and post-development conditions were determined and are summarized in Tables 6 and Table 7 below. The detailed hydrologic parameter sheets for each catchment area are included in Appendix D.

Table 6: Pre-Development Hydrologic Parameters

Catchment Description	101[N]	102[N]	EX1[S]	EX2[S]
Drainage Area (ha)	2.02	3.96	5.17	1.41
Total Imperviousness (%)	0.0	0.0	30.0	37.2
Directly Connected Imperviousness (%)	-	-	20.6	25.9
Curve Number (CN)[1]	78.1	78.1	80.0	80.0
Time to peak (hrs)	0.07	0.08	-	-

1. Curve number presented as utilized in VO modeling. CN reflects composite curve number for rural catchments modeled using NASHYD routine and curve number for pervious areas only for urban catchments using STANDHYD routine.
2. Superscript N represents the catchment was modelled using a NASHYD and a superscript S, represents the catchment was modelled using a STANHYD.

Table 7: Post-Development Hydrologic Parameters

Catchment Description	201[S]	202[S]	EX1[S]	EX2[S]
Drainage Area (ha)	3.50	2.48	5.17	1.41
Total Imperviousness (%)	55.1	32.3	30.0	37.2
Directly Connected Imperviousness (%)	25.4	6.5	20.6	25.9
Curve Number (CN)[1]	80.0	80.0	80.0	80.0
Time to peak (hrs)	-	-	-	-

1. Curve number presented as utilized in VO modeling. CN reflects composite curve number for rural catchments modeled using NASHYD routine and curve number for pervious areas only for urban catchments using STANDHYD routine.
2. Superscript N represents the catchment was modelled using a NASHYD and a superscript S, represents the catchment was modelled using a STANHYD.

7.2 Stormwater Quantity Control

As discussed in Section 7.0, stormwater quantity control requirements for the site include controlling the post-development peak runoff to the pre-development peak runoff for storm events up to and including the 100-year event. According to the Township of Puslinch Municipal Development Standards, the City of Guelph's intensity-duration-frequency data for a 2-year to 100-year Chicago Storm event must be used as the hydraulic parameters for stormwater management modelling with a duration of 3 hours.

Visual OTTHYMO (VO) was used to create pre-development, post-development, and post-development with mitigation model scenarios to quantify the site's peak stormwater flows. The associated hydrologic parameters are outlined in Table 6 and Table 7. The pre-development and post-development stormwater flows directed to the Bronte Creek Tributary and the storage requirements are summarized below in Table 8. The VO model schematics, modelling results, and output files are included in Appendix D.

Table 8: Peak Flows and Target Flows Summary (Discharge towards Bronte Creek Tributary)

<table>
<tr><th>Storm (Year)</th><th>Pre-Dev. Peak Flow Rate[1] (m^3/s)</th><th>Post-Dev. Uncontrolled Peak Flow Rate[2] (m^3/s)</th><th>Post-Dev. Controlled Peak Flow Rate[2] (m^3/s)</th><th>Storage Volume Required (m^3)</th><th>Storage Volume Provided[3] (m^3)</th></tr>
<tr><td>2</td><td>0.29</td><td>0.52</td><td>0.29</td><td>299</td><td rowspan="6">938</td></tr>
<tr><td>5</td><td>0.59</td><td>0.90</td><td>0.57</td><td>455</td></tr>
<tr><td>10</td><td>0.86</td><td>1.22</td><td>0.81</td><td>565</td></tr>
<tr><td>25</td><td>1.17</td><td>1.57</td><td>1.14</td><td>665</td></tr>
<tr><td>50</td><td>1.47</td><td>1.90</td><td>1.39</td><td>782</td></tr>
<tr><td>100</td><td>1.85</td><td>2.32</td><td>1.65</td><td>882</td></tr>
</table>

Notes: 1. Includes runoff from Catchment 101, 102, and EX2.
2. Includes runoff from Catchment 201, 202, and EX2.
3. 938 m^3 of storage is available in the SWM facility including an additional 0.3 m of freeboard.

The Visual OTTHYMO results summarized in Table 8 indicate that water quantity controls are required to control the post-development peak flows to the pre-development peak flows for storm events up to and including the 100-year event. A total storage volume of 938 m^3 is provided within the proposed stormwater management facility in the form of a dry pond to meet the required storage volume.

Catchment 202 will consist of rooftop and rear-yard drainage from the lots located along the southern and eastern property limits. Drainage from Catchment 201 will be overcontrolled to allow for Catchment 202 to drain uncontrolled to the Bronte Creek Tributary.

7.3 Stormwater Quality Control

Stormwater quality controls for the proposed development must incorporate measures to provide "enhanced protection" as outlined by the Township of Puslinch Municipal Development Standards. Enhanced water quality protection involves the removal of at least 80% of the total suspended solids (TSS) from 90% of the annual runoff volume.

Water quality control for Catchment 201 will be provided using an oil-grit separator (Stormceptor EFO8 or approved equivalent). The oil-grit-separator is located upstream of the proposed stormwater management dry pond to provide quality control for runoff before discharging into the pond. The proposed dry pond will also provide 60% TSS removals as indicated in Table 9. Details of the proposed oil-grit separator can be referenced in Appendix D.

Catchment 202 will produce only clean runoff (i.e., landscaped and rooftop runoff). Therefore, quality controls are not proposed.

7.4 Stormwater Management Erosion Control

As outlined above, the proposed development is required to provide erosion control in the form of extended detention. The extended detention includes a minimum of 24-hour detention for the 25 mm storm event, as per the Conservation Halton Stormwater Management Guidelines.

Erosion control for the proposed stormwater management facility is proposed to be provided by the active storage component of the proposed dry pond. A 25 mm 3-Hour Chicago storm event was executed in the proposed conditions VO model. The computed runoff depth and required extended detention volume for the SWM dry pond is summarized in Table 18.

Table 9: Required Extended Detention Volume

Stormwater Management Facility	**Total Contributing Drainage Area** (ha)	**Criteria**	**Required Volume** (m^3)
SWM Dry Pond	3.50	MECP Extended Detention ($40m^3/ha$)	140
		Erosion Control (25mm Runoff Volume)	230

Note: 1. Required storage volumes from Table 3.2 of MECP SWM Planning and Design Manual (2003) based on 40 m^3/ha for extended detention.
2. 25 mm runoff volume obtain from VO model.

As presented in Table 9, the erosion control volume requirements exceed the MECP extended detention volume requirements. Therefore, the Conservation Halton Stormwater Management Guidelines standards govern the required volume for extended detention in the proposed stormwater management dry pond. The governing volume of 230 m^3 must be detained over a period of 24-hour to 48-hours. Drawdown calculations will be prepared and provided at the detailed design stage to demonstrate that a drawdown time of 24-hour to 48-hours can be achieved.

7.5 Stormwater Management Facility Design Requirements

The proposed stormwater management dry pond will provide stormwater quantity, quality, and erosion controls to meet the relevant stormwater criteria outlined in Section 7.0 for the proposed development. The dry pond will provide an active storage component equip with an outlet structure(s) sized to meet stormwater quantity control and erosion control criteria.

Preliminary stormwater pond design and grading was complete and can be referenced on Figure 1 and Figure 3. The pond design was prepared to achieve the following Ministry of Environment, Conservation, and Parks design requirements as outline in Table 4.8 of the MECP Stormwater Management Manual:

- The proposed pond will have 4:1 side slopes.
- Mean depth between 1 m – 3 m.
- A Sediment drying areas was not provided as the proposed oil-grit separator will provide TSS removal prior to stormwater entering the pond.
- The dry pond will be designed with an emergency overflow weir to direct flows towards the Bronte Creek tributary.

At the detailed design stage, additional calculations will be prepared to demonstrate that the stormwater management dry pond meets all applicable Ministry of Environment, Conservation, and Parks design criteria.

7.6 Water Balance

The water balance parameters were established based on the climate data from the Waterloo Wellington A Climate Station for the period 1971-2010, as well as site topography, soil type, and land cover infiltration factors. The results of the water balance indicate that there is an infiltration deficit of approximately 3,686 m3/year (6.1 mm storm event) due to an increase in impervious surface.

Based on review of the Hydrogeological Assessment prepared by Terraprobe Inc. (February 23, 2023) the in-situ hydraulic conductivity of the soils on-site ranged from 1.18×10^{-6} to 1.21×10^{-6} m/s which correlates to an infiltration rate of approximately 10 mm/hr. Therefore, the soils onsite are not conducive to infiltration, and it is recommended that end of pipe LID practices are not implemented onsite to meet the water balance objectives.

Should Conservation Halton still require that the water balance objectives be met we would suggest that lot level soakaway pits be implemented on each lot to infiltrate clean roof runoff. Refer to Table 10 which outlines the storage volume requirements for each lot to meet the water balance requirements on the site should LIDs be required.

Table 10: Water Balance Volume Requirements

Storage Requirements	**Required** (m^3)	**Provided** (m^3)	**Required per Lot** (m^3)
Water Balance	109	116	5.5

As outlined in Table 10 if the Conservation Authority would like the water balance objectives to be met under post-development conditions will require a soakaway pit to store and infiltrate a volume of 5.5 m^3. It should be noted that only clean roof runoff should be directed to each infiltration feature. The detailed water balance calculations can be referenced in Appendix D.

7.7 Floodplain Assessment

The Conservation Halton HEC-RAS floodplain modelling for the Bronte Creek Tributary (March 14, 2012) was obtained and reviewed by Crozier. Review of the modelling and the staked wetland and woodlot environmental constraints on the property ultimately determined the wetland and woodlot setbacks govern the overall development limits for the site.

The Regional floodplain from the Conservation Halton HEC-RAS floodplain model has been delineated on the civil engineering drawings and a 15 m floodplain setback was established based on the Conservation Halton Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document April 27, 2006 (last amended, November 6, 2020). The wetland and woodlot were determined to be the governing development setbacks for the proposed development and therefore, a detailed floodplain assessment has not been completed at this time. Furthermore, a meeting was held with Conservation Halton staff on July 4th to discuss if the Conservation Halton HEC-RAS floodplain model delineation was sufficient for the floodplain delineation for the proposed development. Following the meeting it was noted the Conservation Halton HEC-RAS floodplain model delineation was sufficient for the proposed development. Email excerpts with Conservation Halton staff have been included in Appendix E.

8.0 Erosion and Sediment Controls During Construction

The design of the erosion and sediment controls will be completed during the detailed design phase of the proposed development. The erosion and sediment controls will be required to be installed prior to the beginning of any construction activities. They will be maintained until the site is stabilized or as directed by the Site Engineer and/or Township of Puslinch. Controls will be inspected after each significant rainfall event and maintained in proper working condition.

Further details on the erosion and control measures that may be implemented have been summarized below:

<u>Sediment Control Silt Fence</u>

Sediment Control Silt Fence will be installed on the perimeter of the site to intercept sheet flow. Additional Sediment Control Silt Fence may be added based on field decisions by the Site Engineer and Owner prior to, during, and following construction.

<u>Rock Mud Mat</u>

A rock mud mat will be installed at the entrance to the construction zone to prevent mud tracking from the site onto surrounding lands and the perimeter roadway network. All construction traffic will be restricted to this access only.

<u>Rock Check Dams</u>

Rock check dams installed according to OPSD 219.210 should be installed in the proposed swale to protect from erosion conveyance during construction.

The Removals, Erosion and Sediment Control Plan will be refined throughout the planning application process with consultation with the Township and Conservation Authority to ensure potential environmental hazards during construction are minimized.

9.0 Conclusions & Recommendations

This report was prepared in support of the Zoning By-Law Amendment Application for the property located at 11 Main Street in the Township of Puslinch. The proposed development can be serviced for sanitary, water, and stormwater management in accordance with the Township of Puslinch, County of Wellington, and Conservation Halton requirements and standards. Our conclusions and recommendations include:

Proposed Water and Sanitary Servicing

1. Municipal servicing infrastructure is not available for the site and therefore the proposed development will be serviced by individual onsite sewage systems and drilled wells.

2. On-site soils are primarily classified as silty sand to sand and silt deposits. The anticipated T-time for the soils is 30 min/cm. Groundwater was observed to be 5.21 mbgs to 6.76 mbgs. Additional groundwater information is provided in the Hydrogeological Assessment (Terraprobe, February 23, 2023).

3. The preliminary sewage system design flows are expected to be approximately 3,600 L/d for each lot. Given the preliminary sewage system design flow is less than 10,000 L/day per individual lot, an ECA issued by the MECP will not be required. Each onsite sewage system will consist of an advanced treatment unit discharging to a leaching bed constructed as a Type A dispersal bed with a footprint of approximately 368 m^2. The advanced treatment system will consist of a Level IV treatment unit meeting the CAN/BNQ 3680-600 standard and must achieve the denitrification requirement of at least 62.5% nitrate-nitrogen reduction to meet MECP Guideline D-5-4.

4. Individual lots will be serviced with private drilled wells in accordance with O. Reg. 903 for potable water supply.

Stormwater Management

1. The site's stormwater runoff from the developable area (Catchment 201) will be collected and conveyed towards the proposed stormwater management facility by the proposed storm sewer network and internal road right-of-way. The proposed stormwater management dry pond will control the post-development peak flows to the pre-development peak flows prior to outletting towards the Bronte Creek Tributary. Stormwater runoff the Catchment 202 will flow uncontrolled towards to the Bronte Creek Tributary.

2. Stormwater runoff from Catchment EX1 will continue to be directed around the proposed development towards the Bronte Creek Tributary and stormwater runoff from Catchment EX2 be conveyed through the proposed development by the proposed storm sewer system and internal road right-of-way.

3. Stormwater quality controls for Catchment 201 will be provided by an oil-grit separator (Stormceptor EFO8 or approved equivalent) in series with 60% TSS removal from the proposed dry pond.

4. The stormwater management facility will be designed to meet the erosion control requirements and provide a minimum of 24-hour detention for the 25 mm storm event.

5. The soils onsite are not conducive to infiltration practices. Therefore, no infiltration LID's have been proposed at this time.

Erosion and Sediment Controls

1. Erosion and sediment controls will be implemented prior to construction and maintain to the satisfaction of the Township and Site Engineer until the site is stabilized.

Based on the above conclusions, we recommend the approval of the Zoning By-Law Amendment Application from the perspective of functional servicing and preliminary stormwater management.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

[redacted]

Brett Pond, E.I.T.
Engineering Intern
BP/rl:stm

C.F. CROZIER & ASSOCIATES INC.

[redacted]

Brendan Walton, P.Eng.
Project Manager

[redacted]

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APPENDIX A

Fire Flow Calculations

CROZIER CONSULTING ENGINEERS	**Project:** 11 Main Street **Project NO.:** 2366-6537 **Date:** 1/9/2023 **Designed By:** BP **Checked By:** BW

Adequate Water Supply Calculations (OFM Version)
Part 3 Fire Protection, Occupant Safety and Accessibility of the Ontario Building Code

Building: Type C (Residential) 360 m² 6 m

References

1. Part 3 of the Ontario Building Code (2012)
2. Fire Protection Water Supply Guideline For Part 3 Of The Ontario Building Code, TG-03-1999 (October 1999)
3. Draft Plan of Subdivision, Weston Consulting (February 6, 2023)

Equation

$$Q = KVS_{Total}$$

Q	Minimum supply of water in litres.
K	Water supply coefficient based upon building occupancy.
V	Total building volume in cubic metres.
S_{TOT}	Total of spatial coefficient values from property line exposures on all sides

Minimum Supply of Water

K =	23.0	C Classification	(reference 1.)
V =	2160 m³		
S_{TOT} =	1.8		

Exposure	Distance (m)	S_{side}
North	40.0	0.0
East	6.0	0.4
South	6.0	0.4
West	30.0	0.0

Q = **89,424 L**

Minimum Water Flow Supply Flow Rate

Required minimum water supply flow rate (L/min) (reference 2.)

Floor area ≤ 600 m²:	Yes	
	2700 L/min	Required flow rate
	0.5 hr	Required duration

Q = **81,000 L**

Conclusion

Therefore, the minimum water supply for proposed Building Type C (Residential) is **89,424 L**

APPENDIX B

Sanitary Servicing Calculations

ONSITE SEWAGE SYSTEM RESIDENTIAL CALCULATION SHEET

CROZIER CONSULTING ENGINEERS

Project Name: 11 Main Street
Project Number: 2366-6537
Date: 11/28/2022
Designed By: AL
Checked By: BP, KR

input required

House Details: 4 bedroom
360.00 m2

References

Description		**Number of Units**	**Additional Flow per Unit (L)**	**Total Flow (L/day)**
Base Flow				2000
Additional Flow				
i) Each bedroom over 5		0	500	0
ii) Area over $200m^2$.				
A) Each $10m^2$ over $200m^2$ to $400m^2$		16	100	1600
B) Each $10m^2$ over $400m^2$ to $600m^2$		0	75	0
C) Each $10m^2$ over $600m^2$		0	50	0
	Total Additional Sewage Flow from Area			1600
iii) Fixture Units over 20		25	50	1250
			Addition flow (greatest of i,ii,iii)	**1600**
			Total Daily Design Sanitary Sewage Flow (L/day):	**3600**

Pre-Treatment Options

Required septic tank size = 7200 L minimum

Propose Level IV Treatment (Y/N): Y

Treatment: **WBP Model AD40**, 4000 L/d
Treatment: **ADIPC-11250**
Basket Biofilter Tank: **BT-9000**
Orangeville Precast Concrete Ltd.
2 compartment tank, 5,400 **L**

Native Percolation time, T = 30 min/cm — T-time estimated by Crozier

Imported Sand Percolation time = 20 min/cm

Option #1 - Type A Dispersal Bed

	Required		Provided	
Stone area =	72 m^2	(Q/50)	72 m^2	12m x 6m
Sand area =	270 m^2	(QT/400)	368 m^2	16m x 23m

ONSITE SEWAGE SYSTEM RESIDENTIAL CALCULATION SHEET

CROZIER CONSULTING ENGINEERS

Project Name: 11 Main Street
Project Number: 2366-6537

Date: 11/28/2022
Designed By: AL
Checked By: BP, KR

input required

Fixtures	Number of Fixtures	Fixture Units per Fixture	Total Fixture Units
Bathroom Group (flush tank)	3	6	18.0
2 Piece Bathroom	2	5.5	11.0
Basement Rough-in	0	6	0.0
Sinks (Domestic Lavatory w. 1/2" trap, kitchen sink, single compartment laundry tray)	5	1.5	7.5
Clothes Washer	1	1.5	1.5
Dishwasher (if not connected to kitchen sink)	1	1	1.0
Shower (from 1 head)	1	1.5	2
Floor drain	1	3	3
Laundry Tub	1	1.5	2
		Total Fixture Units	**45.0**

APPENDIX C

Waterloo Biofilter Third-party Verification Studies

WaterNOx-LS Third Party Testing Summary

In the fall of 2016, Waterloo Biofilter Systems Inc. installed their WaterNOx-LS™ denitrification unit at the Bureau de Normalisation du Quebec (BNQ) test site located in Quebec City. The system underwent BNQ 3680-600 test protocol which includes two parts - Period A and Period B. Period A is based on the methodology of NSF/ANSI Standards 40 and 245, containing the same flow patterns and stress tests. Period B provides for a further 6 months of seasonal reliability testing to ensure that the test includes cold weather results.

The WaterNOx-LS is a passive autotrophic denitrification process using sulphur-limestone minerals in a submerged, up-flow configuration. The WaterNOx-LS, which was sized for 1,600 L/day (350 gpd) followed a Waterloo Biofilter nitrifying treatment unit.

Period A Test Results

During Period A wastewater is dosed according to the hydraulic loading specified in NSF-40. Period A includes the wash-day, working-parent, power failure, and vacation period stress tests. All sample results taken during stress tests are included in the analysis. Influent wastewater temperature values ranged from 10.0 °C (50 °F) to 16.5 °C (62 °F) with an average value of 13.3 °C (56 °F). Influent pH averaged 7.9 and effluent pH averaged 7.2.

Table 1 – Period A Results for the WaterNOx-LS

Parameters	Influent	Effluent	Removal
(c)BOD$_5$	260	6	97.6%
TSS	312	3	99.2%
Fecal Coliforms	2,403,000	4,900	99.8%
NO$_{2,3}$	-	0.20	-
TKN	57.1	4.6	92.0%
TN (NO$_{2,3}$ + TKN)	57.1	4.8	91.6%

n = 123; n = 357 for fecals
All parameters in mg/L except Fecal Coliforms in cfu/100mL
All values arithmetic averages except Fecal Coliforms in geometric average

Weekly influent total nitrogen concentrations ranged from 43.0 mg/L to 68.8 mg/L with a six-month average concentration of 57.1 mg/L.

Weekly effluent NO$_{2,3}$ concentrations ranged from < 0.02 mg/L to 3.33 mg/L with a six-month average of 0.20 mg/L. Weekly effluent TKN concentrations ranged from 1.5 mg/L to 16.9 mg/L with a six-month average of 4.6 mg/L. Weekly effluent total nitrogen concentrations ranged from 1.7 mg/L to 17.1 mg/L with a six-month average of 4.8 mg/L. The total nitrogen reduction over the six-month period was 91.6%.

Period B Test Results

Weekday hydraulic loading is modified during Period B to a strenuous 'working parent' schedule where 40% of the flow is delivered over three hours in the morning, and 60% is delivered over three hours in the evening. All samples taken during Period B are included in the analysis. Influent wastewater temperature values ranged from 10.1 °C (50 °F) to 15.8 °C (60 °F) with an average value of 12.3 °C (54 °F). Influent pH averaged 8.0 and effluent pH averaged 7.1.

Table 2 – Period B Results for the WaterNOx-LS

Parameters	Influent	Effluent	Removal
(c)BOD_5	248	4	98.2%
TSS	304	3	99.1%
Fecal Coliforms	2,142,000	2,800	99.9%
$NO_{2,3}$	-	3.38	-
TKN	60.3	8.5	85.9%
TN ($NO_{2,3}$ + TKN)	60.4	11.9	80.3%

n = 59; n = 118 for fecals
All parameters in mg/L except Fecal Coliforms in cfu/100mL
All values arithmetic averages except Fecal Coliforms in geometric average

Weekly influent total nitrogen concentrations ranged from 21.2 mg/L to 85.6 mg/L with a six-month average concentration of 60.4 mg/L.

Weekly effluent $NO_{2,3}$ concentrations ranged from < 0.04 mg/L to 15.2 mg/L with a six-month average of 3.38 mg/L. Weekly effluent TKN concentrations ranged from 1.2 mg/L to 21.2 mg/L with a weekly average of 8.5 mg/L. Weekly effluent total nitrogen concentrations ranged from 3.7 mg/L to 22.2 mg/L with a six-month average of 11.9 mg/L. The total nitrogen reduction over the six-month period was 80.3%.

Conclusion

In summary, the WaterNOx-LS system can successfully remove very high levels of total nitrogen passively, while buffering pH to neutral and keeping $cBOD_5$ and TSS levels below 10 mg/L.

APPENDIX D

Stormwater Servicing Calculations

CROZIER CONSULTING ENGINEERS

Project Name: 11 Main Street
Project Number: 2366-6537
Date: 10/12/2022
By: BP/PR

D.A. NAME **101**
D.A. AREA (ha) **2.02**

Hydrologic Parameters: CALIB NASHYD Command
Pre Development Drainage Area: Catchment 101

Curve Number Calculation

Note: RC and CN values obtained from the MTO Drainage Management Manual Part 4 (1995)
*On-site soils silty sand with poor hydraulic conductivity per Terraprobe Hydrogeological Assessment (February 2023)

Soil Types Present per Wellington County Soils Map (1962):				
Type	ID	Hydrologic Group	% Area	Area
Dumfries Sandy Loam*	DI	D	100	2.02
				0
				0
				0
Total Area				2.02

Impervious Landuses Present:	Gravel		Sidewalk		Driveway		Building		SWMF		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
DI	0		0		0		0		0		0	0
Subtotal	0		0		0		0		0			

Pervious Landuses Present:	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
DI	0.16	79	1.86	78	0		0		0		2.02	157.72
Subtotal	0.16		1.86		0		0		0			

Composite Area Calculations		
	Total Pervious Area	2.02
	Total Impervious Area	0.00
	% Impervious	0.00%
	Composite Curve Number	78.1
	Total Area Check	2.02

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Dumfries Sandy Loam*								
				RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0.16	1.59	0.35	0.16		0		0		0	0.06
Meadow	8	1.86	14.89	0.65	1.86		0		0		0	1.21
Wetland	16	0	0		0		0		0		0	0
Lawn	5	0	0		0		0		0		0	0
Cultivated	7	0	0		0		0		0		0	0
Impervious	2	0	0		0		0		0		0	0
Composite		2.02	8.16	Composite Runoff Coefficient								0.63

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Sheet Flow	50	2.65	5.30%	2.7	0.62	0.02	0.01	0.01	0.03	0.02	0.10	0.07

Appropriate calculated time to peak:	0.07	Appropriate Method:	Airport

CROZIER CONSULTING ENGINEERS

Project Name: 11 Main Street
Project Number: 2366-6537
Date: 10/12/2022
By: BP/PR

D.A. NAME **102**
D.A. AREA (ha) **3.96**

Hydrologic Parameters: CALIB NASHYD Command
Pre Development Drainage Area: Catchment 102

Curve Number Calculation

Note: RC and CN values obtained from the MTO Drainage Management Manual Part 4 (1995)
*On-site soils silty sand with poor hydraulic conductivity per Terraprobe Hydrogeological Assessment (February 2023)

Soil Types Present per Wellington County Soils Map (1962):				
Type	ID	Hydrologic Group	% Area	Area
Dumfries Sandy Loam*	DI	D	100	3.96
				0
				0
				0
Total Area				3.96

Impervious Landuses Present:												
	Gravel		Sidewalk		Driveway		Building		SWMF		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
DI	0		0		0		0		0		0	0
Subtotal	0.00		0		0		0.00		0			

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
DI	0.25	79	3.71	78	0		0		0		3.96	309.13
Subtotal	0.25		3.71		0		0		0			

	Composite Area Calculations	Total Pervious Area	3.96
		Total Impervious Area	0.00
		% Impervious	0.00%
		Composite Curve Number	78.1
		Total Area Check	3.96

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Dumfries Sandy Loam*								
				RC	Area	RC	Area	RC	Area	RC	Area	A*RC
Woodland	10	0.25	2.48	0.35	0.25		0		0		0	0.09
Meadow	8	3.71	29.70	0.65	3.71		0		0		0	2.41
Wetland	16	0	0		0		0		0		0	0
Lawn	5	0	0		0		0		0		0	0.00
Cultivated	7	0	0		0		0		0		0	0
Impervious	1.5	0	0		0		0		0		0	0.00
Composite		3.96	8.13	Composite Runoff Coefficient								0.63

Time to Peak Inputs						Uplands			Bransby Williams		Airport	
Flow Path Description	Length (m)	Drop (m)	Slope (%)	$V/S^{0.5}$	Velocity (m/s)	Tc (hr)	Tp(hr)	TOTAL Tp (hr)	Tc (hr)	Tp(hr)	Tc (hr)	Tp(hr)
Sheet Flow	110	11.40	10.36%	2.7	0.87	0.04	0.02	0.02	0.06	0.04	0.12	0.08

Appropriate calculated time to peak:	0.08	Appropriate Method:	Airport

Project Name:	11 Main Street
Project Number:	2366-6537
Date:	11/28/2023
By:	BP

D.A. NAME	**201**
D.A. AREA (ha)	**3.50**

Hydrologic Parameters: CALIB STANDHYD Command
Post Development Drainage Area: Catchment 201

Curve Number Calculation

Soil Types Present per Wellington County Soils Map (1962):				
Type	ID	Hydrologic	% Area	Area
Dumfries Sandy Loam*	Di	D	100	3.50
				0
				0
				0
Total Area Check				3.50

Note: RC and CN values obtained from the MTO Drainage Management Manual Part 4 (1995)
*On-site soils silty sand with poor hydraulic conductivity per Terraprobe Hydrogeological Assessment (February 2023)

Impervious Landuses Present:												
	Roadway		Gravel		Driveway		Building		SWM Pond		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
Di	0.59	98	0.00		0.10	98	1.04	98	0.20	50	1.93	179.5
Subtotal Area	0.59		0.00		0.10		1.04		0.20		1.93	

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
Di	0.00		0.00		0.00		1.57	80	0.00		1.57	125.6
Subtotal Area	0.00		0.00		0.00		1.57		0.00			

Pervious Area Calculations	Total Pervious Area	1.57
	Composite Pervious Curve Number	80
Impervious Area Calculations	Total Directly Connected Area	0.89
	Total Indirectly Connected Area	1.04
	Total Impervious Area	1.93
	% X imp	25.4
	% T imp	55.1
	Total Area Check	3.50

Initial Abstraction and Tp Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0	0
Meadow	8	0	0
Wetland	16	0	0
Lawn	5	1.57	7.85
Cultivated	7	0	0

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.0	4.00%	20	0.25
Impervious	1.5	4.00%	153	0.013

$$A = 1.5LGI^2$$

Note: LGI formula retrieved from Visual OTTHYMO Reference Manual (pg. 7)

where LGI represents impervious length (m)

CROZIER CONSULTING ENGINEERS

Project Name: 11 Main Street
Project Number: 2366-6537
Date: 11/28/2023
By: BP

D.A. NAME **202**
D.A. AREA (ha) **2.48**

Hydrologic Parameters: CALIB STANDHYD Command
Post Development Drainage Area: Catchment 202

Curve Number Calculation

Soil Types Present per Wellington County Soils Map (1962):				
Type	ID	Hydrologic	% Area	Area
Dumfries Sandy Loam*	Di	D	100	2.48
				0
				0
				0
Total Area Check				2.48

Note: RC and CN values obtained from the MTO Drainage Management Manual Part 4 (1995)
*On-site soils silty sand with poor hydraulic conductivity per Terraprobe Hydrogeological Assessment (February 2023)

Impervious Landuses Present:												
	Roadway		Gravel		Driveway		Building		SWM Pond		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
Di	0.00	98	0.00		0.00	98	0.64	98	0.16	98	0.80	78.4
Subtotal Area	0.00		0.00		0.00		0.64		0.16		0.80	

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
Di	0.00		0.00		0.00		1.68	80	0.00		1.68	134.4
Subtotal Area	0.00		0.00		0.00		1.68		0.00			

Pervious Area Calculations	Total Pervious Area	1.68
	Composite Pervious Curve Number	80
Impervious Area Calculations	Total Directly Connected Area	0.16
	Total Indirectly Connected Area	0.64
	Total Impervious Area	0.80
	% X imp	6.5
	% T imp	32.3
	Total Area Check	2.48

Initial Abstraction and Tp Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0	0
Meadow	8	0	0
Wetland	16	0	0
Lawn	5	1.68	8.40
Cultivated	7	0	0

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.0	4.00%	30	0.25
Impervious	1.0	2.00%	129	0.013

$$A = 1.5LGI^2$$

Note: LGI formula retrieved from Visual OTTHYMO Reference Manual (pg. 7)

where LGI represents impervious length (m)

Project Name:	11 Main Street
Project Number:	2366-6537
Date:	10/12/2022
By:	BP/PR

D.A. NAME **EX1**
D.A. AREA (ha) **5.17**

Hydrologic Parameters: CALIB STANDHYD Command
Pre Development Drainage Area: Catchment EX1

Curve Number Calculation

Soil Types Present per Wellington County Soils Map (1962):				
Type	ID	Hydrologic	% Area	Area
Dumfries Sandy Loam*	Di	D	100	5.17
				0
				0
				0
Total Area Check				5.17

Note: RC and CN values obtained from the MTO Drainage Management Manual Part 4 (1995)
*External soils assumed to be silty sand with poor hydraulic conductivity.

Impervious Landuses Present:												
	Roadway		Gravel		Driveway		Building		SWM Pond		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
Di	0.21	98	0.34	91	0.52	98	0.49	98	0.00	98	1.55	149.5
Subtotal Area	0.21		0.34		0.52		0.49		0.00		1.55	

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
Di	0.00		0.00		0.00		3.62	#REF!	0.00		3.62	#REF!
Subtotal Area	0.00		0.00		0.00		3.62		0.00			

Pervious Area Calculations	Total Pervious Area	3.62
	Composite Pervious Curve Number	#REF!
Impervious Area Calculations	Total Directly Connected Area	1.07
	Total Indirectly Connected Area	0.49
	Total Impervious Area	1.55
	% X imp	20.6
	% T imp	30.0
	Total Area Check	5.17

Initial Abstraction and Tp Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0	0
Meadow	8	0	0
Wetland	16	0	0
Lawn	5	3.62	18.10
Cultivated	7	0	0

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.0	10.00%	30	0.25
Impervious	1.5	10.00%	186	0.013

$$A = 1.5LGI^2$$

Note: LGI formula retrieved from Visual OTTHYMO Reference Manual (pg. 7)

where LGI represents impervious length (m)

CROZIER CONSULTING ENGINEERS

Project Name: 11 Main Street
Project Number: 2366-6537
Date: 10/12/2022
By: BP/PR

D.A. NAME **EX2**
D.A. AREA (ha) **1.41**

Hydrologic Parameters: CALIB STANDHYD Command
Pre Development Drainage Area: Catchment EX2

Curve Number Calculation

Soil Types Present per Wellington County Soils Map (1962):				
Type	ID	Hydrologic	% Area	Area
Dumfries Sandy Loam*	Di	D	100	1.41
				0
				0
				0
Total Area Check				1.41

Note: RC and CN values obtained from the MTO Drainage Management Manual Part 4 (1995)
*External soils assumed to be silty sand with poor hydraulic conductivity.

Impervious Landuses Present:												
	Roadway		Gravel		Driveway		Building		SWM Pond		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
Di	0.05	98	0.00	91	0.31	98	0.16	98	0.00	98	0.52	51.4
Subtotal Area	0.05		0.00		0.31		0.16		0.00		0.52	

Pervious Landuses Present:												
	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
Soils	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
Di	0.00		0.00		0.00		0.89	#REF!	0.00		0.89	#REF!
Subtotal Area	0.00		0.00		0.00		0.89		0.00			

Pervious Area Calculations	Total Pervious Area	0.89
	Composite Pervious Curve Number	#REF!
Impervious Area Calculations	Total Directly Connected Area	0.37
	Total Indirectly Connected Area	0.16
	Total Impervious Area	0.52
	% X imp	25.9
	% T imp	37.2
	Total Area Check	1.41

Initial Abstraction and Tp Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0	0
Meadow	8	0	0
Wetland	16	0	0
Lawn	5	0.89	4.43
Cultivated	7	0	0

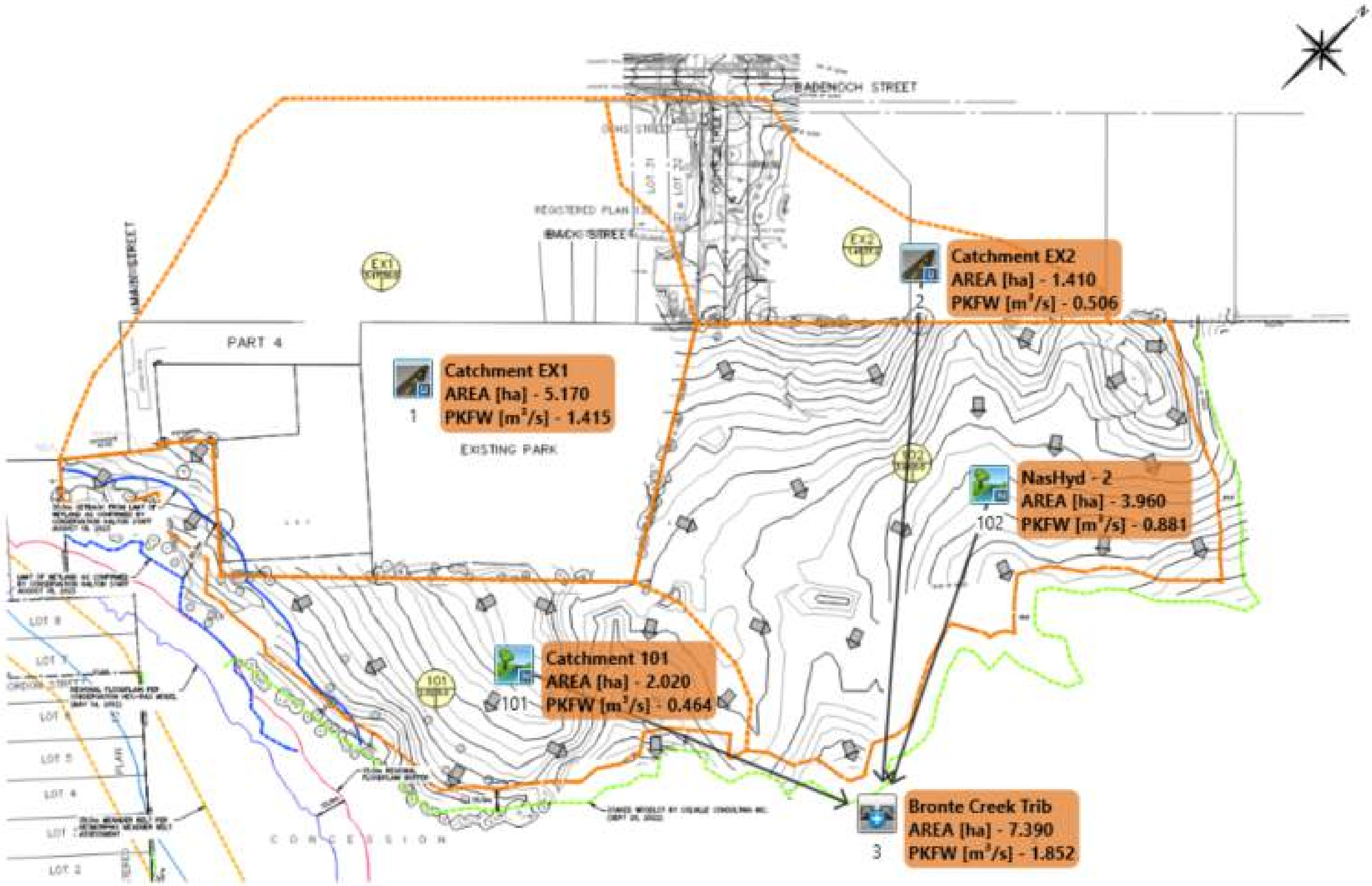
Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.0	10.00%	30	0.25
Impervious	1.5	10.00%	97	0.013

$$A = 1.5LGI^2$$

Note: LGI formula retrieved from Visual OTTHYMO Reference Manual (pg. 7)

where LGI represents impervious length (m)

Pre-Development Visual-Otthymo Schematic



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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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ca8-59db-459a-b739-fc8dc54b4d88\scenar


DATE: 12/20/2023                           TIME: 09:14:41

USER:


COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------------
-------------------------
  ************************************************
  ** SIMULATION : 100yr - 3hr 10min Chicago     **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=4688.000
| Ptotal= 87.03 mm |                          B=  17.000
--------------------                          C=   0.962
```

```
                used in:   INTENSITY =  A / (t + B)^C

                Duration of storm  =  3.00 hrs
                Storm time step    = 10.00 min
                Time to peak ratio =  0.33

            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
            0.00    4.88 |  0.83  196.54 |  1.67   12.48 |  2.50    4.51
            0.17    6.96 |  1.00   83.09 |  1.83    9.60 |  2.67    3.91
            0.33   11.02 |  1.17   41.25 |  2.00    7.66 |  2.83    3.44
            0.50   21.03 |  1.33   25.07 |  2.17    6.29 |
            0.67   62.12 |  1.50   17.06 |  2.33    5.28 |


--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0101)|   Area    (ha)=   2.02   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.16   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.07

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


                             ---- TRANSFORMED HYETOGRAPH ----
            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
           0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
           0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
           0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
           0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
           0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
           0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
           0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
           0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
           0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Unit Hyd Qpeak  (cms)=   1.102

     PEAK FLOW       (cms)=   0.464 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  37.796
     TOTAL RAINFALL   (mm)=  87.029
     RUNOFF COEFFICIENT   =   0.434

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

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

```
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   3.96   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.13   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.08

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


                                      ---- TRANSFORMED HYETOGRAPH ----
                    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                   0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
                   0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
                   0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
                   0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
                   0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
                   0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
                   0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
                   0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
                   0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Unit Hyd Qpeak  (cms)=   1.891

     PEAK FLOW       (cms)=   0.881 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  39.118
     TOTAL RAINFALL   (mm)=  87.029
     RUNOFF COEFFICIENT   =   0.449

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

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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


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

```
                0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
                0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
                0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
                0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
                0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
                0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
                0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
                0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
                0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54       132.03
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.96 (ii)    4.94 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.22
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.20         0.31           0.506 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00            1.00
     RUNOFF VOLUME    (mm)=      85.53        50.18           59.33
     TOTAL RAINFALL   (mm)=      87.03        87.03           87.03
     RUNOFF COEFFICIENT   =       0.98         0.58            0.68

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     2.02   0.464     1.00    37.80
      + ID2= 2 (  0102):     3.96   0.881     1.00    39.12
        ====================================================
        ID = 3 (  0003):     5.98   1.345     1.00    38.67

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     5.98   1.345     1.00    38.67
      + ID2= 2 (  0002):     1.41   0.506     1.00    59.33
```

```
    ====================================================
    ID = 1 (  0003):     7.39   1.852     1.00    42.61

 NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55          3.62
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=     185.65         30.00
     Mannings n           =      0.013         0.250

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


                          ---- TRANSFORMED HYETOGRAPH ----
              TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
               hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
             0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
             0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
             0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
             0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
             0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
             0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
             0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
             0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54       124.00
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.42 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.58         1.01          1.415 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      85.53        49.25          56.72
     TOTAL RAINFALL   (mm)=      87.03        87.03          87.03
     RUNOFF COEFFICIENT   =       0.98         0.57           0.65

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
```

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

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==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\43853
9dc-c114-4e92-b484-93189fe31933\scenar


DATE: 12/20/2023                           TIME: 09:14:40

USER:



COMMENTS: ____________________________________________________________


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  ***********************************************
  ** SIMULATION : 10yr - 3hr 10min Chicago      **
  ***********************************************
```

```
--------------------
| CHICAGO STORM    |     IDF curve parameters: A=2221.000
| Ptotal= 56.26 mm |                           B=  12.000
--------------------                           C=   0.908
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33

                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.00    3.65 |  0.83  134.16 |  1.67    8.06 |  2.50    3.42
                  0.17    4.89 |  1.00   50.03 |  1.83    6.42 |  2.67    3.05
                  0.33    7.23 |  1.17   24.37 |  2.00    5.30 |  2.83    2.75
                  0.50   12.87 |  1.33   15.14 |  2.17    4.50 |
                  0.67   37.17 |  1.50   10.64 |  2.33    3.89 |


------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   2.02   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.16   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.07

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


                                ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
                 0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
                 0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
                 0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
                 0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
                 0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
                 0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
                 0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
                 0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Unit Hyd Qpeak  (cms)=   1.102

     PEAK FLOW       (cms)=   0.214 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  17.682
     TOTAL RAINFALL   (mm)=  56.258
     RUNOFF COEFFICIENT   =   0.314
```

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

------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   3.96   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.13   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.08

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
                0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
                0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
                0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
                0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
                0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
                0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
                0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
                0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Unit Hyd Qpeak  (cms)=   1.891

     PEAK FLOW       (cms)=   0.400 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  18.308
     TOTAL RAINFALL   (mm)=  56.258
     RUNOFF COEFFICIENT   =   0.325

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

------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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

```
                                ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
                 0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
                 0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
                 0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
                 0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
                 0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
                 0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
                 0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
                 0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16        66.97
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.12 (ii)    5.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.14         0.243 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      54.76        25.57         33.13
     TOTAL RAINFALL   (mm)=      56.26        56.26         56.26
     RUNOFF COEFFICIENT   =       0.97         0.45          0.59

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     2.02   0.214     1.00    17.68
      + ID2= 2 (  0102):     3.96   0.400     1.00    18.31
        ====================================================
        ID = 3 (  0003):     5.98   0.614     1.00    18.10

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


--------------------
| ADD HYD  (  0003)|
```

```
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     5.98   0.614     1.00    18.10
      + ID2= 2 (  0002):     1.41   0.243     1.00    33.13
        ===================================================
        ID = 1 (  0003):     7.39   0.858     1.00    20.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
               0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
               0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
               0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
               0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
               0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
               0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
               0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
               0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16        62.36
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.65 (ii)    6.08 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.40         0.51          0.793 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      54.76        24.93          31.08
     TOTAL RAINFALL   (mm)=      56.26        56.26          56.26
     RUNOFF COEFFICIENT   =       0.97         0.44           0.55

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

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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==================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```

```

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\dedb4
de0-df93-4c6b-9ef3-72af313fb461\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\dedb4
de0-df93-4c6b-9ef3-72af313fb461\scenar


DATE: 12/20/2023                           TIME: 09:14:41

USER:



COMMENTS: ____________________________________________________________


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```
  ************************************************
  ** SIMULATION : 25yr - 3hr 10min Chicago      **
  ************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=3158.000
| Ptotal= 68.23 mm |                           B=  15.000
--------------------                           C=   0.936
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33

                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.00    4.19 |  0.83  155.47 |  1.67    9.94 |  2.50    3.90
                  0.17    5.78 |  1.00   63.30 |  1.83    7.78 |  2.67    3.43
                  0.33    8.84 |  1.17   31.36 |  2.00    6.32 |  2.83    3.05
                  0.50   16.30 |  1.33   19.30 |  2.17    5.27 |
                  0.67   47.29 |  1.50   13.35 |  2.33    4.49 |


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   2.02   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.16   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.07

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


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
                 0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
                 0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
                 0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
                 0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
                 0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
                 0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
                 0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
                 0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Unit Hyd Qpeak  (cms)=   1.102

     PEAK FLOW       (cms)=   0.299 (i)
     TIME TO PEAK    (hrs)=   1.000
```

```
     RUNOFF VOLUME    (mm)=  25.063
     TOTAL RAINFALL   (mm)=  68.226
     RUNOFF COEFFICIENT   =   0.367

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0102)|   Area    (ha)=   3.96   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.13   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.08

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


                               ---- TRANSFORMED HYETOGRAPH ----
                    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                   0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
                   0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
                   0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
                   0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
                   0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
                   0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
                   0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
                   0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
                   0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Unit Hyd Qpeak  (cms)=   1.891

     PEAK FLOW       (cms)=   0.564 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  25.944
     TOTAL RAINFALL   (mm)=  68.226
     RUNOFF COEFFICIENT   =   0.380

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
```

```
     Mannings n           =      0.013        0.250

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


                             ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
               0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
               0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
               0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
               0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
               0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
               0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
               0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
               0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47        89.39
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.05 (ii)    5.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.16         0.18          0.308 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      66.73        34.76          43.03
     TOTAL RAINFALL   (mm)=      68.23        68.23          68.23
     RUNOFF COEFFICIENT   =       0.98         0.51           0.63

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     2.02   0.299     1.00    25.06
      + ID2= 2 (  0102):     3.96   0.564     1.00    25.94
        ==================================================
        ID = 3 (  0003):     5.98   0.863     1.00    25.65

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

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

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     5.98   0.863     1.00    25.65
      + ID2= 2 (  0002):     1.41   0.308     1.00    43.03
        ====================================================
        ID = 1 (  0003):     7.39   1.171     1.00    28.96

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
               0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
               0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
               0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
               0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
               0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
               0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
               0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
               0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47        83.57
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.56 (ii)    5.49 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.46         0.70          1.030 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      66.73        34.00          40.74
```

```
     TOTAL RAINFALL   (mm)=      68.23        68.23          68.23
     RUNOFF COEFFICIENT   =       0.98         0.50           0.60

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\56a3f
ed8-c7ef-4fdd-aac2-0291de14e962\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\56a3f
ed8-c7ef-4fdd-aac2-0291de14e962\scenar


DATE: 12/20/2023                           TIME: 09:14:41

USER:


COMMENTS: ____________________________________________________________
```

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  **********************************************
  ** SIMULATION : 2yr - 3hr 10min Chicago       **
  **********************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A= 743.000
| Ptotal= 34.25 mm |                           B=   6.000
--------------------                           C=   0.799
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.15 |  0.83   81.10 |  1.67    5.62 |  2.50    3.01
                 0.17    3.89 |  1.00   25.63 |  1.83    4.75 |  2.67    2.77
                 0.33    5.18 |  1.17   13.34 |  2.00    4.13 |  2.83    2.56
                 0.50    7.98 |  1.33    9.07 |  2.17    3.67 |
                 0.67   19.47 |  1.50    6.91 |  2.33    3.30 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   2.02   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.16   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.07

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
                0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
                0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
                0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
                0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
                0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
                0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
                0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
                0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56
```

```
     Unit Hyd Qpeak  (cms)=   1.102

     PEAK FLOW       (cms)=   0.063 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=   6.381
     TOTAL RAINFALL   (mm)=  34.255
     RUNOFF COEFFICIENT   =   0.186

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

------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0102)|   Area    (ha)=   3.96   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.13   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.08

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


                                ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
                 0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
                 0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
                 0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
                 0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
                 0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
                 0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
                 0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
                 0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Unit Hyd Qpeak  (cms)=   1.891

     PEAK FLOW       (cms)=   0.115 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=   6.614
     TOTAL RAINFALL   (mm)=  34.255
     RUNOFF COEFFICIENT   =   0.193

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

------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=       0.52          0.89
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=      96.95         30.00
     Mannings n           =      0.013         0.250

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


                                 ---- TRANSFORMED HYETOGRAPH ----
                    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                   0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
                   0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
                   0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
                   0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
                   0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
                   0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
                   0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
                   0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
                   0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10         24.94
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       1.37 (ii)     7.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.33          0.13
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.08          0.05           0.115 (iii)
     TIME TO PEAK    (hrs)=       1.00          1.08            1.00
     RUNOFF VOLUME    (mm)=      32.75         10.75           16.44
     TOTAL RAINFALL   (mm)=      34.25         34.25           34.25
     RUNOFF COEFFICIENT   =       0.96          0.31            0.48

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):     2.02   0.063     1.00     6.38
      + ID2= 2 (  0102):     3.96   0.115     1.00     6.61
```

```
        ====================================================
        ID = 3 (  0003):     5.98   0.178     1.00     6.54

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

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     5.98   0.178     1.00     6.54
      + ID2= 2 (  0002):     1.41   0.115     1.00    16.44
        ====================================================
        ID = 1 (  0003):     7.39   0.293     1.00     8.43

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN | TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |  hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
               0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
               0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
               0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
               0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
               0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
               0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
               0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
               0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        22.89
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.02 (ii)    8.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.12
```

```
                                                                 *TOTALS*
     PEAK FLOW       (cms)=       0.24         0.16           0.352 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      32.75        10.38           14.99
     TOTAL RAINFALL   (mm)=      34.25        34.25           34.25
     RUNOFF COEFFICIENT   =       0.96         0.30            0.44

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\e35fa
04f-6062-42df-8d44-cf1d0eb1cb82\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\e35fa
04f-6062-42df-8d44-cf1d0eb1cb82\scenar


DATE: 12/20/2023                           TIME: 09:14:41

USER:
```

COMMENTS: ____

****

** SIMULATION : 50yr - 3hr 10min Chicago **

****

```
--------------------
| CHICAGO STORM    |     IDF curve parameters: A=3886.000
| Ptotal= 77.60 mm |                           B=  16.000
--------------------                           C=   0.950
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.54	0.83	176.19	1.67	11.20	2.50	4.21
0.17	6.37	1.00	73.10	1.83	8.68	2.67	3.68
0.33	9.92	1.17	36.22	2.00	6.99	2.83	3.25
0.50	18.63	1.33	22.14	2.17	5.78		
0.67	54.62	1.50	15.18	2.33	4.89		

```
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area    (ha)=   2.02   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.16   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.07
```

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.54	0.833	54.62	1.583	15.18	2.33	5.78
0.167	4.54	0.917	176.19	1.667	15.18	2.42	4.89
0.250	6.37	1.000	176.19	1.750	11.20	2.50	4.89
0.333	6.37	1.083	73.10	1.833	11.20	2.58	4.21
0.417	9.92	1.167	73.10	1.917	8.68	2.67	4.21
0.500	9.92	1.250	36.22	2.000	8.68	2.75	3.68

```
              0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
              0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
              0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25

     Unit Hyd Qpeak  (cms)=   1.102

     PEAK FLOW       (cms)=   0.380 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  31.265
     TOTAL RAINFALL   (mm)=  77.602
     RUNOFF COEFFICIENT   =   0.403

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

------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   3.96   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.13   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.08

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


                               ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
              0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
              0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
              0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
              0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
              0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
              0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
              0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
              0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25

     Unit Hyd Qpeak  (cms)=   1.891

     PEAK FLOW       (cms)=   0.719 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  32.361
     TOTAL RAINFALL   (mm)=  77.602
     RUNOFF COEFFICIENT   =   0.417

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

------------------------------------------------------------------------------
--------------------
| CALIB              |
```

```
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN | TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |  hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
               0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
               0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
               0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
               0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
               0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
               0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
               0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
               0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
               0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25

     Max.Eff.Inten.(mm/hr)=     176.19       110.39
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.00 (ii)    5.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.18         0.23          0.370 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      76.10        42.32          51.07
     TOTAL RAINFALL   (mm)=      77.60        77.60          77.60
     RUNOFF COEFFICIENT   =       0.98         0.55           0.66

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0003)|
```

```
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0101):      2.02   0.380     1.00    31.26
      + ID2= 2 (  0102):      3.96   0.719     1.00    32.36
        ===================================================
        ID = 3 (  0003):      5.98   1.099     1.00    31.99

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):      5.98   1.099     1.00    31.99
      + ID2= 2 (  0002):      1.41   0.370     1.00    51.07
        ===================================================
        ID = 1 (  0003):      7.39   1.469     1.00    35.63

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55          3.62
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=     185.65         30.00
     Mannings n           =      0.013         0.250

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


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
               0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
               0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
               0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
               0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
               0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
               0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
               0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
               0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25

     Max.Eff.Inten.(mm/hr)=     176.19       103.47
```

```
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.48 (ii)    6.25 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.52         0.83           1.196 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      76.10        41.47           48.61
     TOTAL RAINFALL   (mm)=      77.60        77.60           77.60
     RUNOFF COEFFICIENT   =       0.98         0.53            0.63

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\efc94
b19-2006-4914-b43e-a4d1063b1404\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\efc94
b19-2006-4914-b43e-a4d1063b1404\scenar
```

DATE: 12/20/2023   TIME: 09:14:41

USER:

COMMENTS: ____

```
------------------------------------------------------------------------------------------------------------
  **********************************************
  ** SIMULATION : 5yr - 3hr 10min Chicago       **
  **********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1593.000
| Ptotal= 47.24 mm |                          B=  11.000
--------------------                          C=   0.879
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.46	0.83	109.68	1.67	7.17	2.50	3.26
0.17	4.52	1.00	40.71	1.83	5.81	2.67	2.93
0.33	6.48	1.17	20.28	2.00	4.87	2.83	2.67
0.50	11.07	1.33	12.91	2.17	4.19		
0.67	30.47	1.50	9.28	2.33	3.67		

```
------------------------------------------------------------------------------------------------------
--------------------
| CALIB             |
| NASHYD   (  0101)|   Area    (ha)=   2.02   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.16   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.07

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.46	0.833	30.47	1.583	9.28	2.33	4.19
0.167	3.46	0.917	109.68	1.667	9.28	2.42	3.67

```
            0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
            0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
            0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
            0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
            0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
            0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
            0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Unit Hyd Qpeak  (cms)=   1.102

     PEAK FLOW       (cms)=   0.141 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  12.625
     TOTAL RAINFALL   (mm)=  47.236
     RUNOFF COEFFICIENT   =   0.267

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

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0102)|   Area    (ha)=   3.96   Curve Number   (CN)= 78.1
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.13   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.08

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


                               ---- TRANSFORMED HYETOGRAPH ----
             TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
            0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
            0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
            0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
            0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
            0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
            0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
            0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
            0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
            0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Unit Hyd Qpeak  (cms)=   1.891

     PEAK FLOW       (cms)=   0.262 (i)
     TIME TO PEAK    (hrs)=   1.000
     RUNOFF VOLUME    (mm)=  13.076
     TOTAL RAINFALL   (mm)=  47.236
     RUNOFF COEFFICIENT   =   0.277

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

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
               0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
               0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
               0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
               0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
               0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
               0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
               0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
               0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Max.Eff.Inten.(mm/hr)=     109.68        47.00
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.21 (ii)    6.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.09          0.183 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      45.74        19.10          25.99
     TOTAL RAINFALL   (mm)=      47.24        47.24          47.24
     RUNOFF COEFFICIENT   =       0.97         0.40           0.55

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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


 --------------------
 | ADD HYD  (  0003)|
 |   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
 --------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0101):      2.02   0.141     1.00    12.63
       + ID2= 2 (  0102):      3.96   0.262     1.00    13.08
         ====================================================
         ID = 3 (  0003):      5.98   0.402     1.00    12.92

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


 --------------------
 | ADD HYD  (  0003)|
 |   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
 --------------------          (ha)    (cms)    (hrs)     (mm)
         ID1= 3 (  0003):      5.98   0.402     1.00    12.92
       + ID2= 2 (  0002):      1.41   0.183     1.00    25.99
         ====================================================
         ID = 1 (  0003):      7.39   0.585     1.00    15.42

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ------------------------------------------------------------------------------
 --------------------
 | CALIB            |
 | STANDHYD (  0001)|   Area    (ha)=   5.17
 |ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
 --------------------
                              IMPERVIOUS    PERVIOUS (i)
      Surface Area     (ha)=       1.55         3.62
      Dep. Storage     (mm)=       1.50         5.00
      Average Slope     (%)=      10.00        10.00
      Length            (m)=     185.65        30.00
      Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
                 0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
                 0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
                 0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
                 0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
                 0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
                 0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
```

```
            0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
            0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Max.Eff.Inten.(mm/hr)=     109.68        43.57
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.79 (ii)    6.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.14
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.32         0.34          0.581 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      45.74        18.56          24.16
     TOTAL RAINFALL   (mm)=      47.24        47.24          47.24
     RUNOFF COEFFICIENT   =       0.97         0.39           0.51

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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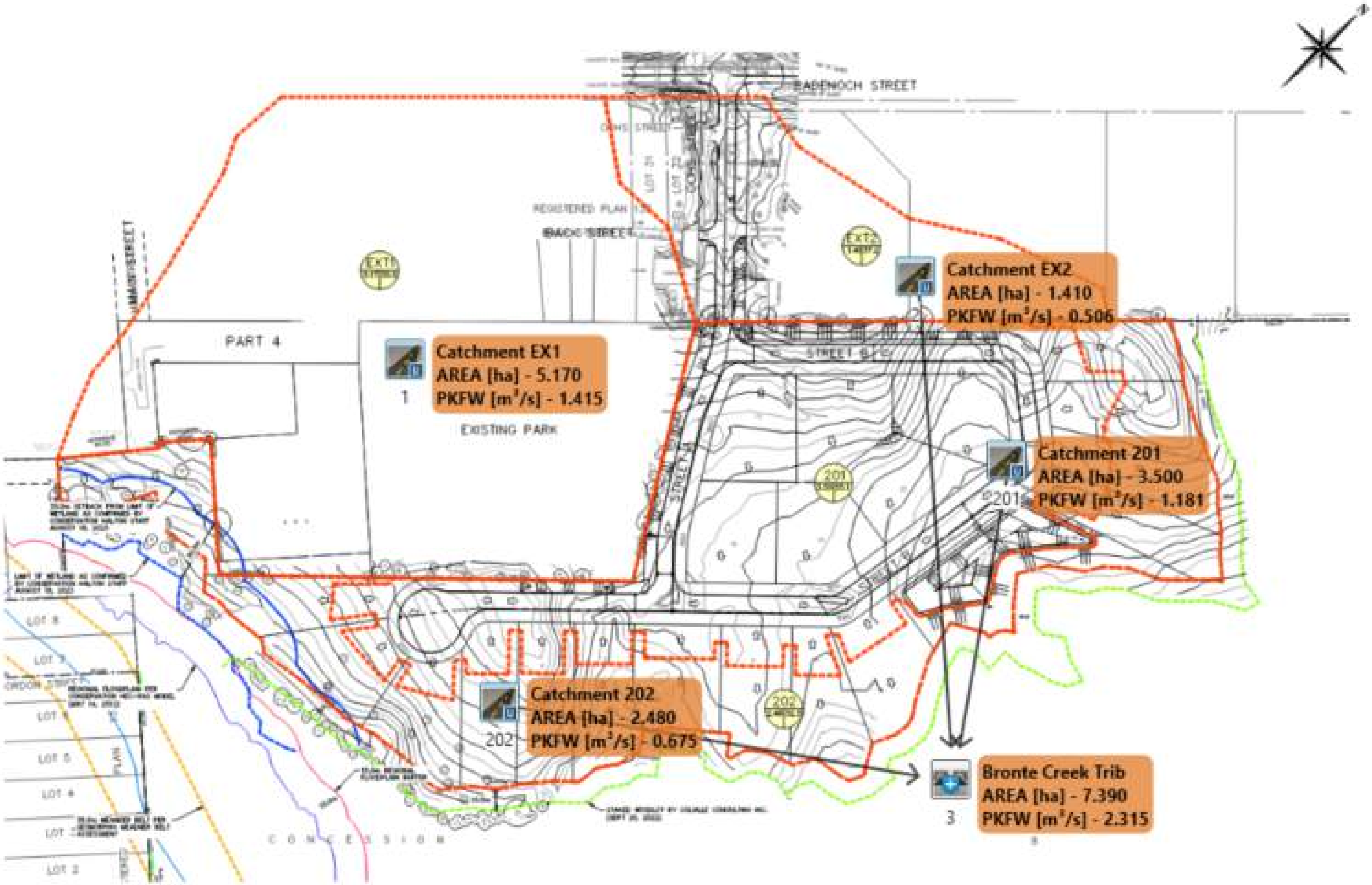
Post-Development Uncontrolled Visual-Otthymo Schematic



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

      V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
```

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

Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\e24a9d29-fbc4-4835-94f1-4595dca26fa5\scenar

Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\e24a9d29-fbc4-4835-94f1-4595dca26fa5\scenar

DATE: 12/20/2023   TIME: 09:14:57

USER:

COMMENTS: ____

```
-------------------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 100yr - 3hr 10min Chicago     **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=4688.000
| Ptotal= 87.03 mm |                          B=  17.000
--------------------                          C=   0.962
```

```
                  used in:   INTENSITY =  A / (t + B)^C

                  Duration of storm  =  3.00 hrs
                  Storm time step    = 10.00 min
                  Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	4.88	0.83	196.54	1.67	12.48	2.50	4.51
0.17	6.96	1.00	83.09	1.83	9.60	2.67	3.91
0.33	11.02	1.17	41.25	2.00	7.66	2.83	3.44
0.50	21.03	1.33	25.07	2.17	6.29		
0.67	62.12	1.50	17.06	2.33	5.28		

```
-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       1.92          1.57
    Dep. Storage     (mm)=       1.50          5.00
    Average Slope     (%)=       4.00          4.00
    Length            (m)=     152.75         20.00
    Mannings n          =      0.013         0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.88	0.833	62.12	1.583	17.06	2.33	6.29
0.167	4.88	0.917	196.54	1.667	17.06	2.42	5.28
0.250	6.96	1.000	196.54	1.750	12.48	2.50	5.28
0.333	6.96	1.083	83.09	1.833	12.48	2.58	4.51
0.417	11.02	1.167	83.09	1.917	9.60	2.67	4.51
0.500	11.02	1.250	41.25	2.000	9.60	2.75	3.91
0.583	21.03	1.333	41.25	2.083	7.66	2.83	3.91
0.667	21.03	1.417	25.07	2.167	7.66	2.92	3.44
0.750	62.12	1.500	25.07	2.250	6.29	3.00	3.44

```
    Max.Eff.Inten.(mm/hr)=     196.54        220.50
               over (min)        5.00         10.00
    Storage Coeff.  (min)=       1.66 (ii)    5.29 (ii)
    Unit Hyd. Tpeak (min)=       5.00         10.00
    Unit Hyd. peak  (cms)=       0.32          0.16
                                                        *TOTALS*
```

```
     PEAK FLOW       (cms)=       0.48         0.79          1.181 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      85.53        57.70          64.77
     TOTAL RAINFALL   (mm)=      87.03        87.03          87.03
     RUNOFF COEFFICIENT   =       0.98         0.66           0.74

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
               0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
               0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
               0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
               0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
               0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
               0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
               0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
               0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54       167.28
                over (min)       5.00        10.00
     Storage Coeff.  (min)=       1.84 (ii)    5.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.63          0.675 (iii)
```

```
     TIME TO PEAK    (hrs)=       1.00          1.08           1.08
     RUNOFF VOLUME    (mm)=      86.03         53.67          55.77
     TOTAL RAINFALL   (mm)=      87.03         87.03          87.03
     RUNOFF COEFFICIENT   =       0.99          0.62           0.64

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52          0.89
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=      96.95         30.00
     Mannings n          =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
                 0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
                 0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
                 0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
                 0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
                 0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
                 0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
                 0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
                 0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54        132.03
                over (min)        5.00          5.00
     Storage Coeff.  (min)=       0.96 (ii)     4.94 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.34          0.22
                                                                 *TOTALS*
```

```
     PEAK FLOW       (cms)=       0.20          0.31           0.506 (iii)
     TIME TO PEAK    (hrs)=       1.00          1.00            1.00
     RUNOFF VOLUME    (mm)=      85.53         50.18           59.33
     TOTAL RAINFALL   (mm)=      87.03         87.03           87.03
     RUNOFF COEFFICIENT   =       0.98          0.58            0.68

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.506     1.00    59.33
      + ID2= 2 (  0201):     3.50   1.181     1.00    64.77
        ====================================================
        ID = 3 (  0003):     4.91   1.687     1.00    63.21

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     4.91   1.687     1.00    63.21
      + ID2= 2 (  0202):     2.48   0.675     1.08    55.77
        ====================================================
        ID = 1 (  0003):     7.39   2.315     1.00    60.71

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55          3.62
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=     185.65         30.00
     Mannings n           =      0.013         0.250
```

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


                                    ---- TRANSFORMED HYETOGRAPH ----
                    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                   0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
                   0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
                   0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
                   0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
                   0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
                   0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
                   0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
                   0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
                   0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54       124.00
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.42 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.58         1.01            1.415 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08             1.00
     RUNOFF VOLUME    (mm)=      85.53        49.25            56.72
     TOTAL RAINFALL   (mm)=      87.03        87.03            87.03
     RUNOFF COEFFICIENT   =       0.98         0.57             0.65

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
```

```
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```
                    *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\690c4
4b2-808d-4c68-908a-4caee98ef7b9\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\690c4
4b2-808d-4c68-908a-4caee98ef7b9\scenar


DATE: 12/20/2023                           TIME: 09:14:57

USER:



COMMENTS: ____________________________________________________________


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  ************************************************
  ** SIMULATION : 10yr - 3hr 10min Chicago      **
  ************************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2221.000
| Ptotal= 56.26 mm |                          B=  12.000
--------------------                          C=   0.908
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
```

```
                    hrs    mm/hr |    hrs    mm/hr |'   hrs    mm/hr |    hrs    mm/hr
                   0.00     3.65 |   0.83   134.16 |   1.67     8.06 |   2.50     3.42
                   0.17     4.89 |   1.00    50.03 |   1.83     6.42 |   2.67     3.05
                   0.33     7.23 |   1.17    24.37 |   2.00     5.30 |   2.83     2.75
                   0.50    12.87 |   1.33    15.14 |   2.17     4.50 |
                   0.67    37.17 |   1.50    10.64 |   2.33     3.89 |


-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92          1.57
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=       4.00          4.00
     Length            (m)=     152.75         20.00
     Mannings n          =      0.013         0.250

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


                              ---- TRANSFORMED HYETOGRAPH ----
                   TIME     RAIN |  TIME     RAIN |'  TIME     RAIN |  TIME     RAIN
                    hrs    mm/hr |   hrs    mm/hr |'   hrs    mm/hr |   hrs    mm/hr
                  0.083     3.65 | 0.833    37.17 | 1.583    10.64 |  2.33     4.50
                  0.167     3.65 | 0.917   134.16 | 1.667    10.64 |  2.42     3.89
                  0.250     4.89 | 1.000   134.16 | 1.750     8.06 |  2.50     3.89
                  0.333     4.89 | 1.083    50.03 | 1.833     8.06 |  2.58     3.42
                  0.417     7.23 | 1.167    50.03 | 1.917     6.42 |  2.67     3.42
                  0.500     7.23 | 1.250    24.37 | 2.000     6.42 |  2.75     3.05
                  0.583    12.87 | 1.333    24.37 | 2.083     5.30 |  2.83     3.05
                  0.667    12.87 | 1.417    15.14 | 2.167     5.30 |  2.92     2.75
                  0.750    37.17 | 1.500    15.14 | 2.250     4.50 |  3.00     2.75

     Max.Eff.Inten.(mm/hr)=     134.16       119.60
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.93 (ii)    6.16 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.15
                                                               *TOTALS*
     PEAK FLOW       (cms)=       0.33         0.41              0.670 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08               1.00
     RUNOFF VOLUME    (mm)=      54.76        30.96              37.01
     TOTAL RAINFALL   (mm)=      56.26        56.26              56.26
     RUNOFF COEFFICIENT   =       0.97         0.55               0.66

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

```
      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  80.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
               0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
               0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
               0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
               0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
               0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
               0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
               0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
               0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16        87.58
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.15 (ii)    7.23 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.31           0.336 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.08
     RUNOFF VOLUME    (mm)=      55.26        28.03           29.79
     TOTAL RAINFALL   (mm)=      56.26        56.26           56.26
     RUNOFF COEFFICIENT   =       0.98         0.50            0.53

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
```

```
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52          0.89
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=      96.95         30.00
     Mannings n          =       0.013         0.250

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


                                ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
               0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
               0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
               0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
               0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
               0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
               0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
               0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
               0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16        66.97
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.12 (ii)    5.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.15
                                                               *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.14              0.243 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08              1.00
     RUNOFF VOLUME    (mm)=      54.76        25.57             33.13
     TOTAL RAINFALL   (mm)=      56.26        56.26             56.26
     RUNOFF COEFFICIENT   =       0.97         0.45              0.59

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

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.243     1.00    33.13
      + ID2= 2 (  0201):     3.50   0.670     1.00    37.01
        ==================================================
        ID = 3 (  0003):     4.91   0.913     1.00    35.89

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

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     4.91   0.913     1.00    35.89
      + ID2= 2 (  0202):     2.48   0.336     1.08    29.79
        ==================================================
        ID = 1 (  0003):     7.39   1.216     1.00    33.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


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

```
              0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
              0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
              0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
              0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
              0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
              0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
              0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
              0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
              0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16        62.36
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       1.65 (ii)    6.08 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.40         0.51          0.793 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      54.76        24.93          31.08
     TOTAL RAINFALL   (mm)=      56.26        56.26          56.26
     RUNOFF COEFFICIENT   =       0.97         0.44           0.55

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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==================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


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

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\51d13
c4e-8ee8-4488-940d-f2c6b9bf0f6b\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\51d13
c4e-8ee8-4488-940d-f2c6b9bf0f6b\scenar


DATE: 12/20/2023                          TIME: 09:14:57

USER:



COMMENTS: ____________________________________________________________


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  ************************************************
  ** SIMULATION : 25yr - 3hr 10min Chicago      **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=3158.000
| Ptotal= 68.23 mm |                          B=  15.000
--------------------                          C=   0.936
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    4.19 |  0.83  155.47 |  1.67    9.94 |  2.50    3.90
                 0.17    5.78 |  1.00   63.30 |  1.83    7.78 |  2.67    3.43
                 0.33    8.84 |  1.17   31.36 |  2.00    6.32 |  2.83    3.05
                 0.50   16.30 |  1.33   19.30 |  2.17    5.27 |
                 0.67   47.29 |  1.50   13.35 |  2.33    4.49 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   3.50
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92         1.57
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=     152.75        20.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
                 0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
                 0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
                 0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
                 0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
                 0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
                 0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
                 0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
                 0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47       154.79
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.82 (ii)    5.81 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.38         0.55           0.845 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      66.73        41.08           47.59
     TOTAL RAINFALL   (mm)=      68.23        68.23           68.23
     RUNOFF COEFFICIENT   =       0.98         0.60            0.70

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
```

```
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
                0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
                0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
                0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
                0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
                0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
                0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
                0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
                0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47       115.21
                over (min)       5.00        10.00
     Storage Coeff.  (min)=       2.02 (ii)    6.58 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.42         0.454 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.08
     RUNOFF VOLUME    (mm)=      67.23        37.66         39.58
     TOTAL RAINFALL   (mm)=      68.23        68.23         68.23
     RUNOFF COEFFICIENT   =       0.99         0.55          0.58

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

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  80.0    Ia = Dep. Storage  (Above)
       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0002)|   Area    (ha)=   1.41
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52          0.89
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=      96.95         30.00
     Mannings n           =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
               0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
               0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
               0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
               0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
               0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
               0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
               0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
               0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47         89.39
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       1.05 (ii)     5.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.34          0.16
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.16          0.18           0.308 (iii)
     TIME TO PEAK    (hrs)=       1.00          1.08            1.00
     RUNOFF VOLUME    (mm)=      66.73         34.76           43.03
     TOTAL RAINFALL   (mm)=      68.23         68.23           68.23
     RUNOFF COEFFICIENT   =       0.98          0.51            0.63

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):      1.41   0.308     1.00    43.03
      + ID2= 2 (  0201):      3.50   0.845     1.00    47.59
        ====================================================
        ID = 3 (  0003):      4.91   1.153     1.00    46.28

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):      4.91   1.153     1.00    46.28
      + ID2= 2 (  0202):      2.48   0.454     1.08    39.58
        ====================================================
        ID = 1 (  0003):      7.39   1.566     1.00    44.03

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55          3.62
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=     185.65         30.00
     Mannings n          =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
               0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
               0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
               0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
               0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
               0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
               0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
               0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
               0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47         83.57
                over (min)        5.00         10.00
```

```
     Storage Coeff.  (min)=       1.56 (ii)    5.49 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.46         0.70          1.030 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      66.73        34.00          40.74
     TOTAL RAINFALL   (mm)=      68.23        68.23          68.23
     RUNOFF COEFFICIENT   =       0.98         0.50           0.60

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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===================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```
Developed and Distributed by Smart City Water Inc


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\8ac62
30c-c0db-491c-941a-2f18626f4835\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\8ac62
30c-c0db-491c-941a-2f18626f4835\scenar
```

```
DATE: 12/20/2023                           TIME: 09:14:57

USER:


COMMENTS: _______________________________________________________

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  ************************************************
  ** SIMULATION : 2yr - 3hr 10min Chicago       **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 743.000
| Ptotal= 34.25 mm |                          B=   6.000
--------------------                          C=   0.799
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.15 |  0.83   81.10 |  1.67    5.62 |  2.50    3.01
                 0.17    3.89 |  1.00   25.63 |  1.83    4.75 |  2.67    2.77
                 0.33    5.18 |  1.17   13.34 |  2.00    4.13 |  2.83    2.56
                 0.50    7.98 |  1.33    9.07 |  2.17    3.67 |
                 0.67   19.47 |  1.50    6.91 |  2.33    3.30 |


-----------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92         1.57
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=     152.75        20.00
     Mannings n          =       0.013        0.250

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

```
                             ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
              0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
              0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
              0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
              0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
              0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
              0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
              0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
              0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        49.49
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       2.36 (ii)    7.37 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.30         0.13
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.20         0.16            0.321 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08             1.00
     RUNOFF VOLUME    (mm)=      32.75        14.03            18.79
     TOTAL RAINFALL   (mm)=      34.25        34.25            34.25
     RUNOFF COEFFICIENT   =       0.96         0.41             0.55

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                             ---- TRANSFORMED HYETOGRAPH ----
```

```
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
               0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
               0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
               0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
               0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
               0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
               0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
               0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
               0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        34.32
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.62 (ii)   10.02 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.29         0.10
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.10          0.114 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17           1.17
     RUNOFF VOLUME    (mm)=      33.25        12.21          13.57
     TOTAL RAINFALL   (mm)=      34.25        34.25          34.25
     RUNOFF COEFFICIENT   =       0.97         0.36           0.40

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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

```
                             ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
              0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
              0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
              0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
              0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
              0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
              0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
              0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
              0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        24.94
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       1.37 (ii)    7.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.13
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.05          0.115 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      32.75        10.75          16.44
     TOTAL RAINFALL   (mm)=      34.25        34.25          34.25
     RUNOFF COEFFICIENT   =       0.96         0.31           0.48

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.115     1.00    16.44
      + ID2= 2 (  0201):     3.50   0.321     1.00    18.79
        ====================================================
        ID = 3 (  0003):     4.91   0.435     1.00    18.11

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     4.91   0.435     1.00    18.11
      + ID2= 2 (  0202):     2.48   0.114     1.17    13.57
        ====================================================
        ID = 1 (  0003):     7.39   0.516     1.00    16.59

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
               0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
               0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
               0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
               0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
               0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
               0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
               0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
               0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        22.89
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.02 (ii)    8.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.12
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.24         0.16           0.352 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      32.75        10.38           14.99
     TOTAL RAINFALL   (mm)=      34.25        34.25           34.25
     RUNOFF COEFFICIENT   =       0.96         0.30            0.44

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

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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====================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```
Developed and Distributed by Smart City Water Inc

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

Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\1deea060-cf5f-4b6a-91b7-44a91e42ccb4\scenar
Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\1deea060-cf5f-4b6a-91b7-44a91e42ccb4\scenar

DATE: 12/20/2023   TIME: 09:14:57

USER:

COMMENTS: ____

****

```
 ** SIMULATION : 50yr - 3hr 10min Chicago      **
 ************************************************

--------------------
| CHICAGO STORM    |     IDF curve parameters: A=3886.000
| Ptotal= 77.60 mm |                           B=  16.000
--------------------                           C=   0.950
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33

                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.00    4.54 |  0.83  176.19 |  1.67   11.20 |  2.50    4.21
                  0.17    6.37 |  1.00   73.10 |  1.83    8.68 |  2.67    3.68
                  0.33    9.92 |  1.17   36.22 |  2.00    6.99 |  2.83    3.25
                  0.50   18.63 |  1.33   22.14 |  2.17    5.78 |
                  0.67   54.62 |  1.50   15.18 |  2.33    4.89 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92          1.57
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=       4.00          4.00
     Length            (m)=     152.75         20.00
     Mannings n           =      0.013         0.250

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


                                ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
                 0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
                 0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
                 0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
                 0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
                 0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
                 0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
                 0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
                 0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25
```

```
     Max.Eff.Inten.(mm/hr)=     176.19       187.42
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.73 (ii)    5.52 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.43         0.67           1.011 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      76.10        49.28           56.09
     TOTAL RAINFALL   (mm)=      77.60        77.60           77.60
     RUNOFF COEFFICIENT   =       0.98         0.64            0.72

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
                0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
                0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
                0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
                0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
                0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
                0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
                0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
                0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25
```

```
     Max.Eff.Inten.(mm/hr)=     176.19       140.96
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.92 (ii)    6.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.15
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.53        0.563 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08         1.08
     RUNOFF VOLUME    (mm)=      76.60        45.54        47.55
     TOTAL RAINFALL   (mm)=      77.60        77.60        77.60
     RUNOFF COEFFICIENT   =       0.99         0.59         0.61

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
                0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
                0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
                0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
                0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
                0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
                0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
                0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
                0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25
```

```
     Max.Eff.Inten.(mm/hr)=     176.19       110.39
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.00 (ii)    5.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.18         0.23           0.370 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      76.10        42.32           51.07
     TOTAL RAINFALL   (mm)=      77.60        77.60           77.60
     RUNOFF COEFFICIENT   =       0.98         0.55            0.66

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.370     1.00    51.07
      + ID2= 2 (  0201):     3.50   1.011     1.00    56.09
        ====================================================
        ID = 3 (  0003):     4.91   1.381     1.00    54.65

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     4.91   1.381     1.00    54.65
      + ID2= 2 (  0202):     2.48   0.563     1.08    47.55
        ====================================================
        ID = 1 (  0003):     7.39   1.899     1.00    52.27

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
```

```
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
                0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
                0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
                0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
                0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
                0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
                0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
                0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
                0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25

     Max.Eff.Inten.(mm/hr)=     176.19       103.47
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.48 (ii)    6.25 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.52         0.83         1.196 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      76.10        41.47         48.61
     TOTAL RAINFALL   (mm)=      77.60        77.60         77.60
     RUNOFF COEFFICIENT   =       0.98         0.53          0.63

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
==================================================================================
=========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
```

```
        V   V    I     SS    U   U  AAAAA  L
        V   V    I      SS   U   U  A   A  L
         VV      I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```
Developed and Distributed by Smart City Water Inc

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

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\d27b8
44b-a255-44ef-96a8-59f1acfbe457\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\d27b8
44b-a255-44ef-96a8-59f1acfbe457\scenar


DATE: 12/20/2023                          TIME: 09:14:57

USER:



COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------
-------------------------
  ************************************************
  ** SIMULATION : 5yr - 3hr 10min Chicago       **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1593.000
| Ptotal= 47.24 mm |                          B=  11.000
--------------------                          C=   0.879
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33
```

```
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.00    3.46 |  0.83  109.68 |  1.67    7.17 |  2.50    3.26
               0.17    4.52 |  1.00   40.71 |  1.83    5.81 |  2.67    2.93
               0.33    6.48 |  1.17   20.28 |  2.00    4.87 |  2.83    2.67
               0.50   11.07 |  1.33   12.91 |  2.17    4.19 |
               0.67   30.47 |  1.50    9.28 |  2.33    3.67 |


--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92         1.57
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=     152.75        20.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
              0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
              0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
              0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
              0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
              0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
              0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
              0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
              0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Max.Eff.Inten.(mm/hr)=     109.68        86.78
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.09 (ii)    6.68 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.27         0.29          0.504 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      45.74        23.69          29.29
     TOTAL RAINFALL   (mm)=      47.24        47.24          47.24
     RUNOFF COEFFICIENT   =       0.97         0.50           0.62
```

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN | TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |  hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
               0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
               0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
               0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
               0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
               0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
               0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
               0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
               0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
               0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Max.Eff.Inten.(mm/hr)=     109.68        62.44
                over (min)       5.00        10.00
     Storage Coeff.  (min)=       2.33 (ii)    8.15 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.30         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.21          0.234 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.08
     RUNOFF VOLUME    (mm)=      46.24        21.17          22.80
     TOTAL RAINFALL   (mm)=      47.24        47.24          47.24
     RUNOFF COEFFICIENT   =       0.98         0.45           0.48
```

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
               0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
               0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
               0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
               0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
               0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
               0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
               0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
               0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Max.Eff.Inten.(mm/hr)=     109.68        47.00
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.21 (ii)    6.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.09          0.183 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      45.74        19.10          25.99
     TOTAL RAINFALL   (mm)=      47.24        47.24          47.24
     RUNOFF COEFFICIENT   =       0.97         0.40           0.55
```

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.183     1.00    25.99
      + ID2= 2 (  0201):     3.50   0.504     1.00    29.29
        ====================================================
        ID = 3 (  0003):     4.91   0.687     1.00    28.35

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

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 3 (  0003):     4.91   0.687     1.00    28.35
      + ID2= 2 (  0202):     2.48   0.234     1.08    22.80
        ====================================================
        ID = 1 (  0003):     7.39   0.896     1.00    26.48

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
```

```
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
               0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
               0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
               0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
               0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
               0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
               0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
               0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
               0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

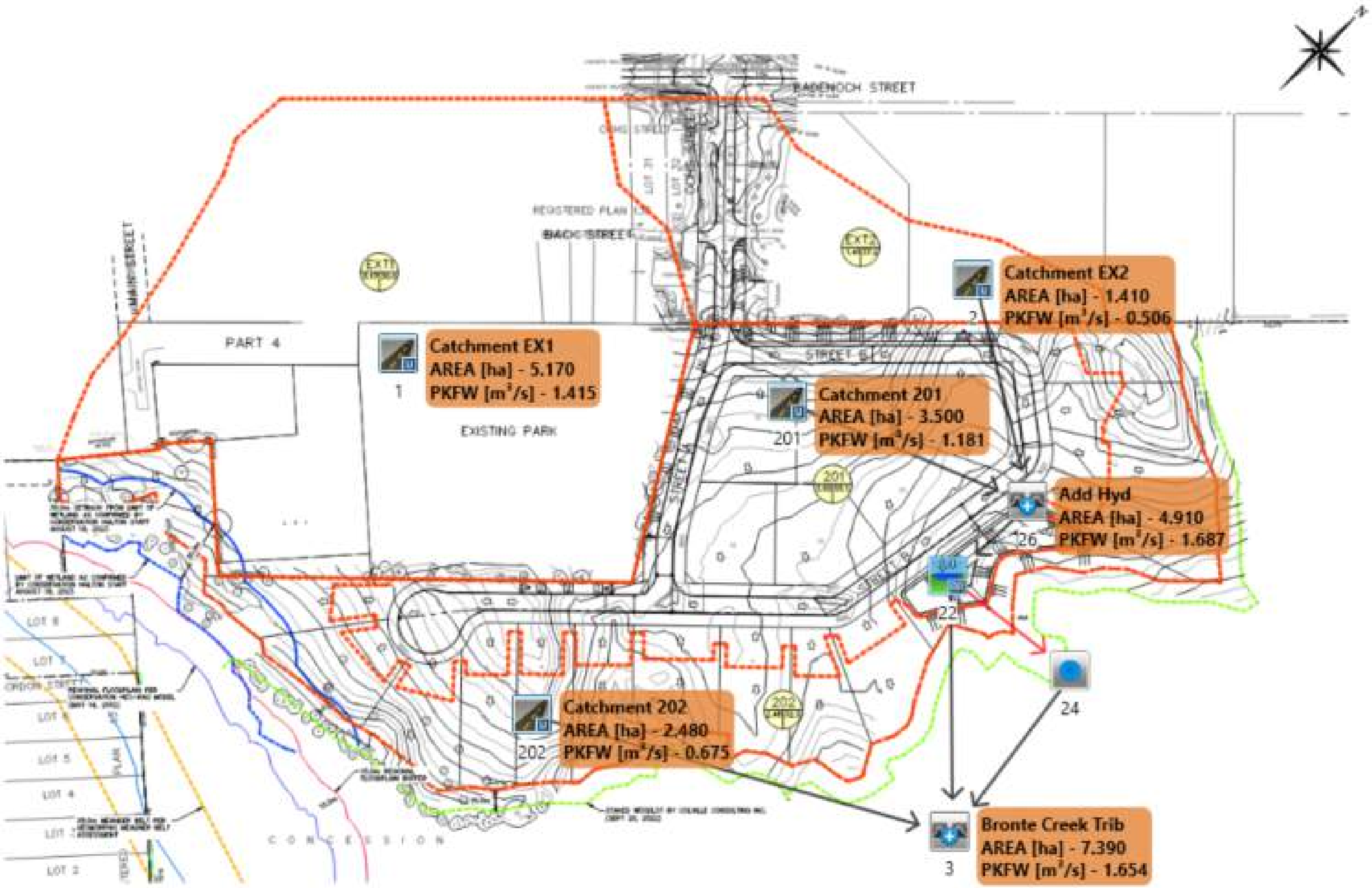
     Max.Eff.Inten.(mm/hr)=     109.68        43.57
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.79 (ii)    6.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.14
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.32         0.34             0.581 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08              1.00
     RUNOFF VOLUME    (mm)=      45.74        18.56             24.16
     TOTAL RAINFALL   (mm)=      47.24        47.24             47.24
     RUNOFF COEFFICIENT   =       0.97         0.39              0.51

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

Post-Development Controlled Visual-Otthymo Schematic



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

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\49581
d19-e44c-41b5-9170-58cdf0dfd03e\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\49581
d19-e44c-41b5-9170-58cdf0dfd03e\scenar


DATE: 12/20/2023                           TIME: 09:30:02

USER:



COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------------------
-------------------------
  ************************************************
  ** SIMULATION : 100yr - 3hr 10min Chicago     **
  ************************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A=4688.000
| Ptotal= 87.03 mm |                          B=  17.000
--------------------                          C=   0.962
```

```
                 used in:   INTENSITY =  A / (t + B)^C

                 Duration of storm  =  3.00 hrs
                 Storm time step    = 10.00 min
                 Time to peak ratio =  0.33

          TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
           hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
          0.00    4.88 |  0.83  196.54 |  1.67   12.48 |  2.50    4.51
          0.17    6.96 |  1.00   83.09 |  1.83    9.60 |  2.67    3.91
          0.33   11.02 |  1.17   41.25 |  2.00    7.66 |  2.83    3.44
          0.50   21.03 |  1.33   25.07 |  2.17    6.29 |
          0.67   62.12 |  1.50   17.06 |  2.33    5.28 |


-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92         1.57
     Dep. Storage     (mm)=       1.70         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=     152.75        20.00
     Mannings n           =      0.013        0.250

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


                             ---- TRANSFORMED HYETOGRAPH ----
          TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
           hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
         0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
         0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
         0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
         0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
         0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
         0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
         0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
         0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
         0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54       220.50
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.66 (ii)    5.29 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.16
                                                          *TOTALS*
```

```
     PEAK FLOW       (cms)=       0.48         0.79          1.181 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      85.33        57.70          64.72
     TOTAL RAINFALL   (mm)=      87.03        87.03          87.03
     RUNOFF COEFFICIENT   =       0.98         0.66           0.74

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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


                                 ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN | TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |  hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
               0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
               0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
               0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
               0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
               0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
               0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
               0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
               0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54       132.03
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.96 (ii)    4.94 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.22
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.20         0.31          0.506 (iii)
```

```
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      85.53        50.18          59.33
     TOTAL RAINFALL   (mm)=      87.03        87.03          87.03
     RUNOFF COEFFICIENT   =       0.98         0.58           0.68

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0026)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.506     1.00    59.33
      + ID2= 2 (  0201):     3.50   1.181     1.00    64.72
        ====================================================
        ID = 3 (  0026):     4.91   1.687     1.00    63.17

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0022)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.7170      0.0625
                          0.1790     0.0290   |   0.9060      0.0781
                          0.3510     0.0430   |   1.1770      0.0938
                          0.5220     0.0550   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0026)      4.910      1.687      1.00      63.17
   OUTFLOW: ID= 1 (  0022)      4.910      1.073      1.17      63.16
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 63.62
                   TIME SHIFT OF PEAK FLOW         (min)= 10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0882
```

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

  --------------------------
  | Junction Command(0024) |
  --------------------------

                            AREA     QPEAK   TPEAK     R.V.
                            (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0022)     0.00     0.00    0.00     0.00
  OUTFLOW: ID= 2(  0024)     0.00     0.00    0.00     0.00

  -------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.79         1.69
     Dep. Storage     (mm)=        1.00         5.00
     Average Slope     (%)=        2.00         4.00
     Length            (m)=      128.58        30.00
     Mannings n           =       0.013        0.250

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


                                ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
                 0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
                 0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
                 0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
                 0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
                 0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
                 0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
                 0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
                 0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54       167.28
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.84 (ii)    5.77 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                               *TOTALS*
     PEAK FLOW       (cms)=       0.09         0.63           0.675 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.08
     RUNOFF VOLUME    (mm)=      86.03        53.67           55.77
     TOTAL RAINFALL   (mm)=      87.03        87.03           87.03
```

```
     RUNOFF COEFFICIENT   =       0.99         0.62           0.64

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     2.48   0.675     1.08    55.77
      + ID2= 2 (  0022):     4.91   1.073     1.17    63.16
        ====================================================
        ID = 3 (  0003):     7.39   1.654     1.08    60.68

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

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0024 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0003):     7.39   1.654     1.08    60.68
      + ID2= 2 (  0024):     0.00   0.000     0.00     0.00
        ====================================================
        ID = 1 (  0003):     7.39   1.654     1.08    60.68

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n           =      0.013        0.250
```

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


                          ---- TRANSFORMED HYETOGRAPH ----
            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
           0.083    4.88 | 0.833   62.12 | 1.583   17.06 |  2.33    6.29
           0.167    4.88 | 0.917  196.54 | 1.667   17.06 |  2.42    5.28
           0.250    6.96 | 1.000  196.54 | 1.750   12.48 |  2.50    5.28
           0.333    6.96 | 1.083   83.09 | 1.833   12.48 |  2.58    4.51
           0.417   11.02 | 1.167   83.09 | 1.917    9.60 |  2.67    4.51
           0.500   11.02 | 1.250   41.25 | 2.000    9.60 |  2.75    3.91
           0.583   21.03 | 1.333   41.25 | 2.083    7.66 |  2.83    3.91
           0.667   21.03 | 1.417   25.07 | 2.167    7.66 |  2.92    3.44
           0.750   62.12 | 1.500   25.07 | 2.250    6.29 |  3.00    3.44

     Max.Eff.Inten.(mm/hr)=     196.54       124.00
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.42 (ii)    5.98 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.58         1.01           1.415 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      85.53        49.25           56.72
     TOTAL RAINFALL   (mm)=      87.03        87.03           87.03
     RUNOFF COEFFICIENT   =       0.98         0.57            0.65

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
```

```
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\6642b
92f-f643-402b-99a7-bb13f4b2a990\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\6642b
92f-f643-402b-99a7-bb13f4b2a990\scenar


DATE: 12/20/2023                           TIME: 09:30:02

USER:



COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------
-------------------------
  ************************************************
  ** SIMULATION : 10yr - 3hr 10min Chicago      **
  ************************************************


--------------------
| CHICAGO STORM    |     IDF curve parameters: A=2221.000
| Ptotal= 56.26 mm |                           B=  12.000
--------------------                           C=   0.908
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.65 |  0.83  134.16 |  1.67    8.06 |  2.50    3.42
                 0.17    4.89 |  1.00   50.03 |  1.83    6.42 |  2.67    3.05
                 0.33    7.23 |  1.17   24.37 |  2.00    5.30 |  2.83    2.75
                 0.50   12.87 |  1.33   15.14 |  2.17    4.50 |
```

```
             0.67   37.17 |  1.50   10.64 |  2.33    3.89 |


---------------------------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92         1.57
     Dep. Storage     (mm)=       1.70         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=     152.75        20.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
               0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
               0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
               0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
               0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
               0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
               0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
               0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
               0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16       119.60
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.93 (ii)    6.16 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.33         0.41           0.670 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      54.56        30.96           36.96
     TOTAL RAINFALL   (mm)=      56.26        56.26           56.26
     RUNOFF COEFFICIENT   =       0.97         0.55            0.66

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
                0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
                0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
                0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
                0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
                0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
                0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
                0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
                0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16        66.97
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.12 (ii)    5.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.14          0.243 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      54.76        25.57          33.13
     TOTAL RAINFALL   (mm)=      56.26        56.26          56.26
     RUNOFF COEFFICIENT   =       0.97         0.45           0.59

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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

--------------------
| ADD HYD  (  0026)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.243     1.00    33.13
      + ID2= 2 (  0201):     3.50   0.670     1.00    36.96
        ====================================================
        ID = 3 (  0026):     4.91   0.913     1.00    35.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0022)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.7170      0.0625
                          0.1790     0.0290   |   0.9060      0.0781
                          0.3510     0.0430   |   1.1770      0.0938
                          0.5220     0.0550   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0026)      4.910      0.913      1.00      35.86
   OUTFLOW: ID= 1 (  0022)      4.910      0.528      1.25      35.85
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 57.83
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0565

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

  --------------------------
  | Junction Command(0024) |
  --------------------------

                            AREA     QPEAK   TPEAK     R.V.
                            (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0022)     0.00     0.00    0.00     0.00
  OUTFLOW: ID= 2(  0024)     0.00     0.00    0.00     0.00

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

```
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
               0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
               0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
               0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
               0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
               0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
               0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
               0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
               0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16        87.58
                over (min)       5.00        10.00
     Storage Coeff.  (min)=       2.15 (ii)    7.23 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.06         0.31          0.336 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.08
     RUNOFF VOLUME    (mm)=      55.26        28.03          29.79
     TOTAL RAINFALL   (mm)=      56.26        56.26          56.26
     RUNOFF COEFFICIENT   =       0.98         0.50           0.53

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     2.48   0.336     1.08    29.79
      + ID2= 2 (  0022):     4.91   0.528     1.25    35.85
        ===================================================
        ID = 3 (  0003):     7.39   0.812     1.17    33.82

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

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0024 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0003):     7.39   0.812     1.17    33.82
      + ID2= 2 (  0024):     0.00   0.000     0.00     0.00
        ===================================================
        ID = 1 (  0003):     7.39   0.812     1.17    33.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.65 | 0.833   37.17 | 1.583   10.64 |  2.33    4.50
                0.167    3.65 | 0.917  134.16 | 1.667   10.64 |  2.42    3.89
                0.250    4.89 | 1.000  134.16 | 1.750    8.06 |  2.50    3.89
                0.333    4.89 | 1.083   50.03 | 1.833    8.06 |  2.58    3.42
                0.417    7.23 | 1.167   50.03 | 1.917    6.42 |  2.67    3.42
```

```
              0.500    7.23 | 1.250   24.37 | 2.000    6.42 |  2.75    3.05
              0.583   12.87 | 1.333   24.37 | 2.083    5.30 |  2.83    3.05
              0.667   12.87 | 1.417   15.14 | 2.167    5.30 |  2.92    2.75
              0.750   37.17 | 1.500   15.14 | 2.250    4.50 |  3.00    2.75

     Max.Eff.Inten.(mm/hr)=     134.16        62.36
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       1.65 (ii)    6.08 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.40         0.51          0.793 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      54.76        24.93          31.08
     TOTAL RAINFALL   (mm)=      56.26        56.26          56.26
     RUNOFF COEFFICIENT   =       0.97         0.44           0.55

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
```

C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\50606
1a7-bd76-4f82-8662-cb130327e5e2\scenar
Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\50606
1a7-bd76-4f82-8662-cb130327e5e2\scenar

DATE: 12/20/2023 TIME: 09:30:02

USER:

COMMENTS: ____

```
----------------------------------------------------------------------------------
-------------------------
  ************************************************
  ** SIMULATION : 25mm - 3hr 10min Chicago      **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 743.000
| Ptotal= 34.25 mm |                          B=   6.000
--------------------                          C=   0.799
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	3.15	0.83	81.10	1.67	5.62	2.50	3.01
0.17	3.89	1.00	25.63	1.83	4.75	2.67	2.77
0.33	5.18	1.17	13.34	2.00	4.13	2.83	2.56
0.50	7.98	1.33	9.07	2.17	3.67		
0.67	19.47	1.50	6.91	2.33	3.30		

```
-------------------------------------------------------------------------------
--------------------
| MODIFY STORM     |    MODIFYING PARAMETERS
--------------------    Time shift  (min)    =  0.00
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.167	2.30	1.000	59.19	1.833	4.10	2.67	2.19
0.333	2.84	1.167	18.70	2.000	3.47	2.83	2.02

```
              0.500    3.78 | 1.333    9.73 | 2.167    3.02 |  3.00    1.87
              0.667    5.83 | 1.500    6.62 | 2.333    2.68 |
              0.833   14.21 | 1.667    5.05 | 2.500    2.41 |

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92         1.57
     Dep. Storage     (mm)=       1.70         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=     152.75        20.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.30 | 0.833   14.21 | 1.583    5.05 |  2.33    2.68
              0.167    2.30 | 0.917   59.19 | 1.667    5.05 |  2.42    2.41
              0.250    2.84 | 1.000   59.19 | 1.750    4.10 |  2.50    2.41
              0.333    2.84 | 1.083   18.70 | 1.833    4.10 |  2.58    2.19
              0.417    3.78 | 1.167   18.70 | 1.917    3.47 |  2.67    2.19
              0.500    3.78 | 1.250    9.73 | 2.000    3.47 |  2.75    2.02
              0.583    5.83 | 1.333    9.73 | 2.083    3.02 |  2.83    2.02
              0.667    5.83 | 1.417    6.62 | 2.167    3.02 |  2.92    1.87
              0.750   14.21 | 1.500    6.62 | 2.250    2.68 |  3.00    1.87

     Max.Eff.Inten.(mm/hr)=      59.19        26.31
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.68 (ii)    9.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.29         0.12
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.08          0.199 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      23.30         8.02          11.90
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.93         0.32           0.48

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
```

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
    Surface Area      (ha)=       0.52         0.89
    Dep. Storage      (mm)=       1.50         5.00
    Average Slope      (%)=      10.00        10.00
    Length             (m)=      96.95        30.00
    Mannings n            =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    2.30 | 0.833   14.21 | 1.583    5.05 |  2.33    2.68
                 0.167    2.30 | 0.917   59.19 | 1.667    5.05 |  2.42    2.41
                 0.250    2.84 | 1.000   59.19 | 1.750    4.10 |  2.50    2.41
                 0.333    2.84 | 1.083   18.70 | 1.833    4.10 |  2.58    2.19
                 0.417    3.78 | 1.167   18.70 | 1.917    3.47 |  2.67    2.19
                 0.500    3.78 | 1.250    9.73 | 2.000    3.47 |  2.75    2.02
                 0.583    5.83 | 1.333    9.73 | 2.083    3.02 |  2.83    2.02
                 0.667    5.83 | 1.417    6.62 | 2.167    3.02 |  2.92    1.87
                 0.750   14.21 | 1.500    6.62 | 2.250    2.68 |  3.00    1.87

    Max.Eff.Inten.(mm/hr)=      59.19        11.99
               over (min)       5.00        15.00
    Storage Coeff.  (min)=       1.55 (ii)   10.11 (ii)
    Unit Hyd. Tpeak (min)=       5.00        15.00
    Unit Hyd. peak  (cms)=       0.33         0.10
                                                           *TOTALS*
    PEAK FLOW       (cms)=       0.06         0.02           0.067 (iii)
    TIME TO PEAK    (hrs)=       1.00         1.17            1.00
    RUNOFF VOLUME    (mm)=      23.50         5.78           10.37
    TOTAL RAINFALL   (mm)=      25.00        25.00           25.00
    RUNOFF COEFFICIENT   =       0.94         0.23            0.41

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

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

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

 --------------------
 | ADD HYD  (  0026)|
 |   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
 --------------------         (ha)    (cms)    (hrs)     (mm)
         ID1= 1 (  0002):     1.41   0.067     1.00    10.37
       + ID2= 2 (  0201):     3.50   0.199     1.00    11.90
         ==================================================
         ID = 3 (  0026):     4.91   0.266     1.00    11.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
 ------------------------------------------------------------------------------
 --------------------
 | RESERVOIR(  0022)|     OVERFLOW IS ON
 | IN= 2---> OUT= 1 |
 | DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
 --------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |   0.7170      0.0625
                           0.1790     0.0290   |   0.9060      0.0781
                           0.3510     0.0430   |   1.1770      0.0938
                           0.5220     0.0550   |   0.0000      0.0000

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0026)      4.910      0.266      1.00      11.46
   OUTFLOW: ID= 1 (  0022)      4.910      0.112      1.25      11.45
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 42.08
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0183

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

   --------------------------
   | Junction Command(0024) |
   --------------------------

                            AREA     QPEAK   TPEAK     R.V.
                            (ha)     (cms)    (hrs)    (mm)
   INFLOW : ID= 3(  0022)    0.00     0.00    0.00     0.00
   OUTFLOW: ID= 2(  0024)    0.00     0.00    0.00     0.00
```

```
  ------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.30 | 0.833   14.21 | 1.583    5.05 |  2.33    2.68
               0.167    2.30 | 0.917   59.19 | 1.667    5.05 |  2.42    2.41
               0.250    2.84 | 1.000   59.19 | 1.750    4.10 |  2.50    2.41
               0.333    2.84 | 1.083   18.70 | 1.833    4.10 |  2.58    2.19
               0.417    3.78 | 1.167   18.70 | 1.917    3.47 |  2.67    2.19
               0.500    3.78 | 1.250    9.73 | 2.000    3.47 |  2.75    2.02
               0.583    5.83 | 1.333    9.73 | 2.083    3.02 |  2.83    2.02
               0.667    5.83 | 1.417    6.62 | 2.167    3.02 |  2.92    1.87
               0.750   14.21 | 1.500    6.62 | 2.250    2.68 |  3.00    1.87

     Max.Eff.Inten.(mm/hr)=      59.19        17.37
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.98 (ii)   12.69 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.28         0.08
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.03         0.05          0.056 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17           1.17
     RUNOFF VOLUME    (mm)=      24.00         6.76           7.88
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.96         0.27           0.32

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     2.48   0.056     1.17     7.88
      + ID2= 2 (  0022):     4.91   0.112     1.25    11.45
        ==================================================
        ID = 3 (  0003):     7.39   0.163     1.17    10.25

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0024 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0003):     7.39   0.163     1.17    10.25
      + ID2= 2 (  0024):     0.00   0.000     0.00     0.00
        ==================================================
        ID = 1 (  0003):     7.39   0.163     1.17    10.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    2.30 | 0.833   14.21 | 1.583    5.05 |  2.33    2.68
                0.167    2.30 | 0.917   59.19 | 1.667    5.05 |  2.42    2.41
                0.250    2.84 | 1.000   59.19 | 1.750    4.10 |  2.50    2.41
                0.333    2.84 | 1.083   18.70 | 1.833    4.10 |  2.58    2.19
```

```
                0.417    3.78 | 1.167   18.70 | 1.917    3.47 |  2.67    2.19
                0.500    3.78 | 1.250    9.73 | 2.000    3.47 |  2.75    2.02
                0.583    5.83 | 1.333    9.73 | 2.083    3.02 |  2.83    2.02
                0.667    5.83 | 1.417    6.62 | 2.167    3.02 |  2.92    1.87
                0.750   14.21 | 1.500    6.62 | 2.250    2.68 |  3.00    1.87

     Max.Eff.Inten.(mm/hr)=      59.19        10.89
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.29 (ii)   11.18 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.30         0.09
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.17         0.07          0.198 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17           1.00
     RUNOFF VOLUME    (mm)=      23.50         5.54           9.24
     TOTAL RAINFALL   (mm)=      25.00        25.00          25.00
     RUNOFF COEFFICIENT   =       0.94         0.22           0.37

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 FINISH
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\a1c73
80d-0557-47e6-901f-44f01a3abbcc\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\a1c73
80d-0557-47e6-901f-44f01a3abbcc\scenar


DATE: 12/20/2023                           TIME: 09:30:02

USER:



COMMENTS: ____________________________________________________________


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  ************************************************
  ** SIMULATION : 25yr - 3hr 10min Chicago      **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=3158.000
| Ptotal= 68.23 mm |                          B=  15.000
--------------------                          C=   0.936
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    4.19 |  0.83  155.47 |  1.67    9.94 |  2.50    3.90
                 0.17    5.78 |  1.00   63.30 |  1.83    7.78 |  2.67    3.43
                 0.33    8.84 |  1.17   31.36 |  2.00    6.32 |  2.83    3.05
                 0.50   16.30 |  1.33   19.30 |  2.17    5.27 |
                 0.67   47.29 |  1.50   13.35 |  2.33    4.49 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
```

```
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92         1.57
     Dep. Storage     (mm)=       1.70         5.00
     Average Slope     (%)=       4.00         4.00
     Length            (m)=     152.75        20.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
                0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
                0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
                0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
                0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
                0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
                0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
                0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
                0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47       154.79
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.82 (ii)    5.81 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.38         0.55         0.845 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      66.53        41.08         47.54
     TOTAL RAINFALL   (mm)=      68.23        68.23         68.23
     RUNOFF COEFFICIENT   =       0.98         0.60          0.70

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.41
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
               0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
               0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
               0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
               0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
               0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
               0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
               0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
               0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47        89.39
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.05 (ii)    5.43 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.16         0.18           0.308 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      66.73        34.76           43.03
     TOTAL RAINFALL   (mm)=      68.23        68.23           68.23
     RUNOFF COEFFICIENT   =       0.98         0.51            0.63

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0026)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
```

```
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.308     1.00    43.03
      + ID2= 2 (  0201):     3.50   0.845     1.00    47.54
        ====================================================
        ID = 3 (  0026):     4.91   1.153     1.00    46.25

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0022)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.7170      0.0625
                          0.1790     0.0290   |   0.9060      0.0781
                          0.3510     0.0430   |   1.1770      0.0938
                          0.5220     0.0550   |   0.0000      0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0026)      4.910      1.153      1.00      46.25
   OUTFLOW: ID= 1 (  0022)      4.910      0.757      1.17      46.24
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 65.62
                   TIME SHIFT OF PEAK FLOW        (min)= 10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0665

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

  --------------------------
  | Junction Command(0024) |
  --------------------------

                          AREA     QPEAK   TPEAK     R.V.
                          (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0022)    0.00     0.00    0.00     0.00
  OUTFLOW: ID= 2(  0024)    0.00     0.00    0.00     0.00

  -------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
```

```
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
               0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
               0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
               0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
               0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
               0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
               0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
               0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
               0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47       115.21
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.02 (ii)    6.58 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.14
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.07         0.42           0.454 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.08
     RUNOFF VOLUME    (mm)=      67.23        37.66           39.58
     TOTAL RAINFALL   (mm)=      68.23        68.23           68.23
     RUNOFF COEFFICIENT   =       0.99         0.55            0.58

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
        ID1= 1 (  0202):     2.48   0.454     1.08    39.58
      + ID2= 2 (  0022):     4.91   0.757     1.17    46.24
        ====================================================
        ID = 3 (  0003):     7.39   1.138     1.17    44.01

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0024 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0003):     7.39   1.138     1.17    44.01
      + ID2= 2 (  0024):     0.00   0.000     0.00     0.00
        ====================================================
        ID = 1 (  0003):     7.39   1.138     1.17    44.01

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.19 | 0.833   47.29 | 1.583   13.35 |  2.33    5.27
               0.167    4.19 | 0.917  155.47 | 1.667   13.35 |  2.42    4.49
               0.250    5.78 | 1.000  155.47 | 1.750    9.94 |  2.50    4.49
               0.333    5.78 | 1.083   63.30 | 1.833    9.94 |  2.58    3.90
               0.417    8.84 | 1.167   63.30 | 1.917    7.78 |  2.67    3.90
               0.500    8.84 | 1.250   31.36 | 2.000    7.78 |  2.75    3.43
               0.583   16.30 | 1.333   31.36 | 2.083    6.32 |  2.83    3.43
               0.667   16.30 | 1.417   19.30 | 2.167    6.32 |  2.92    3.05
               0.750   47.29 | 1.500   19.30 | 2.250    5.27 |  3.00    3.05

     Max.Eff.Inten.(mm/hr)=     155.47        83.57
```

```
             over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.56 (ii)    5.49 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.16
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.46         0.70        1.030 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08         1.00
     RUNOFF VOLUME    (mm)=      66.73        34.00        40.74
     TOTAL RAINFALL   (mm)=      68.23        68.23        68.23
     RUNOFF COEFFICIENT   =       0.98         0.50         0.60

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```


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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\3abd9
40e-09ea-4ce3-b84f-798f85ad2228\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\3abd9
40e-09ea-4ce3-b84f-798f85ad2228\scenar
```

```
DATE: 12/20/2023                            TIME: 09:30:02

USER:


COMMENTS: ____________________________________________________________

-----------------------------------------------------------------------------------
-------------------------
  ************************************************
  ** SIMULATION : 2yr - 3hr 10min Chicago       **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 743.000
| Ptotal= 34.25 mm |                          B=   6.000
--------------------                          C=   0.799
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    3.15 |  0.83   81.10 |  1.67    5.62 |  2.50    3.01
                 0.17    3.89 |  1.00   25.63 |  1.83    4.75 |  2.67    2.77
                 0.33    5.18 |  1.17   13.34 |  2.00    4.13 |  2.83    2.56
                 0.50    7.98 |  1.33    9.07 |  2.17    3.67 |
                 0.67   19.47 |  1.50    6.91 |  2.33    3.30 |


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        1.92         1.57
     Dep. Storage     (mm)=        1.70         5.00
     Average Slope     (%)=        4.00         4.00
     Length            (m)=      152.75        20.00
     Mannings n          =       0.013        0.250

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

```
                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
                0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
                0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
                0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
                0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
                0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
                0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
                0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
                0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        49.49
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       2.36 (ii)    7.37 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.30         0.13
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.20         0.16             0.321 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08              1.00
     RUNOFF VOLUME    (mm)=      32.55        14.03             18.74
     TOTAL RAINFALL   (mm)=      34.25        34.25             34.25
     RUNOFF COEFFICIENT   =       0.95         0.41              0.55

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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

```
                                 ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
                 0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
                 0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
                 0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
                 0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
                 0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
                 0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
                 0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
                 0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        24.94
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.37 (ii)    7.75 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.13
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.05            0.115 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08             1.00
     RUNOFF VOLUME    (mm)=      32.75        10.75            16.44
     TOTAL RAINFALL   (mm)=      34.25        34.25            34.25
     RUNOFF COEFFICIENT   =       0.96         0.31             0.48

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0026)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.115     1.00    16.44
      + ID2= 2 (  0201):     3.50   0.321     1.00    18.74
        ==================================================
        ID = 3 (  0026):     4.91   0.435     1.00    18.08

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0022)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
```

```
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.7170     0.0625
                          0.1790     0.0290   |   0.9060     0.0781
                          0.3510     0.0430   |   1.1770     0.0938
                          0.5220     0.0550   |   0.0000     0.0000

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0026)      4.910      0.435      1.00      18.08
   OUTFLOW: ID= 1 (  0022)      4.910      0.190      1.25      18.07
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00       0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 43.56
                   TIME SHIFT OF PEAK FLOW         (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0299

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

  --------------------------
  | Junction Command(0024) |
  --------------------------

                          AREA     QPEAK   TPEAK     R.V.
                          (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0022)    0.00     0.00    0.00     0.00
  OUTFLOW: ID= 2(  0024)    0.00     0.00    0.00     0.00

  -----------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n          =      0.013        0.250

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


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

```
                0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
                0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
                0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
                0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
                0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
                0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
                0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
                0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
                0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        34.32
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       2.62 (ii)   10.02 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.29         0.10
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.04         0.10           0.114 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17            1.17
     RUNOFF VOLUME    (mm)=      33.25        12.21           13.57
     TOTAL RAINFALL   (mm)=      34.25        34.25           34.25
     RUNOFF COEFFICIENT   =       0.97         0.36            0.40

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     2.48   0.114     1.17    13.57
      + ID2= 2 (  0022):     4.91   0.190     1.25    18.07
        ====================================================
        ID = 3 (  0003):     7.39   0.289     1.17    16.56

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
*** W A R N I N G :  HYDROGRAPH   0024 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0003):     7.39   0.289     1.17    16.56
      + ID2= 2 (  0024):     0.00   0.000     0.00     0.00
        ==================================================
        ID = 1 (  0003):     7.39   0.289     1.17    16.56

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN | TIME    RAIN |' TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |  hrs   mm/hr |'  hrs   mm/hr |   hrs   mm/hr
               0.083    3.15 | 0.833   19.47 | 1.583    6.91 |  2.33    3.67
               0.167    3.15 | 0.917   81.10 | 1.667    6.91 |  2.42    3.30
               0.250    3.89 | 1.000   81.10 | 1.750    5.62 |  2.50    3.30
               0.333    3.89 | 1.083   25.63 | 1.833    5.62 |  2.58    3.01
               0.417    5.18 | 1.167   25.63 | 1.917    4.75 |  2.67    3.01
               0.500    5.18 | 1.250   13.34 | 2.000    4.75 |  2.75    2.77
               0.583    7.98 | 1.333   13.34 | 2.083    4.13 |  2.83    2.77
               0.667    7.98 | 1.417    9.07 | 2.167    4.13 |  2.92    2.56
               0.750   19.47 | 1.500    9.07 | 2.250    3.67 |  3.00    2.56

     Max.Eff.Inten.(mm/hr)=      81.10        22.89
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.02 (ii)    8.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.12
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.24         0.16           0.352 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      32.75        10.38           14.99
     TOTAL RAINFALL   (mm)=      34.25        34.25           34.25
     RUNOFF COEFFICIENT   =       0.96         0.30            0.44

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

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2015)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```



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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\cba1e
d0d-3b4f-4544-b620-d6966eeeafff\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\cba1e
d0d-3b4f-4544-b620-d6966eeeafff\scenar


DATE: 12/20/2023                           TIME: 09:30:02

USER:


COMMENTS: ____________________________________________________________


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```
 *********************************************
 ** SIMULATION : 50yr - 3hr 10min Chicago     **
 *********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=3886.000
| Ptotal= 77.60 mm |                          B=  16.000
--------------------                          C=   0.950
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    4.54 |  0.83  176.19 |  1.67   11.20 |  2.50    4.21
                 0.17    6.37 |  1.00   73.10 |  1.83    8.68 |  2.67    3.68
                 0.33    9.92 |  1.17   36.22 |  2.00    6.99 |  2.83    3.25
                 0.50   18.63 |  1.33   22.14 |  2.17    5.78 |
                 0.67   54.62 |  1.50   15.18 |  2.33    4.89 |


-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.92          1.57
     Dep. Storage     (mm)=       1.70          5.00
     Average Slope     (%)=       4.00          4.00
     Length            (m)=     152.75         20.00
     Mannings n          =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
                0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
                0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
                0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
                0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
                0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
                0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
                0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
```

```
                0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25

     Max.Eff.Inten.(mm/hr)=     176.19       187.42
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.73 (ii)    5.52 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.16
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.43         0.67          1.011 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      75.90        49.28          56.04
     TOTAL RAINFALL   (mm)=      77.60        77.60          77.60
     RUNOFF COEFFICIENT   =       0.98         0.64           0.72

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                                 IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n           =      0.013        0.250

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


                                  ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
                0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
                0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
                0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
                0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
                0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
                0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
                0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
                0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25
```

```
     Max.Eff.Inten.(mm/hr)=     176.19       110.39
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.00 (ii)    5.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.16
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.18         0.23         0.370 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      76.10        42.32         51.07
     TOTAL RAINFALL   (mm)=      77.60        77.60         77.60
     RUNOFF COEFFICIENT   =       0.98         0.55          0.66

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0026)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.370     1.00    51.07
      + ID2= 2 (  0201):     3.50   1.011     1.00    56.04
        ===================================================
        ID = 3 (  0026):     4.91   1.381     1.00    54.61

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0022)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.7170      0.0625
                          0.1790     0.0290   |   0.9060      0.0781
                          0.3510     0.0430   |   1.1770      0.0938
                          0.5220     0.0550   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0026)      4.910      1.381      1.00       54.61
   OUTFLOW: ID= 1 (  0022)      4.910      0.896      1.17       54.61
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00        0.00
```

```
                 TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                 CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                 PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 64.83
                 TIME SHIFT OF PEAK FLOW        (min)= 10.00
                 MAXIMUM  STORAGE   USED       (ha.m.)=  0.0782

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

  --------------------------
  | Junction Command(0024) |
  --------------------------

                          AREA     QPEAK   TPEAK     R.V.
                          (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0022)    0.00     0.00    0.00     0.00
  OUTFLOW: ID= 2(  0024)    0.00     0.00    0.00     0.00

  -------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
              0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
              0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
              0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
              0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
              0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
              0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
              0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
              0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25

     Max.Eff.Inten.(mm/hr)=     176.19       140.96
               over (min)         5.00        10.00
```

```
     Storage Coeff.  (min)=       1.92 (ii)    6.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.15
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.53         0.563 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.08
     RUNOFF VOLUME    (mm)=      76.60        45.54         47.55
     TOTAL RAINFALL   (mm)=      77.60        77.60         77.60
     RUNOFF COEFFICIENT   =       0.99         0.59          0.61

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     2.48   0.563     1.08    47.55
      + ID2= 2 (  0022):     4.91   0.896     1.17    54.61
        ====================================================
        ID = 3 (  0003):     7.39   1.385     1.08    52.24

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

--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0024 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0003):     7.39   1.385     1.08    52.24
      + ID2= 2 (  0024):     0.00   0.000     0.00     0.00
        ====================================================
        ID = 1 (  0003):     7.39   1.385     1.08    52.24

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55         3.62
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=     185.65        30.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                   TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                    hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.083    4.54 | 0.833   54.62 | 1.583   15.18 |  2.33    5.78
                  0.167    4.54 | 0.917  176.19 | 1.667   15.18 |  2.42    4.89
                  0.250    6.37 | 1.000  176.19 | 1.750   11.20 |  2.50    4.89
                  0.333    6.37 | 1.083   73.10 | 1.833   11.20 |  2.58    4.21
                  0.417    9.92 | 1.167   73.10 | 1.917    8.68 |  2.67    4.21
                  0.500    9.92 | 1.250   36.22 | 2.000    8.68 |  2.75    3.68
                  0.583   18.63 | 1.333   36.22 | 2.083    6.99 |  2.83    3.68
                  0.667   18.63 | 1.417   22.14 | 2.167    6.99 |  2.92    3.25
                  0.750   54.62 | 1.500   22.14 | 2.250    5.78 |  3.00    3.25

     Max.Eff.Inten.(mm/hr)=     176.19       103.47
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.48 (ii)    6.25 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                           *TOTALS*
     PEAK FLOW       (cms)=       0.52         0.83          1.196 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      76.10        41.47          48.61
     TOTAL RAINFALL   (mm)=      77.60        77.60          77.60
     RUNOFF COEFFICIENT   =       0.98         0.53           0.63

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
==================================================================================
=========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2015)
```

```
       V     V   I    SS      U    U    A A    L
        V   V    I     SS     U    U   AAAAA   L
        V   V    I      SS    U    U   A    A  L
         VV      I    SSSSS   UUUUU   A    A   LLLLL

        OOO    TTTTT  TTTTT   H    H   Y    Y   M    M    OOO     TM
       O    O    T      T     H    H    Y Y     MM MM   O    O
       O    O    T      T     H    H     Y      M    M  O    O
        OOO      T      T     H    H     Y      M    M   OOO
```

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\868cc
d88-a4ff-4525-908a-de644f97bc5e\scenar
  Summary filename:
C:\Users\bpond\AppData\Local\Civica\VH5\db2b9d01-d7f6-4e0b-8e9d-a57b449df036\868cc
d88-a4ff-4525-908a-de644f97bc5e\scenar


DATE: 12/20/2023                           TIME: 09:30:02

USER:



COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------
-------------------------
  ************************************************
  ** SIMULATION : 5yr - 3hr 10min Chicago       **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1593.000
| Ptotal= 47.24 mm |                          B=  11.000
--------------------                          C=   0.879
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  3.00 hrs
                        Storm time step    = 10.00 min
```

```
                  Time to peak ratio =  0.33

            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
            0.00    3.46 |  0.83  109.68 |  1.67    7.17 |  2.50    3.26
            0.17    4.52 |  1.00   40.71 |  1.83    5.81 |  2.67    2.93
            0.33    6.48 |  1.17   20.28 |  2.00    4.87 |  2.83    2.67
            0.50   11.07 |  1.33   12.91 |  2.17    4.19 |
            0.67   30.47 |  1.50    9.28 |  2.33    3.67 |


--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0201)|   Area    (ha)=   3.50
|ID= 1 DT= 5.0 min |   Total Imp(%)=  55.00   Dir. Conn.(%)=  25.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        1.92          1.57
     Dep. Storage     (mm)=        1.70          5.00
     Average Slope     (%)=        4.00          4.00
     Length            (m)=      152.75         20.00
     Mannings n           =       0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
           0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
           0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
           0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
           0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
           0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
           0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
           0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
           0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
           0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Max.Eff.Inten.(mm/hr)=      109.68         86.78
                over (min)         5.00         10.00
     Storage Coeff.  (min)=        2.09 (ii)     6.68 (ii)
     Unit Hyd. Tpeak (min)=        5.00         10.00
     Unit Hyd. peak  (cms)=        0.31          0.14
                                                             *TOTALS*
     PEAK FLOW       (cms)=        0.27          0.29          0.504 (iii)
     TIME TO PEAK    (hrs)=        1.00          1.08           1.00
     RUNOFF VOLUME    (mm)=       45.54         23.69          29.24
     TOTAL RAINFALL   (mm)=       47.24         47.24          47.24
```

```
     RUNOFF COEFFICIENT   =       0.96         0.50           0.62

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   1.41
|ID= 1 DT= 5.0 min |   Total Imp(%)=  37.20   Dir. Conn.(%)=  25.90
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.89
     Dep. Storage     (mm)=       1.50         5.00
     Average Slope     (%)=      10.00        10.00
     Length            (m)=      96.95        30.00
     Mannings n          =      0.013        0.250

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


                                 ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.46 | 0.833   30.47 | 1.583    9.28 |   2.33    4.19
               0.167    3.46 | 0.917  109.68 | 1.667    9.28 |   2.42    3.67
               0.250    4.52 | 1.000  109.68 | 1.750    7.17 |   2.50    3.67
               0.333    4.52 | 1.083   40.71 | 1.833    7.17 |   2.58    3.26
               0.417    6.48 | 1.167   40.71 | 1.917    5.81 |   2.67    3.26
               0.500    6.48 | 1.250   20.28 | 2.000    5.81 |   2.75    2.93
               0.583   11.07 | 1.333   20.28 | 2.083    4.87 |   2.83    2.93
               0.667   11.07 | 1.417   12.91 | 2.167    4.87 |   2.92    2.67
               0.750   30.47 | 1.500   12.91 | 2.250    4.19 |   3.00    2.67

     Max.Eff.Inten.(mm/hr)=     109.68        47.00
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.21 (ii)    6.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.33         0.15
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.11         0.09          0.183 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      45.74        19.10          25.99
     TOTAL RAINFALL   (mm)=      47.24        47.24          47.24
     RUNOFF COEFFICIENT   =       0.97         0.40           0.55
```

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

--------------------
| ADD HYD  (  0026)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     1.41   0.183     1.00    25.99
      + ID2= 2 (  0201):     3.50   0.504     1.00    29.24
        ========================================================
        ID = 3 (  0026):     4.91   0.687     1.00    28.31

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0022)|     OVERFLOW IS ON
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.7170      0.0625
                          0.1790     0.0290   |   0.9060      0.0781
                          0.3510     0.0430   |   1.1770      0.0938
                          0.5220     0.0550   |   0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0026)      4.910      0.687      1.00       28.31
   OUTFLOW: ID= 1 (  0022)      4.910      0.379      1.25       28.30
   OVERFLOW:ID= 3 (  0003)      0.000      0.000      0.00        0.00

                   TOTAL NUMBER OF SIMULATION OVERFLOW  =     0
                   CUMULATIVE TIME OF OVERFLOW  (HOURS) =  0.00
                   PERCENTAGE OF TIME OVERFLOWING   (%) =  0.00

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 55.07
                   TIME SHIFT OF PEAK FLOW        (min)= 15.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0455

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

  --------------------------
  | Junction Command(0024) |
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  --------------------------

                         AREA     QPEAK   TPEAK     R.V.
                         (ha)     (cms)    (hrs)    (mm)
  INFLOW : ID= 3(  0022)    0.00     0.00    0.00     0.00
  OUTFLOW: ID= 2(  0024)    0.00     0.00    0.00     0.00

  --------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0202)|   Area    (ha)=   2.48
|ID= 1 DT= 5.0 min |   Total Imp(%)=  32.00   Dir. Conn.(%)=   6.50
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.79         1.69
     Dep. Storage     (mm)=       1.00         5.00
     Average Slope     (%)=       2.00         4.00
     Length            (m)=     128.58        30.00
     Mannings n           =      0.013        0.250

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


                             ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
               0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
               0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
               0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
               0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
               0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
               0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
               0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
               0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Max.Eff.Inten.(mm/hr)=     109.68        62.44
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.33 (ii)    8.15 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.30         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.05         0.21          0.234 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.08
     RUNOFF VOLUME    (mm)=      46.24        21.17          22.80
     TOTAL RAINFALL   (mm)=      47.24        47.24          47.24
     RUNOFF COEFFICIENT   =       0.98         0.45           0.48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!
***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
```

```
              YOU SHOULD CONSIDER SPLITTING THE AREA.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


--------------------
| ADD HYD  (  0003)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0202):     2.48   0.234     1.08    22.80
      + ID2= 2 (  0022):     4.91   0.379     1.25    28.30
        ===================================================
        ID = 3 (  0003):     7.39   0.571     1.17    26.46

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


--------------------
| ADD HYD  (  0003)|
|   3 +  2 =  1    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
*** W A R N I N G :  HYDROGRAPH   0024 <ID= 2> IS DRY.
*** W A R N I N G :  HYDROGRAPH   0001 = HYDROGRAPH 0003
        ID1= 3 (  0003):     7.39   0.571     1.17    26.46
      + ID2= 2 (  0024):     0.00   0.000     0.00     0.00
        ===================================================
        ID = 1 (  0003):     7.39   0.571     1.17    26.46

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   5.17
|ID= 1 DT= 5.0 min |   Total Imp(%)=  30.00   Dir. Conn.(%)=  20.60
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.55          3.62
     Dep. Storage     (mm)=       1.50          5.00
     Average Slope     (%)=      10.00         10.00
     Length            (m)=     185.65         30.00
     Mannings n           =      0.013         0.250

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

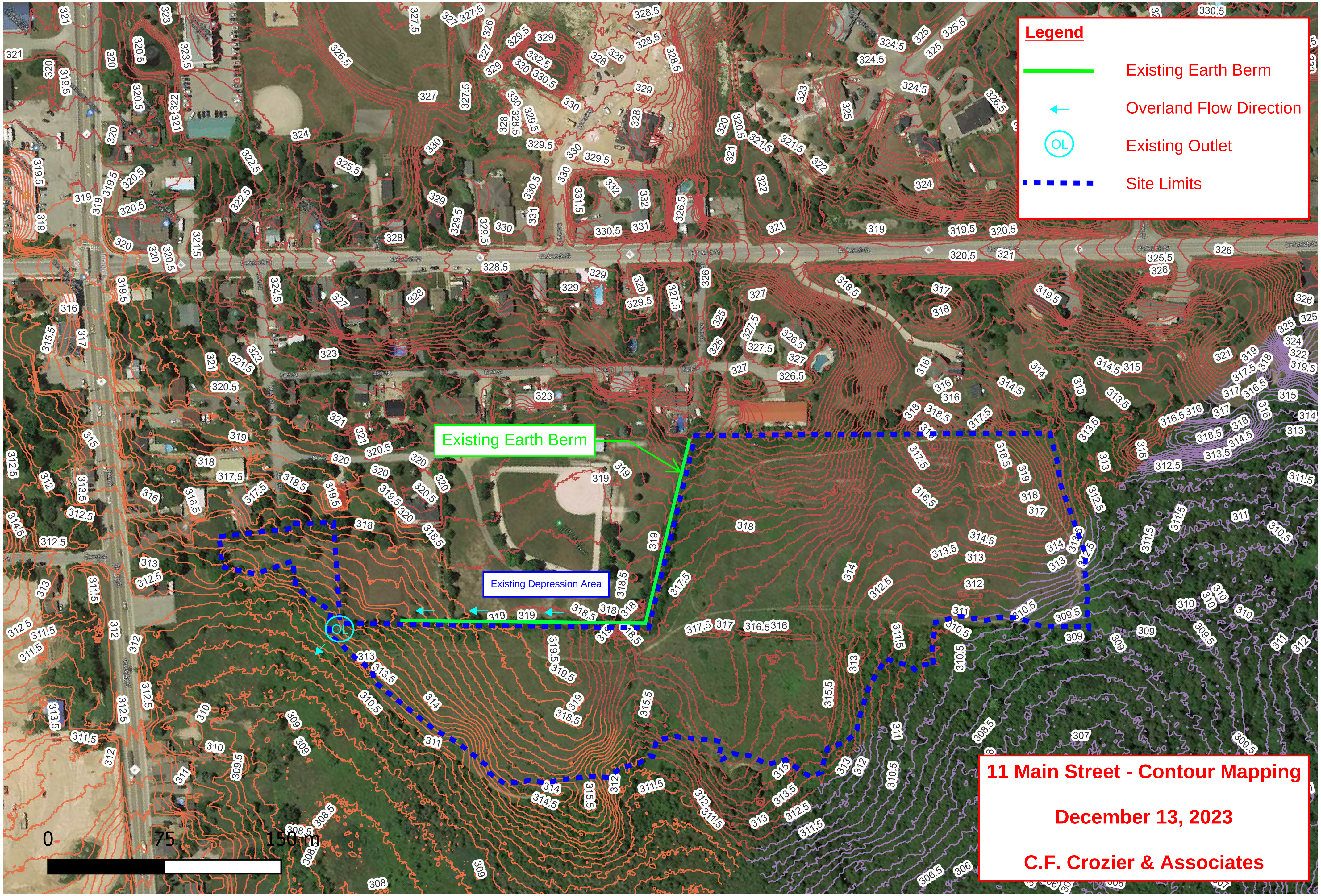
```
                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    3.46 | 0.833   30.47 | 1.583    9.28 |  2.33    4.19
              0.167    3.46 | 0.917  109.68 | 1.667    9.28 |  2.42    3.67
              0.250    4.52 | 1.000  109.68 | 1.750    7.17 |  2.50    3.67
              0.333    4.52 | 1.083   40.71 | 1.833    7.17 |  2.58    3.26
              0.417    6.48 | 1.167   40.71 | 1.917    5.81 |  2.67    3.26
              0.500    6.48 | 1.250   20.28 | 2.000    5.81 |  2.75    2.93
              0.583   11.07 | 1.333   20.28 | 2.083    4.87 |  2.83    2.93
              0.667   11.07 | 1.417   12.91 | 2.167    4.87 |  2.92    2.67
              0.750   30.47 | 1.500   12.91 | 2.250    4.19 |  3.00    2.67

     Max.Eff.Inten.(mm/hr)=     109.68        43.57
               over (min)         5.00        10.00
     Storage Coeff.  (min)=       1.79 (ii)    6.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.32         0.14
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.32         0.34            0.581 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08             1.00
     RUNOFF VOLUME    (mm)=      45.74        18.56            24.16
     TOTAL RAINFALL   (mm)=      47.24        47.24            47.24
     RUNOFF COEFFICIENT   =       0.97         0.39             0.51

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

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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


Legend
Existing Earth Berm
Overland Flow Direction
OL
Existing Outlet
Site Limits
Existing Earth Berm
Existing Depression Area
OL
0
75
150 m
11 Main Street - Contour Mapping
December 13, 2023
C.F. Crozier & Associates

Project Name: 11 Main Street
Project No: 2366-6357
Modelled By: BP
Checked By: BW
Date: 2023.12.05

CROZIER
CONSULTING ENGINEERS

Climatic Water Budget - Thornthwaite Method
Project Name: 11 Main Street
*WATERLOO WELLINGTON A - Climate Normals 1971-2000 Station Data

	Degrees	Minutes	Seconds	
Insert Latitude:	43	27	0	*Only Applicable Between Latitudes 40° - 50°

Month	Mean Temperature (◦C)	Heat index	" a "	PET - Potential Evapotranspiration (mm)	Daily Correction Value	Adjusted PET - Potential Evapotranspiration (mm)	Total Precipitation (mm)	Surplus (mm)	Deficit (mm)
January	-7.1	0.0	0.49	0.0	0.77	0.0	64.4	64.4	0.0
February	-6.4	0.0	0.49	0.0	0.87	0.0	51.5	51.5	0.0
March	-1.2	0.0	0.49	0.0	0.99	0.0	69.9	69.9	0.0
April	5.8	1.3	0.51	27.5	1.11	30.7	76.9	46.2	0.0
May	12.5	4.0	0.56	61.5	1.23	75.5	78.3	2.8	0.0
June	17.3	6.5	0.61	86.5	1.29	111.4	81.3	0.0	30.1
July	19.8	8.0	0.63	99.6	1.26	125.9	91.8	0.0	34.1
August	18.7	7.4	0.62	93.8	1.17	109.8	86.3	0.0	23.5
September	14.3	4.9	0.58	70.8	1.05	74.2	85.8	11.6	0.0
October	8.2	2.1	0.53	39.6	0.92	36.4	65.6	29.2	0.0
November	2.3	0.3	0.50	10.5	0.81	8.4	82.7	74.3	0.0
December	-3.8	0.0	0.49	0.0	0.75	0.0	73.6	73.6	0.0
Totals		**34.5**	**1.05**			**572.3**	**908.1**	**423.5**	**87.7**

TOTAL WATER DEFICIT = **87.7 mm**
TOTAL WATER SURPLUS (SURPLUS - DEFICIT) = **335.8 mm**
Precipitation Adjustment Factor : **none**

NOTES:
1. Water budget adjusted for latitude and daylight.
2. (◦C) - Represents calculated mean of daily temperatures for the month.
3. Precipitation and Temperature data from the *WATERLOO WELLINGTON A (Station No.6149387) Environment Canada Station Datc
4. Total Water Surplus (Thornthwaite, 1948) is calculated as total precipitation minus adjusted potential evapostranspiration.

CROZIER
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Project Name: 11 Main Street
Project No: 2366-6357
Modelled By: BP
Checked By: BW
Date: 2023.12.05

Water Budget - Pre-Development
Project Name: 11 Main Street
Water Balance/Water Budget Assessment

Pre-development pervious area.
Pre-development impervious area.

Note: Site land use areas consistent with Pre-Development SWM hydrologic modeling & calculations

Catchment Designation	Site - Pre-Development		
	Pervious Area	Impervious	Totals
Area (m^2)	59800	0	59800
Pervious Area (m^2)	59800	0	59800
Impervious Area (m^2)	0	0	0
Infiltration Factors			
Topography Infiltration Factor	0.10	0	
Soil Infiltration Factor	0.20	0	
Land Cover Infiltration Factor	0.10	0	
MOE Infiltration Factor	0.40		
Actual Infiltration Factor	0.40	0	
Run-off Coefficient	0.25	0.90	
Runoff from Impervious Surfaces *	0	0.90	
Inputs (per Unit Area)			
Precipitation (mm/yr)	908	908	908
Run-On (mm/yr)	0	0	0
Other Inputs (mm/yr)	0	0	0
Total Inputs (mm/yr)	**908**	**908**	**908**
Outputs (per Unit Area)			
Precipitation Surplus (mm/yr)	336	817	336
Net Surplus (mm/yr)	336	817	336
Evapotranspiration (mm/yr) *	572	182	572
Infiltration (mm/yr)	134	0	134
Soakaway Infiltration (mm/yr)	0	0	0
Total Infiltration (mm/yr)	134	0	134
Runoff Pervious Areas (mm/yr)	201	0	201
Runoff Impervious Areas (mm/yr)	0	726	0
Total Runoff (mm/yr)	201	726	201
Total Outputs (mm/yr)	**908**	**908**	**908**
Difference (Inputs- Outputs)	**0**	**0**	**0**
Inputs (Volumes)			
Precipitation (m^3/yr)	54304	0	54304
Run-On (m^3/yr)	0	0	0
Other Inputs (m^3/yr)	0	0	0
Total Inputs (m^3/yr)	**54304**	**0**	**54304**
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	20081	0	20081
Net Surplus (m^3/yr)	20081	0	20081
Evapotranspiration (m^3/yr) *	34224	0	34224
Infiltration (m^3/yr)	8032	0	8032
Soakaway Infiltration (m^3/yr)	0	0	0
Total Infiltration (m^3/yr)	8032	0	8032
Runoff Pervious Areas (m^3/yr)	12048	0	12048
Runoff Impervious Areas (m^3/yr)	0	0	0
Total Runoff (m^3/yr)	12048	0	12048
Total Outputs (m^3/yr)	**54304**	**0**	**54304**
Difference (Inputs- Outputs)	**0**	**0**	**0**

NOTES:
* Evaporation from impervious areas was assumed to be 20% of precipitation.

Project Name: 11 Main Street
Project No: 2366-6357
Modelled By: BP
Checked By: BW
Date: 2023.12.05

CROZIER CONSULTING ENGINEERS

Water Budget - Post-Development *without Mitigation*
Project Name: 11 Main Street
Water Balance/Water Budget Assessment

Post-development pervious area.
Post-development impervious area.

Note: Site land use areas consistent with Post-Development SWM hydrologic modeling & calculations

Catchment Designation	Site - Post-Development		
	Pervious Area	**Impervious Area**	**Totals**
Area (m^2)	32500	27300	59800
Pervious Area (m^2)	32500	0	32500
Impervious Area (m^2)	0	27300	27300
Infiltration Factors			
Topography Infiltration Factor	0.10	0	
Soil Infiltration Factor	0.20	0	
Land Cover Infiltration Factor	0.10	0	
MOE Infiltration Factor	0.40	0.00	
Actual Infiltration Factor	0.40	0.00	
Run-off Coefficient	0.25	0.90	
Runoff from Impervious Surfaces *	0.00	0.90	
Inputs (per Unit Area)			
Precipitation (mm/yr)	908	908	908
Run-On (mm/yr)	0	0	0
Other Inputs (mm/yr)	0	0	0
Total Inputs (mm/yr)	**908**	**908**	**908**
Outputs (per Unit Area)			
Precipitation Surplus (mm/yr)	336	817	556
Net Surplus (mm/yr)	336	817	556
Evapotranspiration (mm/yr) *	572	182	394
Infiltration (mm/yr)	134	0	73
Soakaway Infiltration (mm/yr)	0	0	0
Total Infiltration (mm/yr)	134	0	73
Runoff Pervious Areas (mm/yr)	201	0	109
Runoff Impervious Areas (mm/yr)	0	726	332
Total Runoff (mm/yr)	201	726	441
Total Outputs (mm/yr)	**908**	**908**	**908**
Difference (Inputs- Outputs)	**0**	**0**	**0**
Inputs (Volumes)			
Precipitation (m^3/yr)	29513	24791	54304
Run-On (m^3/yr)	0	0	0
Other Inputs (m^3/yr)	0	0	0
Total Inputs (m^3/yr)	**29513**	**24791**	**54304**
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	10913	22312	33225
Net Surplus (m^3/yr)	10913	22312	33225
Evapotranspiration (m^3/yr) *	18600	4958	23558
Infiltration (m^3/yr)	4365	0	4365
Soakaway Infiltration (m^3/yr)	0	0	0
Total Infiltration (m^3/yr)	4365	0	4365
Runoff Pervious Areas (m^3/yr)	6548	0	6548
Runoff Impervious Areas (m^3/yr)	0	19833	19833
Total Runoff (m^3/yr)	6548	19833	26381
Total Outputs (m^3/yr)	**29513**	**24791**	**54304**
Difference (Inputs- Outputs)	**0**	**0**	**0**

Pre-Development Total Infiltration:
8032 m3/yr

NOTES:
* Evaporation from impervious areas was assumed to be 20% of precipitation.

Project Name: 11 Main Street
Project No: 2366-6357
Modelled By: BP
Checked By: BW
Date: 2023.12.05

Water Budget - Post-Development ***with Mitigation***
Project Name: 11 Main Street
Water Balance/Water Budget Assessment

Post-development pervious area.
Post-development impervious area.

Catchment Designation	Site - Post-Development		
	Pervious Area	Impervious Area	Totals
Area (m^2)	32500	27300	59800
Pervious Area (m^2)	32500	0	32500
Impervious Area (m^2)	0	27300	27300
Infiltration Factors			
Topography Infiltration Factor	0.10	0	
Soil Infiltration Factor	0.20	0	
Land Cover Infiltration Factor	0.1	0	
MOE Infiltration Factor	0.40	0.00	
Actual Infiltration Factor	0.40	0.00	
Run-off Coefficient	0.25	0.90	
Runoff from Impervious Surfaces *	0.00	0.90	
Inputs (per Unit Area)			
Precipitation (mm/yr)	908	908	908
Run-On (mm/yr)	0	0	0
Other Inputs (mm/yr)	0	0	0
Total Inputs (mm/yr)	**908**	**908**	**908**
Outputs (per Unit Area)			
Precipitation Surplus (mm/yr)	336	817	556
Net Surplus (mm/yr)	336	817	556
Evapotranspiration (mm/yr) *	572	182	394
Infiltration (mm/yr)	134	0	73
Soakaway Infiltration (mm/yr)	0	135	62
Total Infiltration (mm/yr)	134	135	135
Runoff Pervious Areas (mm/yr)	201	0	109
Runoff Impervious Areas (mm/yr)	0	591	270
Total Runoff (mm/yr)	201	591	380
Total Outputs (mm/yr)	**908**	**908**	**908**
Difference (Inputs- Outputs)	**0**	**0**	**0**
Inputs (Volumes)			
Precipitation (m^3/yr)	29513	24791	54304
Run-On (m^3/yr)	0	0	0
Other Inputs (m^3/yr)	0	0	0
Total Inputs (m^3/yr)	**29513**	**24791**	**54304**
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	10913	22312	33225
Net Surplus (m^3/yr)	10913	22312	33225
Evapotranspiration (m^3/yr) *	18600	4958	23558
Infiltration (m^3/yr)	4365	0	4365
Underground Storage Infiltration (m^3/yr)	0	3686	3686
Total Infiltration (m^3/yr)	4365	3686	8051
Runoff Pervious Areas (m^3/yr)	6548	0	6548
Runoff Impervious Areas (m^3/yr)	0	16147	16147
Total Runoff (m^3/yr)	6548	16147	22695
Total Outputs (m^3/yr)	**29513**	**24791**	**54304**
Difference (Inputs- Outputs)	**0**	**0**	**0**

3686 Proposed Infiltration via Mitigatior
<u>Pre-Development Total Infiltration:</u>
134 mm/yr

Note:
0 mm
Precipitation available between Apr-Oct (non-winter months). Therefore available for infiltration into non-frozen soil

<u>Pre-Development Total Infiltration:</u>
8032 m3/yr

NOTES:
* Evaporation from impervious areas was assumed to be 20% of precipitation

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Project: 11 Main Street
Project No: 2366-6357
Modelled By: BP
Checked By: BW
Date: 2023.12.05

Water Budget Summary
Project Name: 11 Main Street
Water Balance/Water Budget Assessment

Characteristic	Site				
	Pre-Development	Post-Development	Post-Development *with Mitigation*	Change (Pre to Post)	Change (Pre to Post) *with Mititgation*
Inputs (Volumes)					
Precipitation (m^3/yr)	54304	54304	54304	0%	0%
Run-On (m^3/yr)	0	0	0	0%	0%
Other inputs (m^3/yr)	0	0	0	0%	0%
Total Inputs (m^3/yr)	**54304**	**54304**	**54304**	**0**	**0**
Outputs (Volumes)					
Precipitation Surplus (m^3/yr)	20081	33225	33225	65%	65%
Net Surplus (m^3/yr)	20081	33225	33225	65%	65%
Evapotranspiration (m^3/yr)	34224	23558	23558	-31%	-31%
Infiltration (m^3/yr)	8032	4365	4365	-46%	-46%
Soakaway Infiltration (m^3/yr)	0	0	**3686**	-	**3686 m3/yr**
Total Infiltration (m^3/yr)	**8032**	**4365**	**8051**	-46%	0%
Runoff Pervious Areas (m^3/yr)	12048	6548	6548	-46%	-46%
Runoff Impervious Areas (m^3/yr)	0	19833	16147	-	-
Total Runoff (m^3/yr)	12048	26381	22695	119%	88%
Total Outputs (m^3/yr)	**54304**	**54304**	**54304**	0%	0%

NOTES:

- Total Infiltration into groundwater system (8032m3/yr) is to be maintained via enhanced topsoi
- The Infiltration by the enhanced topsoil to match Pre-Development as close as possible is shown above (3686 m3/yr). As shown above, a small surplus to the Pre-Dev't Total Infiltration is provided.
- The site soils for the site consist silty sand. Please refer to the included Terraprobe Hydrogeological Assessment (November 18, 2022)
- Months contributing to Water Balance (winter months not considered due to freezing effects) - April, May, June, July, August, September, October = 7 month

Project:	11 Main Street
Project No:	2366-6357
Modelled By:	BP
Date:	2023.12.05

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Design Storm Determination
Project Name: 11 Main Street
Water Balance/Water Budget Assessment

Days with Precipitation (From Climate Data)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
>= 0.2 mm	13.4	12	11.7	10.4	11	11.5	13.3	83
>= 5 mm	4.7	4.9	5	5	4.5	5	4.2	33
>= 10 mm	2.6	2.8	3	3.1	2.9	2.9	2.4	20
>= 25 mm	0.37	0.43	0.37	0.87	0.8	0.6	0.13	4

Available Precipitation

Storm Event (mm)	Total Days Per Year	Incremental Precipitation (mm/yr)	Cumulative Precipitation (mm/yr)
0.2	83	16.7	16.7
5	33	166.5	183.2
10	20	197.0	380.2
25	4	89.3	469.4
Total	**140**	**469.4**	

Infiltration Target:	3686	m^3/year	
Contributing Area:	16800	m^2	Rooftop Area
Infiltration Target:	220	mm/year	
Runoff Coefficient:	0.90		Rooftop runoff coefficient
Design Precipitation:	244	mm/yr	(Design Infiltration / Contributing RC)
Therefore Min. Design Storm:	6.1	mm	
Chosen Design Storm:	6.5	mm	
Required Storage:	109	m^3	Volume per Storm Event
Storage Provided:	5.5	m^3	Soakaway Pit Volume per Lot

CROZIER
CONSULTING ENGINEERS

Project: 11 Main Street
Project No.: 2366-6537
Created By: BP
Checked By: BW
Date: 11/28/2023

Erosion Control Volume Calculations (MECP)

Area Name	Drainage Area			
Area to Pond =	3.50	ha	Percent Impervious	55.1%
Vextended detention (MECP) =	230	m^3	Percent Pervious	44.9%

Extended Detention Volume:

Greater of : Standard Detention:	V =	40	m^3 / ha	(MECP requirement)
	V =	140	m^3	
Detention of 25mm Runoff:	Depth =	11.95		(from VO model)
(Runoff volume from 25mm VO Model)	V =	230	m^3	
Required Extended Detention Volume =		**230**	m^3	

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

11/30/2023

Province:	Ontario
City:	Puslinch
Nearest Rainfall Station:	WATERLOO WELLINGTON AP
Climate Station Id:	6149387
Years of Rainfall Data:	34

Project Name:	11 Main Street
Project Number:	2366-6537
Designer Name:	Brett Pond
Designer Company:	C.F. Crozier & Associates
Designer Email:	bpond@cfcrozier.ca
Designer Phone:	226-567-9393
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	11 Main Street

Drainage Area (ha):	3.5
% Imperviousness:	55.10

Runoff Coefficient 'c': 0.63

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	83.62
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	2158
Estimated Average Annual Sediment Volume (L/yr):	1754

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	54
EFO6	69
EFO8	80
EFO10	85
EFO12	89

Recommended Stormceptor EFO Model: EFO8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 80

Water Quality Runoff Volume Capture (%): > 90

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

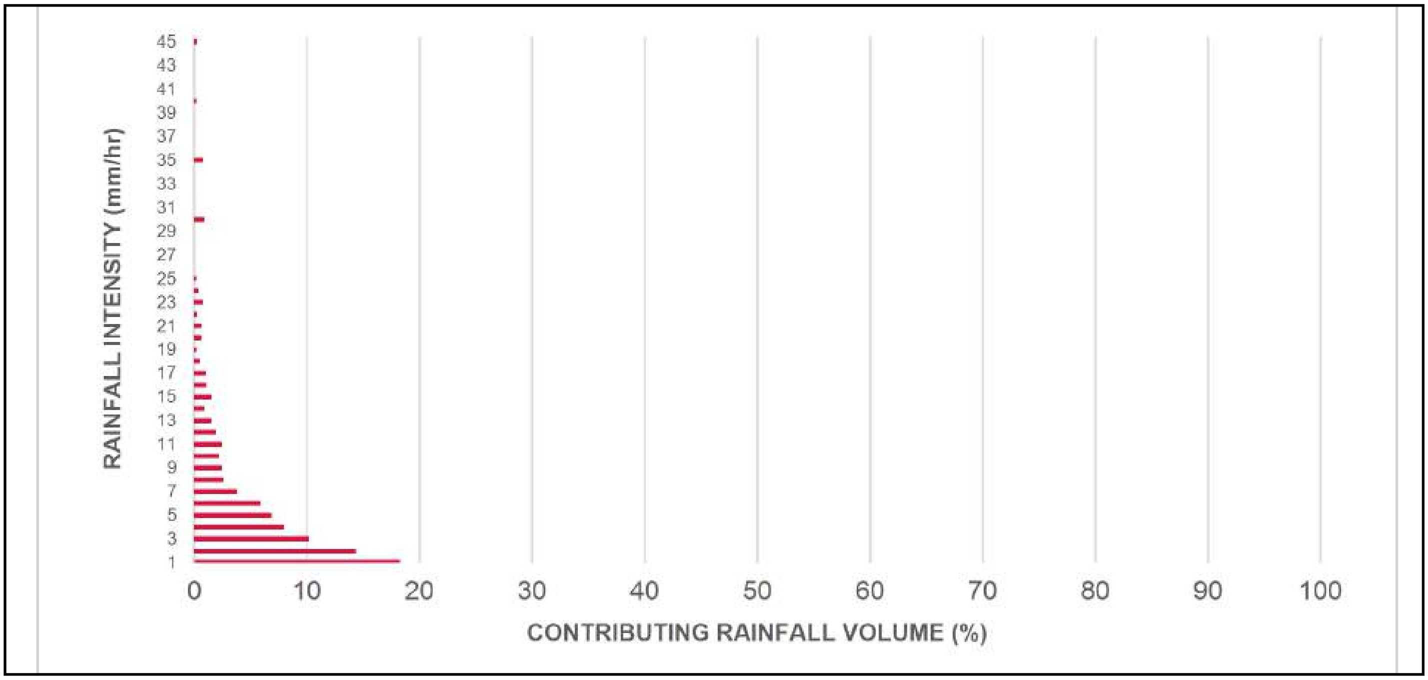
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

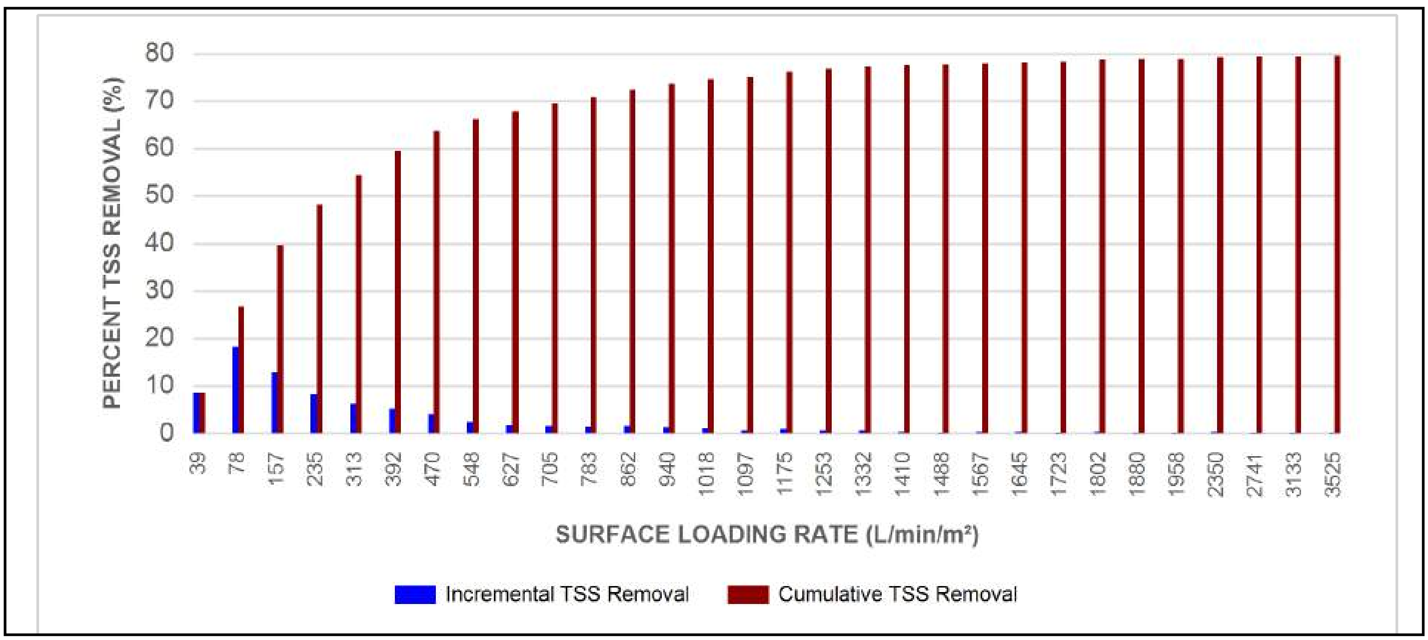
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.5	8.5	3.07	184.0	39.0	100	8.5	8.5
1.00	18.3	26.8	6.14	368.0	78.0	100	18.3	26.8
2.00	14.4	41.3	12.27	736.0	157.0	89	12.9	39.7
3.00	10.2	51.5	18.41	1104.0	235.0	82	8.3	48.1
4.00	8.0	59.5	24.54	1473.0	313.0	78	6.2	54.3
5.00	6.9	66.4	30.68	1841.0	392.0	74	5.1	59.5
6.00	5.9	72.3	36.81	2209.0	470.0	71	4.2	63.6
7.00	3.8	76.1	42.95	2577.0	548.0	67	2.6	66.2
8.00	2.6	78.7	49.09	2945.0	627.0	64	1.7	67.8
9.00	2.5	81.1	55.22	3313.0	705.0	64	1.6	69.4
10.00	2.2	83.3	61.36	3681.0	783.0	63	1.4	70.8
11.00	2.5	85.8	67.49	4050.0	862.0	63	1.6	72.4
12.00	2.0	87.8	73.63	4418.0	940.0	62	1.2	73.6
13.00	1.6	89.4	79.76	4786.0	1018.0	61	1.0	74.6
14.00	0.9	90.4	85.90	5154.0	1097.0	59	0.6	75.1
15.00	1.6	91.9	92.04	5522.0	1175.0	58	0.9	76.1
16.00	1.1	93.0	98.17	5890.0	1253.0	56	0.6	76.7
17.00	1.0	94.0	104.31	6258.0	1332.0	54	0.6	77.2
18.00	0.5	94.6	110.44	6627.0	1410.0	52	0.3	77.5
19.00	0.2	94.8	116.58	6995.0	1488.0	49	0.1	77.6
20.00	0.6	95.4	122.71	7363.0	1567.0	47	0.3	77.9
21.00	0.6	96.1	128.85	7731.0	1645.0	45	0.3	78.2
22.00	0.3	96.4	134.99	8099.0	1723.0	43	0.1	78.3
23.00	0.8	97.2	141.12	8467.0	1802.0	41	0.3	78.7
24.00	0.4	97.6	147.26	8835.0	1880.0	39	0.2	78.8
25.00	0.2	97.8	153.39	9204.0	1958.0	38	0.1	78.9
30.00	0.9	98.7	184.07	11044.0	2350.0	31	0.3	79.2
35.00	0.8	99.5	214.75	12885.0	2741.0	27	0.2	79.4
40.00	0.2	99.7	245.43	14726.0	3133.0	24	0.1	79.4
45.00	0.3	100.0	276.11	16566.0	3525.0	21	0.1	79.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**79 %**

Climate Station ID: 6149387 *Years of Rainfall Data*: 34

RAINFALL DATA FROM WATERLOO WELLINGTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL
FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

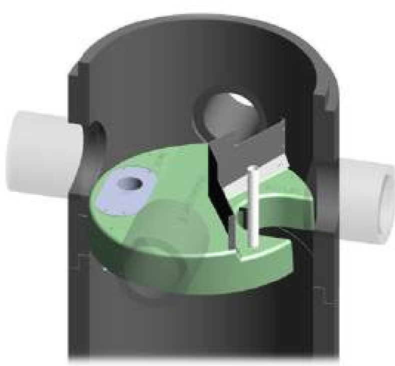
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

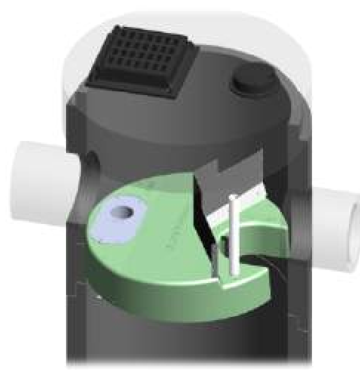
DESIGN FLEXIBILITY

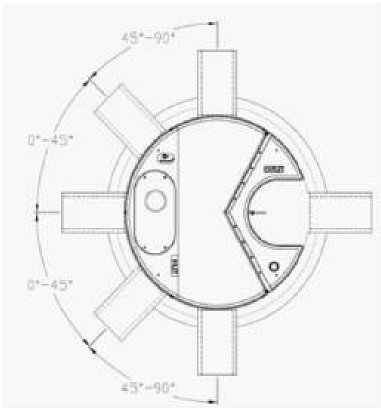
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR
"OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 L/min/m^2 shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m^2. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m^2.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

APPENDIX E

Conservation Halton Email Excerpts

From: Ola Panczyk <opanczyk@hrca.on.ca>
Sent: Tuesday, August 1, 2023 2:57 PM
To: Brendan Walton; Janet Engel
Cc: Kayly Robbins; Brett Pond
Subject: RE: [EXTERNAL]11 Main Street, Morriston | Floodplain Study Follow-up (CFCA 2366-6537)

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Filed to Sharepoint

Hi Brendan,

Thank you for your patience while we reviewed the overlay in relation to CH's hydraulic model.

For this specific site, based on the quality of the existing model and the location of the proposed development, CH has no objection to the use of CH's HEC-RAS model for the purposes of delineating the flood hazard limit. Please ensure a topographic survey is included in the future submission, which delineates the flood hazard based on the elevations from the HEC-RAS model.

Please note that any changes to the location of the proposed development may require updated flood hazard modelling.

If you have any questions, please let me know.

Thank you,
Ola

Conservation Halton

Ola Panczyk
Environmental Planner

2596 Britannia Road West, Burlington, ON L7P 0G3
905.336.1158 ext.2279 | opanczyk@hrca.on.ca
conservationhalton.ca

From: Brendan Walton <bwalton@cfcrozier.ca>
Sent: Tuesday, July 18, 2023 1:31 PM
To: Ola Panczyk <opanczyk@hrca.on.ca>; Janet Engel <jengel@hrca.on.ca>
Cc: Kayly Robbins <krobbins@westonconsulting.com>; Brett Pond <bpond@cfcrozier.ca>
Subject: RE: [EXTERNAL]11 Main Street, Morriston | Floodplain Study Follow-up (CFCA 2366-6537)

Hi Ola,

Thank you for confirming. We look forward to CH's feedback next week.

Kind regards,

Brendan

Brendan Walton, P.Eng.
Project Manager, Land Development
Office: 548.708.0022
Collingwood | Milton | Toronto | Bradford | Guelph

From: Ola Panczyk <opanczyk@hrca.on.ca>
Sent: Monday, July 17, 2023 10:37 AM
To: Brendan Walton <bwalton@cfcrozier.ca>; Janet Engel <jengel@hrca.on.ca>
Cc: Kayly Robbins <krobbins@westonconsulting.com>; Brett Pond <bpond@cfcrozier.ca>
Subject: RE: [EXTERNAL]11 Main Street, Morriston | Floodplain Study Follow-up (CFCA 2366-6537)

Hi Brendan,

Confirming receipt of your email. Thanks for providing the overlay. We will take a look and discuss internally. We will aim to get back to you next week.

Kind regards,
Ola

Ola Panczyk
Environmental Planner

2596 Britannia Road West, Burlington, ON L7P 0G3
905.336.1158 ext.2279 | opanczyk@hrca.on.ca
conservationhalton.ca

From: Brendan Walton <bwalton@cfcrozier.ca>
Sent: Wednesday, July 12, 2023 1:13 PM
To: Ola Panczyk <opanczyk@hrca.on.ca>; Janet Engel <jengel@hrca.on.ca>
Cc: Kayly Robbins <krobbins@westonconsulting.com>; Brett Pond <bpond@cfcrozier.ca>
Subject: [EXTERNAL]11 Main Street, Morriston | Floodplain Study Follow-up (CFCA 2366-6537)

Good afternoon Ola, Janet,

Thank you again for meeting with us last week regarding this project. It was nice catching up with each of you!

As requested, please see attached overlay figure that outlines the Regional floodplain and 15.0 m set-back near Highway 6 on a satellite image. As discussed on the call, we believe a detailed hydrologic/hydraulic floodplain assessment for the proposed development is not required considering the floodplain (dark blue solid line) and associated set-back (red solid line) are sufficiently far enough away from the proposed dwellings and building envelopes (black dashed lines). There are also environmental features (i.e., wetland, woodlot) located outside of the floodplain that further increase the separation distance from the Regional floodplain.

Upon your review, please let us know if you have any questions or would like to discuss. We are happy to have a follow up discussion too if helpful.

Kind regards,

Brendan
Brendan Walton, P.Eng.
Project Manager, Land Development

FIGURES

LEGEND

	PROPERTY LINE
	EXISTING CONTOUR (1.0m)
215.00	EXISTING GRADE
	STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
	CONCEPTUAL 360 m^2 BUILDING ENVELOPE
	PROPOSED TYPE A DISPERSAL BED 368 m^2
W	CONCEPTUAL PROPOSED DRILLED WELL LOCATION C/W 15.0m OBC SETBACK
	PROPOSED STORM MANHOLE
	PROPOSED MANHOLE CATCHBASIN
/	PROPOSED CATCHBASIN / DOUBLE CATCHBASIN

NOTES:

1. PROPOSED DRIVEWAY LOCATIONS AND APRONS TO BE CONFIRMED DURING DESIGN PROCESS.

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/DEC/20
0	ISSUED ZBA AND DPS APPLICATIONS	2023/FEB/17

ELEVATION NOTE:

ELEVATIONS HEREON ARE GEODETIC (CGVD-1928:78) AND ARE DERIVED FROM GNSS OBSERVATIONS USING NATURAL RESOURCES CANADA'S GEOID MODEL HT_2.0 ON.

SURVEY NOTES:

SURVEY COMPLETED BY J.D. BARNES LTD. (2023/JAN/31)
DRAWING FILE No.: 22-14-718-00-TOPO

BEARINGS ARE UTM GRID, DERIVED FROM RTN OBSERVATIONS UTM ZONE 17, NAD83 (GSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9996781

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON SITE PLAN BY WESTON CONSULTING INC.
DRAWING No. 10779 CONCEPTS/C2_2022-03-16
DATE RECEIVED 2023/FEB/06

DRAWING NOTES:

THIS DRAWING IS THE EXCLUSIVE PROPERTY OF C.F. CROZIER & ASSOCIATES INC. AND THE REPRODUCTION OF ANY PART OF IT WITHOUT PRIOR WRITTEN CONSENT OF THIS OFFICE IS STRICTLY PROHIBITED.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO THIS OFFICE PRIOR TO CONSTRUCTION.

THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT. DO NOT SCALE THIS DRAWING.

ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

PRELIMINARY SITE SERVICING PLAN (EAST)

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn	Design	Project No.	
M.I.M	M.I.M.	2366-6537	
Check	Check	Scale	Dwg.
B.W.	B.W.	1:500	FIG. 1

SEWAGE SYSTEM NOTES

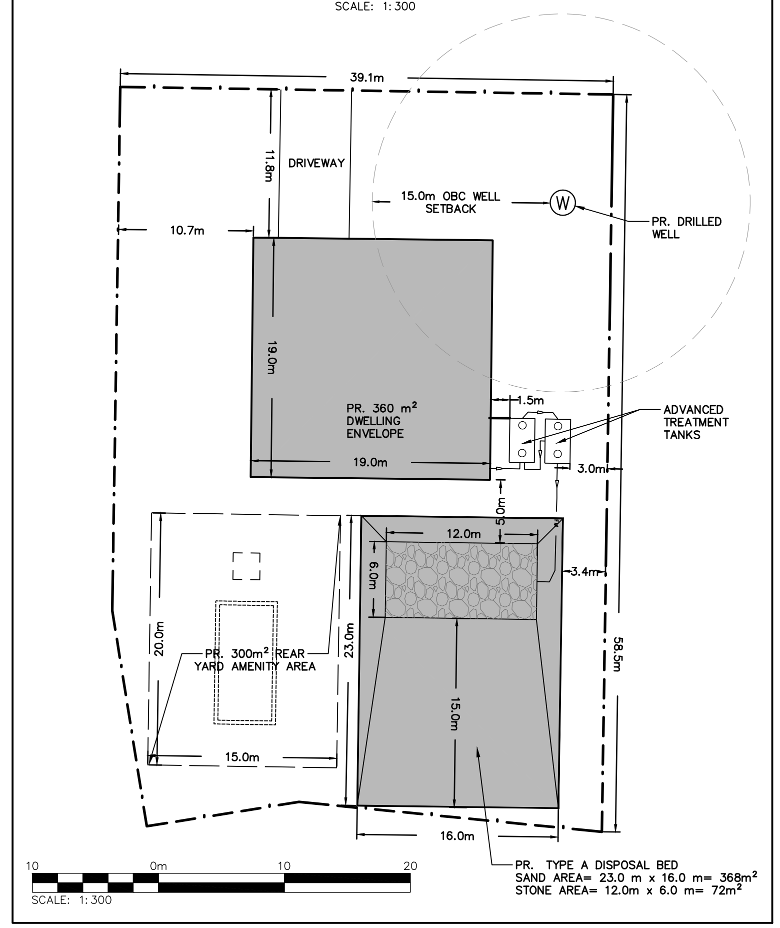
1. PROPOSED SEWAGE SYSTEM CONSTRUCTION TO BE UNDERTAKEN IN ACCORDANCE WITH THE ONTARIO BUILDING CODE, ONTARIO MINISTRY OF ENVIRONMENT, AND THE MANUFACTURER'S RECOMMENDATIONS.
2. INSTALLATION OF ALL COMPONENTS OF THE SEWAGE SYSTEM TO BE COMPLETED BY A LICENSED AND REGISTERED ONSITE SEWAGE SYSTEM INSTALLER IN THE PROVINCE OF ONTARIO.
3. THE CONTRACTOR SHALL COORDINATE AND PAY FOR ALL NECESSARY INSPECTIONS WITH THE TOWN AND OTHER AUTHORITIES PERTAINING TO THE INSTALLATION OF THEIR WORK.
4. CONTRACTOR TO LOCATE ALL UNDERGROUND UTILITIES AND EXISTING SEWAGE WORKS PRIOR TO CONSTRUCTION.
5. ALL COMPONENT LOCATIONS SHALL BE FIELD VERIFIED WITH THE ENGINEER PRIOR TO INSTALLATION.
6. ALL EARTHWORKS, INCLUDING PLACEMENT OF FILL ARE TO BE UNDERTAKEN WITH TRACK MOUNTED EQUIPMENT TO KEEP COMPACTION TO A MINIMUM. KEEP ALL TRAFFIC IN THE AREA OF THE PROPOSED LEACHING BED TO A MINIMUM.
7. ALL TOPSOIL AND ORGANICS TO BE REMOVED FROM LEACHING BED AREA.
8. IF HIGH GROUNDWATER CONDITIONS ARE EVIDENT AT THE TIME OF CONSTRUCTION, THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY. ALL VERTICAL CLEARANCE DISTANCES AS REQUIRED BY THE ONTARIO BUILDING CODE MUST BE MAINTAINED.
9. GRAVITY SEWERS TO HAVE MINIMUM 0.6 M COVER AND SHALL BE INSULATED WHERE LESS THAN 1.0M COVER IS PROVIDED. FORCEMAIN SHALL BE INSULATED WHERE LESS THAN 1.5 M COVER IS PROVIDED. BEDDING, COVER AND BACKFILL TO BE IN ACCORDANCE WITH OPSS.
10. UNLESS OTHERWISE NOTED PE FORCEMAIN TO BE HDPE SERIES 100 OR DR 13.5 PE AND PVC FORCEMAIN TO BE SCHEDULE 40. GRAVITY SEWERS TO BE SDR-35. FORCE MAIN TO BE PROVIDED WITH TRACER WIRE, SECURED TO THE TOP OF THE PIPE WITH WATER PROOF TAPE OR ZIP TIES.
11. ALL PIPES SUBJECT TO VEHICULAR TRAFFIC SHALL BE ADEQUATELY PROTECTED.
12. ALL METAL IN TANKS OR PUMP CHAMBERS TO BE GLAVANIZED OR STAINLESS STEEL
13. ALL JOINTS BELOW THE HIGH WATER LEVEL IN PRECAST TANKS TO BE SEALED WITH MASTIC SEALANT IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS FOR WATERTIGHT SEAL. ALL TANK INLETS AND OUTLETS TO BE EQUIPPED WITH CAST IN RUBBER BOOT FOR WATER TIGHT SEAL. UNLESS OTHERWISE NOTED ALL TANK INLETS AND OUTLETS TO BE EQUIPPED WITH TEES.
14. ALL TANKS TO BE PROVIDED WITH PRECAST CONCRETE OR PVC ACCESS RISERS TO GRADE. HATCHES TO BE BOLTED AND GASKETED AND ACCESSIBLE AT GRADE. ALL CIRCULAR HATCHES TO BE 600 MM DIAMETER POLYLOK RISER WITH CAST IN ADAPTOR. ALL SQUARE ACCESS OPENINGS TO BE EQUIPPED WITH CONCRETE RISERS. VENTED HATCHES TO BE PROVIDED ON TANKS CONTAINING PUMPS.
15. EXISTING SOILS SHALL BE SCARIFIED AT A RIGHT ANGLE TO THE DIRECTION OF LATERAL SEWAGE FLOW IN THE LEACHING BED PRIOR TO IMPORTING FILL OR INSTALLING DISTRIBUTION PIPE STONE LAYER.
16. WHEN THE IMPORTATION OF FILL IS REQUIRED, FILL SHOULD BE END-DUMPED AND GRADED PROGRESSIVELY OVER THE PREPARED SITE AREA WITH TRACK MOUNTED EQUIPMENT.
17. ALL ELEVATIONS TO BE VERIFIED PRIOR TO BACKFILL
18. ALL FILL MATERIAL PLACED BENEATH TANKS TO BE COMPACTED TO 95%.
19. ALL DISTURBED AREAS TO BE TOPSOILED (100MM MINIMUM) AND SEEDED COMPLETE WITH FERTILIZER AND MULCH IN ACCORDANCE WITH OPSS
20. THE INSTALLING CONTRACTOR SHALL INSTALL THE SEWAGE SYSTEM USING A TRANSIT/LEVEL AND SHALL PROVIDE SAME FOR INSPECTION OF ANY COMPONENT.
21. MAXIMUM BURIAL DEPTH OF TANKS NOT TO EXCEED TO MANUFACTURERS RECOMMENDATIONS
22. CLEARANCE DISTANCES FROM PROPERTY LINES, STRUCTURES, WELLS, AND SURFACE WATER WILL ADHERE TO THE REQUIREMENTS OF OBC 8.2.1.6.A
23. A LEACHING BED SHALL NOT BE LOCATED ON AN AREA WITH A SLOPE OF GREATER THAN 4 UNITS HORIZONTALLY TO 1 UNIT VERTICALLY.
24. THE HEADER LINE, DISTRIBUTION PIPES AND LEACHING BED SHALL BE EQUIPPED WITH MEANS OF DETECTION AS REQUIRED BY OBC 8.7.2.2. (2). LIGHT COLOURED PLASTIC COATED 14 GAUGE TRACER WIRE OR EPOXY COATED, 10m REBAR LAID HORIZONTALLY AT EACH CORNER OF THE BED IS ACCEPTABLE.
25. STONE TRENCH OR LAYER TO BE COVERED WITH PERMEABLE GEOTEXTILE PRIOR TO BACKFILL.
26. STONE TO CONFORM WITH OBC 8.7.3.3.
27. ALL IMPORTED SAND FILL TO HAVE A T-TIME OF 6 TO 10 MIN/CM AND A SILT/CLAY CONTENT OF NO MORE THAN 5% AND SHALL BE VERIFIED IN WRITING BY A SOIL TESTING FIRM AND APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.
28. ANAEROBIC DIGESTER AND BIOFILTER BASKET PUMPS AS DESIGNED AND SUPPLIED BY WATERLOO BIOFILTER.
29. PUMP CHAMBER TO BE VENTED AND EQUIPPED WITH AUDIBLE AND VISUAL HIGH LEVEL ALARM
30. ALL VALVES TO PROVIDE NO OBSTRUCTION TO FLOW WHEN FULLY OPENED. ALL VALVES AND COUPLINGS TO BE ACCESSIBLE AT GRADE.
31. ALL PUMP FLOATS TO BE SECURED TO A REMOVABLE PVC FLOAT TREE
32. ALL PUMP CONTROL PANELS TO BE EQUIPPED WITH SEPARATE CIRCUIT BREAKERS FOR PUMP CIRCUIT
33. NO JUNCTION BOXES IN RISERS
34. ALL BURIED ELECTRICAL WIRING TO BE IN PVC CONDUIT
35. PRIOR TO ACCEPTANCE CONTRACTOR TO PROVIDE DOCUMENTATION THAT ALL ELECTRICAL WORK HAS BEEN INPSECTED AND APPROVED BY THE ELECTRICAL AUTHORITY HAVING JURISDICTION

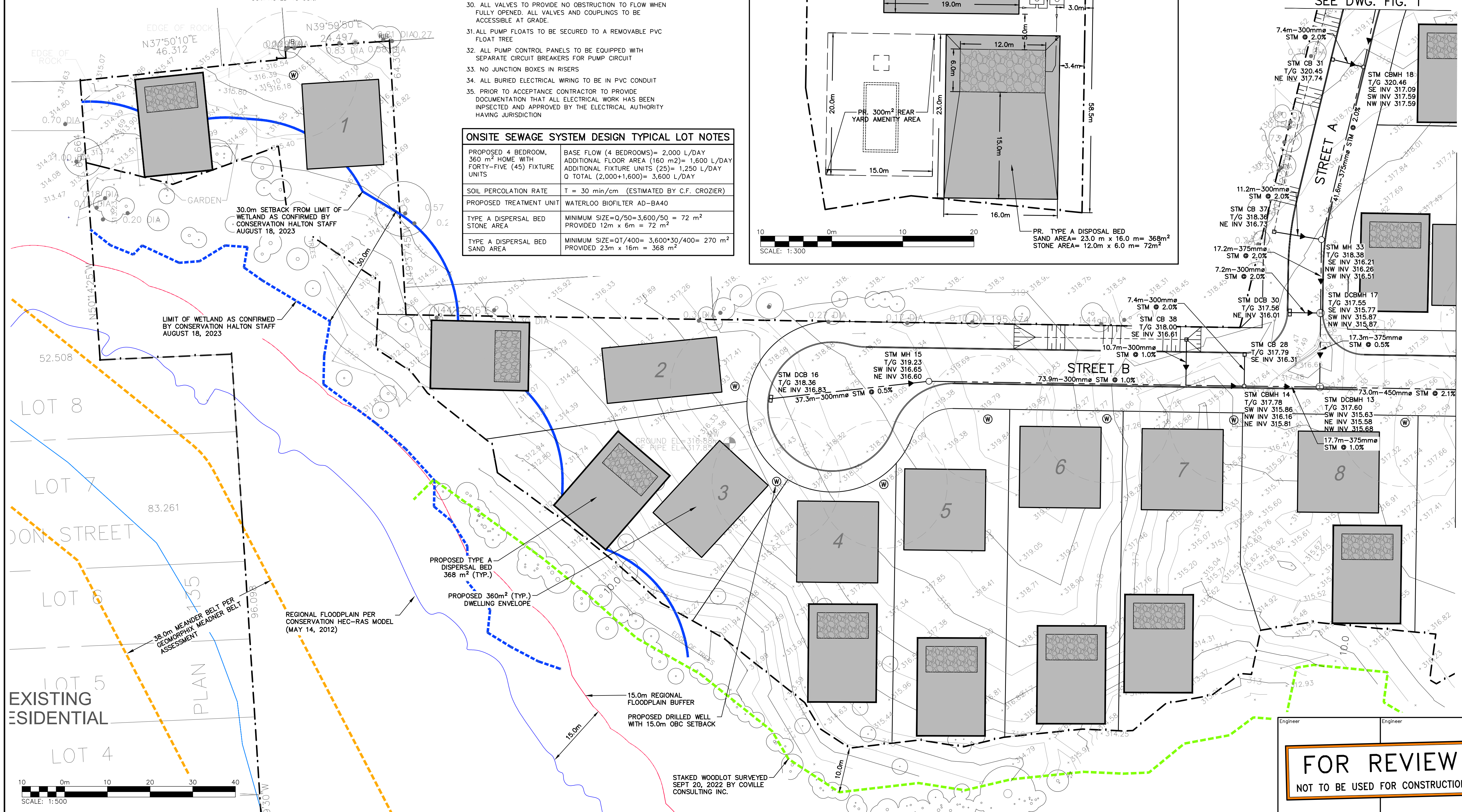
ONSITE SEWAGE SYSTEM DESIGN TYPICAL LOT NOTES

PROPOSED 4 BEDROOM, 360 m^2 HOME WITH FORTY-FIVE (45) FIXTURE UNITS	BASE FLOW (4 BEDROOMS)= 2,000 L/DAY ADDITIONAL FLOOR AREA (160 m2)= 1,600 L/DAY ADDITIONAL FIXTURE UNITS (25)= 1,250 L/DAY Q TOTAL (2,000+1,600)= 3,600 L/DAY
SOIL PERCOLATION RATE	T = 30 min/cm (ESTIMATED BY C.F. CROZIER)
PROPOSED TREATMENT UNIT	WATERLOO BIOFILTER AD-BA40
TYPE A DISPERSAL BED STONE AREA	MINIMUM SIZE=Q/50=3,600/50 = 72 m^2 PROVIDED 12m x 6m = 72 m^2
TYPE A DISPERSAL BED SAND AREA	MINIMUM SIZE=QT/400= 3,600*30/400= 270 m^2 PROVIDED 23m x 16m = 368 m^2

TYPICAL LOT SCHEMATIC (LOT 8)

SCALE: 1:300





LEGEND

	PROPERTY LINE
	EXISTING CONTOUR (1.0m)
×215.00	EXISTING GRADE
	REGIONAL FLOODPLAIN (CONSERVATION HALTON)
	REGIONAL FLOODPLAIN 15.0m BUFFER
	STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
	LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF (AUGUST 18, 2023)
	30.0m SETBACK FROM LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF AUGUST 18, 2023
	MEANDER BELT 38m BUFFER (19m EACH SIDE)
	CONCEPTUAL 360 m^2 BUILDING ENVELOPE
	PROPOSED TYPE A DISPERSAL BED 368 m^2
Ⓦ	CONCEPTUAL PROPOSED DRILLED WELL LOCATION C/W 15.0m OBC SETBACK
	PROPOSED STORM MANHOLE
	PROPOSED MANHOLE CATCHBASIN
	PROPOSED CATCHBASIN / DOUBLE CATCHBASIN

NOTES:

1. PROPOSED DRIVEWAY LOCATIONS AND APRONS TO BE CONFIRMED DURING DESIGN PROCESS.

SEE DWG. FIG. 1

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/DEC/20
0	ISSUED ZBA AND DPS APPLICATIONS	2023/FEB/17

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SURVEY NOTES:

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DRAWING FILE No.: 22-14-718-00-TOPO

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SITE PLAN NOTES:

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DRAWING No. 10779 CONCEPTS/C2_2022-03-16
DATE RECEIVED 2023/FEB/06

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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

PRELIMINARY SITE SERVICING PLAN (WEST)

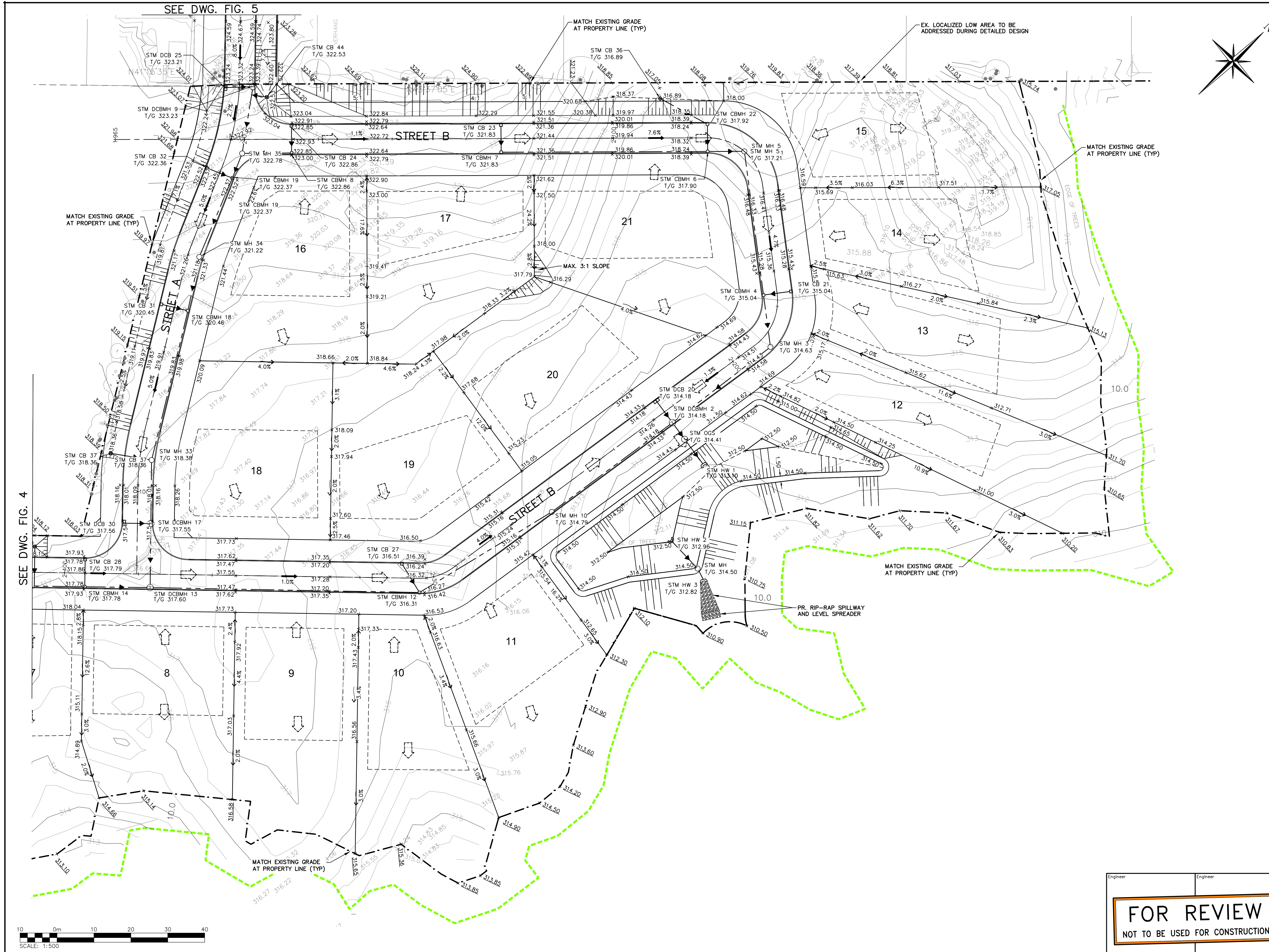
Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn	Design	Project No.
M.I.M	M.I.M.	2366-6537

Check	Check	Scale	Dwg.
B.W.	B.W.	1:500	FIG. 2



LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.50m)
- EXISTING CONTOUR (1.0m)
- x215.00 EXISTING GRADE
- x215.00 PROPOSED GRADE
- x215.00 PROPOSED GRADE (TO MATCH EXISTING)
- 2.0% PROPOSED MINOR FLOW DIRECTION
- PROPOSED SLOPE (3:1 MAX.)
- PROPOSED MAJOR OVERLAND FLOW DIRECTION
- STAKED WOODLOT BY COLVILLE CONSULTING INC.
- PROPOSED STORM MANHOLE
- PROPOSED MANHOLE CATCHBASIN
- PROPOSED CATCHBASIN / DOUBLE CATCHBASIN

No.	ISSUE / REVISION	YYYY/MMM/DD
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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

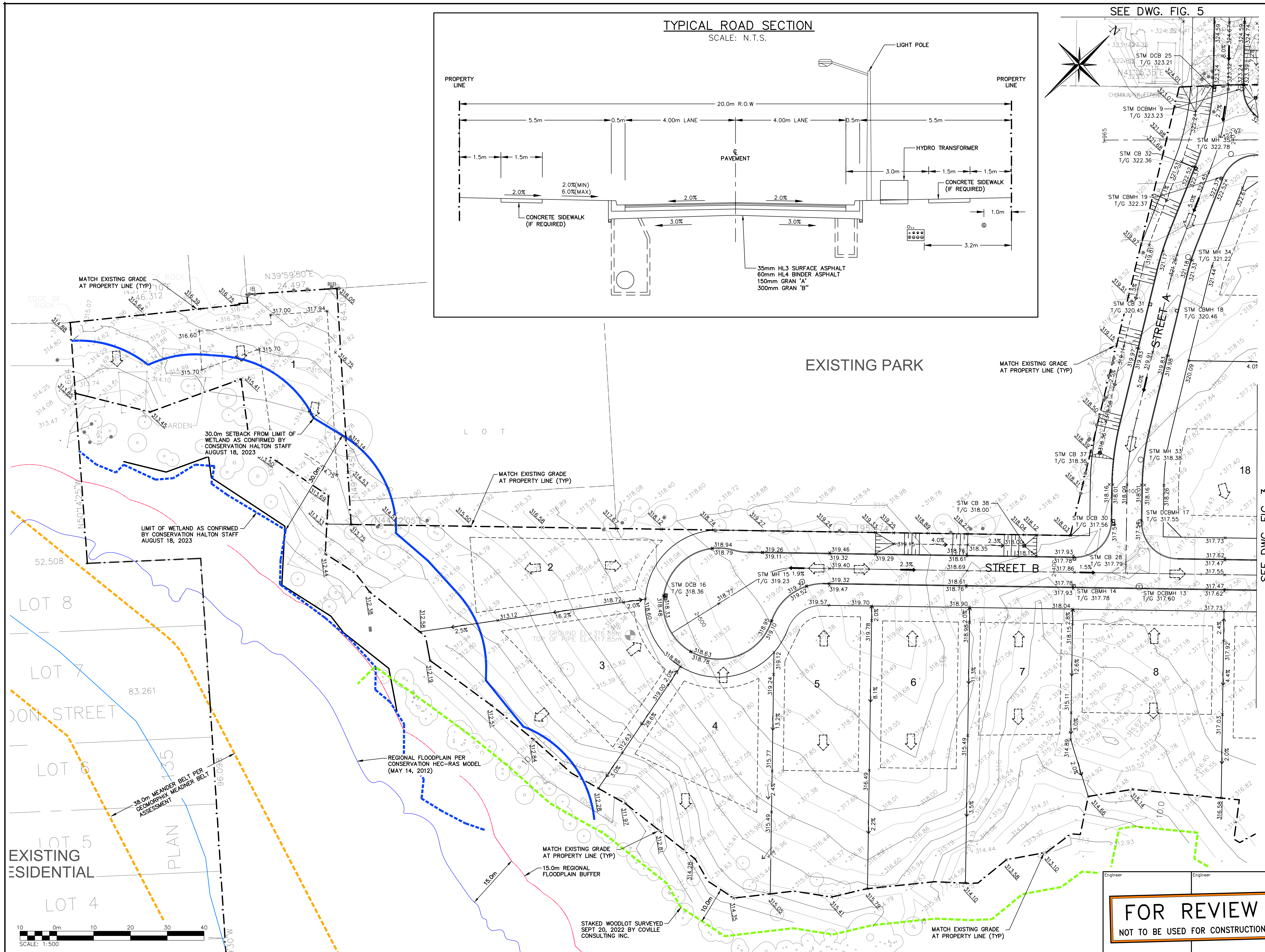
SITE GRADING PLAN (EAST)

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn	Design	Project No.	
M.I.M	M.I.M.	2366–6537	
Check	Check	Scale	Dwg.
B.W.	B.W.	1:500	FIG. 3



LEGEND

	PROPERTY LINE
	EXISTING CONTOUR (0.50m)
	EXISTING CONTOUR (1.0m)
×215.00	EXISTING GRADE
×215.00	PROPOSED GRADE
×215.00	PROPOSED GRADE (TO MATCH EXISTING)
2.0%	PROPOSED MINOR FLOW DIRECTION
	PROPOSED SLOPE (3:1 MAX.)
	PROPOSED MAJOR OVERLAND FLOW DIRECTION
	STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
	LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF (AUGUST 18, 2023)
	30.0m SETBACK FROM LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF AUGUST 18, 2023
	MEANDER BELT 38m BUFFER (19m EACH SIDE)
	REGIONAL FLOODPLAIN (CONSERVATION HALTON)
	REGIONAL FLOODPLAIN 15.0m BUFFER
	PROPOSED STORM MANHOLE / MANHOLE CATCHBASIN
	PROPOSED CATCHBASIN

No.	ISSUE / REVISION	YYYY/MMM/DD
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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

SITE GRADING PLAN (WEST)

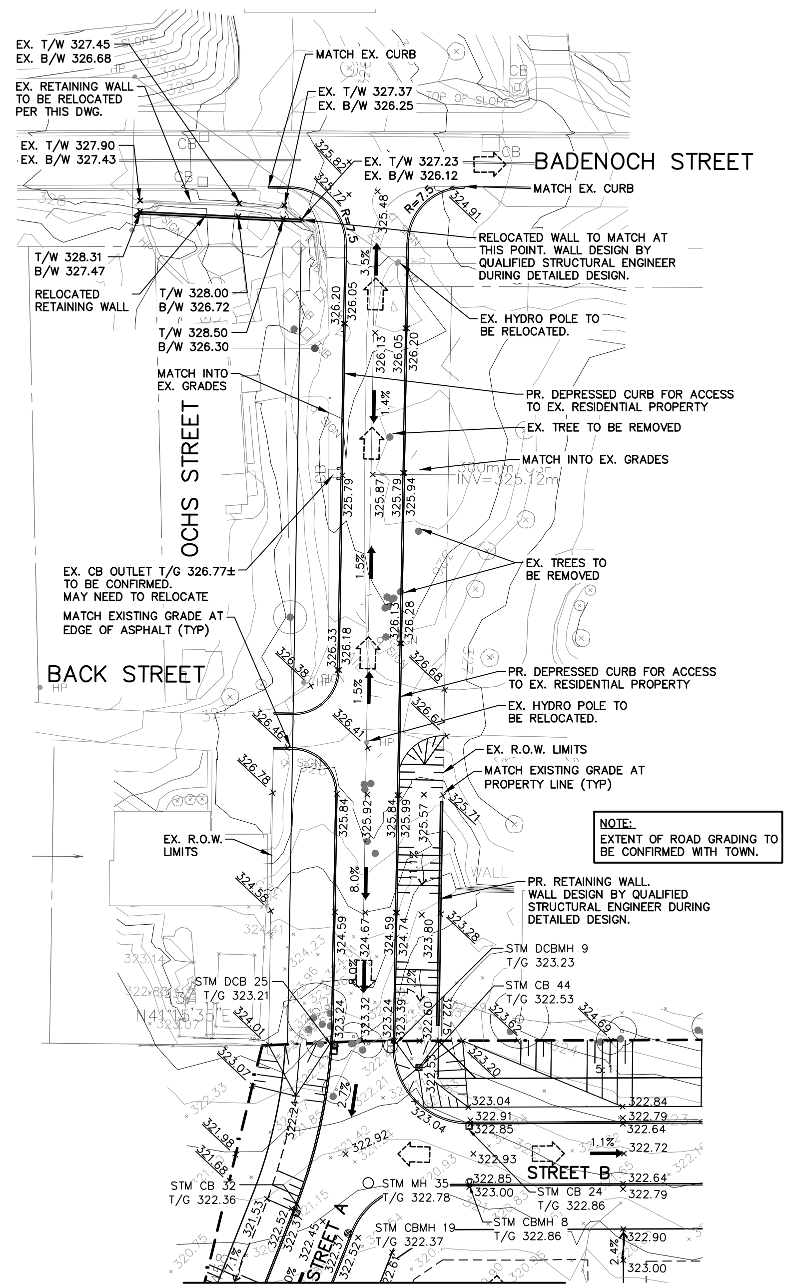
Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER CONSULTING ENGINEERS

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905.875.0026 T
905.875.4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn	M.I.M	Design	M.I.M.	Project No.	2366-6537
Check	B.W.	Check	B.W.	Scale 1:500	Dwg. FIG. 4



KEY PLAN
SCALE: N.T.S.

LEGEND

— — · —	PROPERTY LINE
	EXISTING CONTOUR (0.50m)
	EXISTING CONTOUR (1.0m)
×215.00	EXISTING GRADE
×215.00	PROPOSED GRADE
×215.00	PROPOSED GRADE (TO MATCH EXISTING)
2.0%	PROPOSED MINOR FLOW DIRECTION
	PROPOSED SLOPE (3:1 MAX.)
	PROPOSED MAJOR OVERLAND FLOW DIRECTION

NOTE:

EXTERNAL OF OCHS STREET IS FOR SCHEMATIC PURPOSES ONLY. DETAILED DESIGN OF OCHS STREET TO BE COMPLETED THROUGH CONSULTATION WITH THE TOWNSHIP DURING SUBSEQUENT PLANNING APPLICATION.

EXTERNAL DRAINAGE FROM PRIVATE LOTS TO BE CONVEYED AS PART OF THESE ROAD IMPROVEMENTS.

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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

EXTERNAL GRADING PLAN
(OCHS STREET)

Engineer | Engineer

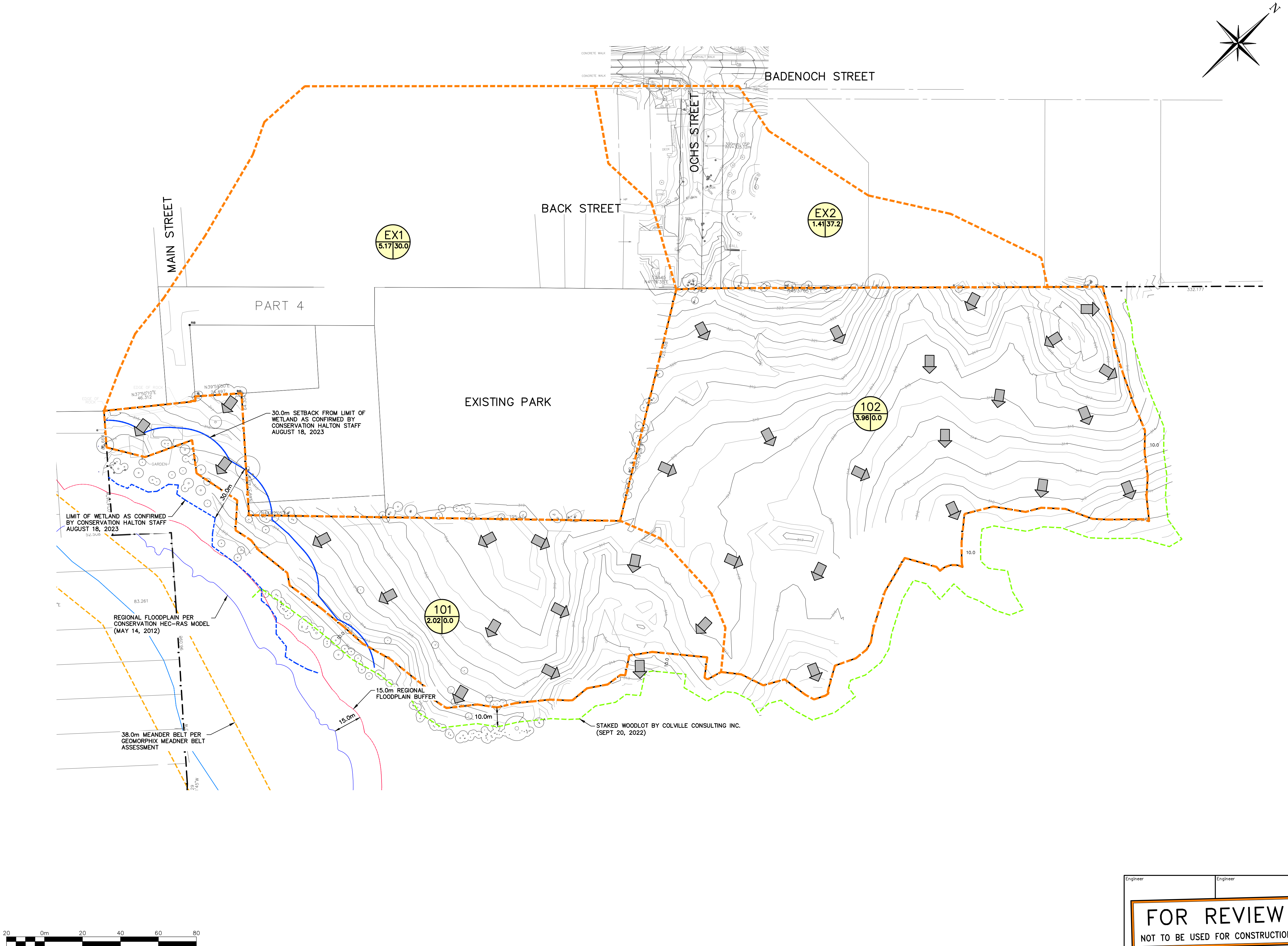
FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

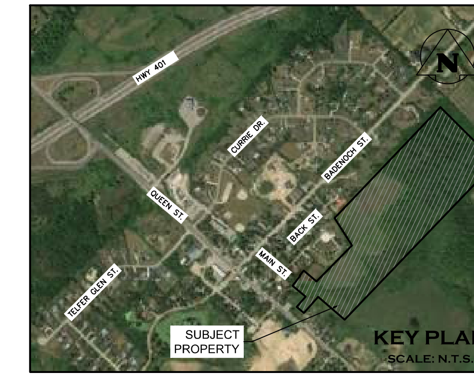
CROZIER
CONSULTING ENGINEERS

2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905.875.0026 T
905.875.4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn	M.I.M.	Design	M.I.M.	Project No.	2366-6537
Check	B.W.	Check	B.W.	Scale 1:500	Dwg. FIG. 5

10 0m 10 20 30 40
SCALE: 1:500





LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING DITCH
- EXISTING OVERLAND FLOW DIRECTION
- PRE-DEVELOPMENT STORM DRAINAGE CATCHMENT
- REGIONAL FLOODPLAIN (CONSERVATION HALTON)
- REGIONAL FLOODPLAIN 15.0m BUFFER
- STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
- LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF (AUGUST 18, 2023)
- 30.0m SETBACK FROM LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF AUGUST 18, 2023
- MEANDER BELT 38m BUFFER (19m EACH SIDE)
- ID — CATCHMENT I.D.; A | %IMP — AREA (ha) | PERCENT IMPERVIOUS

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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

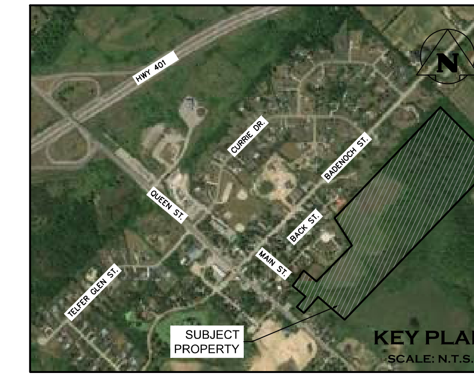
PRE-DEVELOPMENT DRAINAGE PLAN

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn	M.I.M	Design	M.I.M.	Project No.	2366-6537
Check	B.W.	Check	B.W.	Scale 1:1000	Dwg. FIG. 6



LEGEND

	PROPERTY LINE
	EXISTING CONTOUR (0.5m)
	EXISTING CONTOUR (1.0m)
	EXISTING DITCH
x 215.00	EXISTING GRADE
	PROPOSED OVERLAND FLOW DIRECTION
	POST-DEVELOPMENT STORM DRAINAGE CATCHMENT
	REGIONAL FLOODPLAIN (CONSERVATION HALTON)
	REGIONAL FLOODPLAIN 15.0m BUFFER
	STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
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	MEANDER BELT 38m BUFFER (19m EACH SIDE)
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	PROPOSED SINGLE / DOUBLE CATCHBASIN
	PROPOSED SINGLE CATCHBASIN MANHOLE
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SURVEY NOTES:

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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

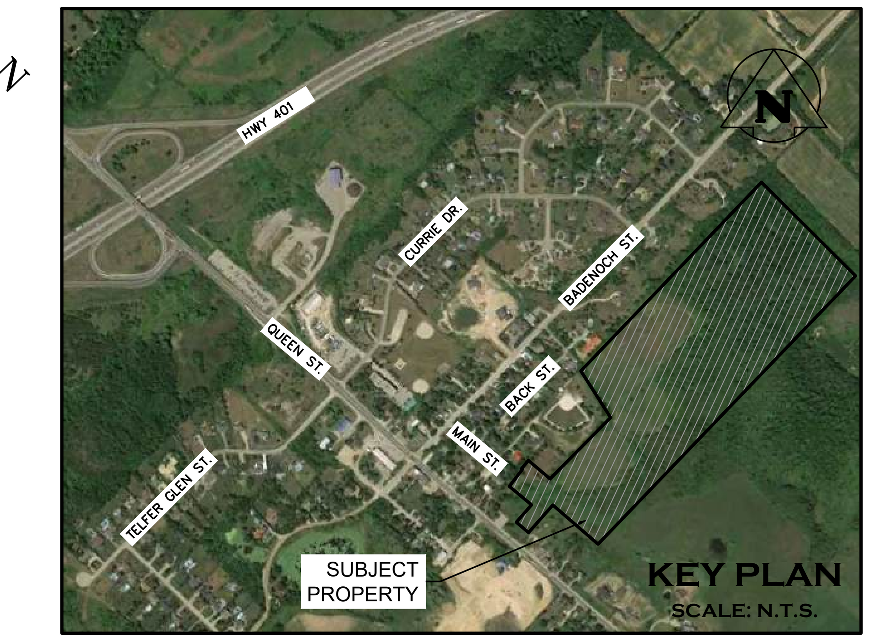
POST-DEVELOPMENT
DRAINAGE PLAN

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn	M.I.M	Design	M.I.M.	Project No.	2366-6537
Check	B.W.	Check	B.W.	Scale 1:1000	Dwg. FIG. 7



LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (1.0m)
- EXISTING GRADE
- STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
- CONCEPTUAL 360 m² BUILDING ENVELOPE
- PROPOSED TYPE A DISPERSAL BED 368 m²
- CONCEPTUAL PROPOSED DRILLED WELL LOCATION C/W 15.0m OBC SETBACK
- PROPOSED STORM MANHOLE
- PROPOSED MANHOLE CATCHBASIN
- PROPOSED CATCHBASIN / DOUBLE CATCHBASIN

NOTES:

1. PROPOSED DRIVEWAY LOCATIONS AND APRONS TO BE CONFIRMED DURING DESIGN PROCESS.

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SURVEY NOTES:

SURVEY COMPLETED BY J.D. BARNES LTD. (2023/JAN/31)
DRAWING FILE No.: 22-14-718-00-TOPO

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UTM ZONE 17, NAD83 (GSRS) (2010.0)

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SITE PLAN NOTES:

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DRAWING No. 10779 CONCEPTS/C2_2022-03-16
DATE RECEIVED 2023/FEB/06

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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

PRELIMINARY SITE SERVICING PLAN (EAST)

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

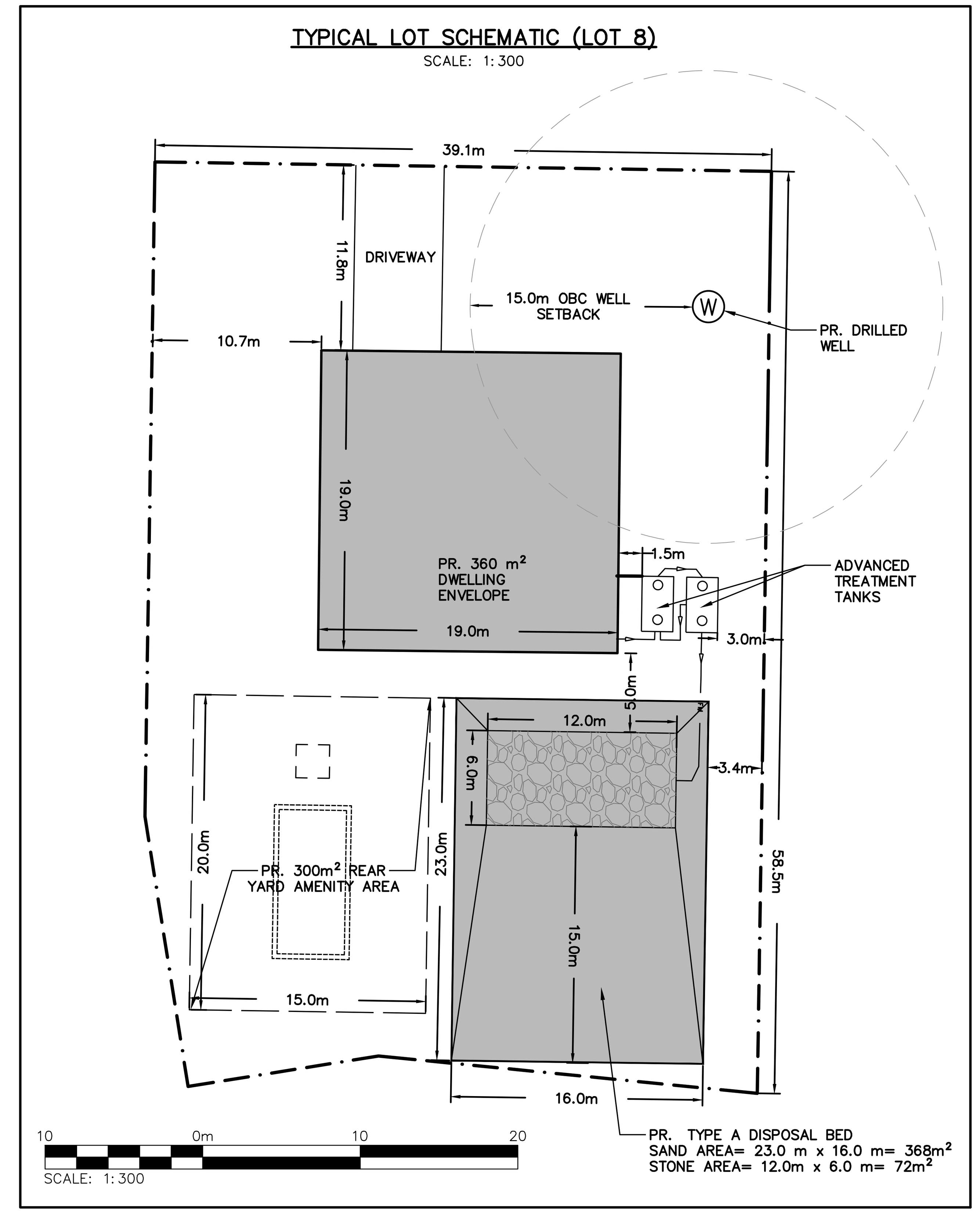
Drawn	M.I.M	Design	M.I.M.	Project No.	2366-6537
Check	B.W.	Check	B.W.	Scale 1:500	Dwg. FIG. 1

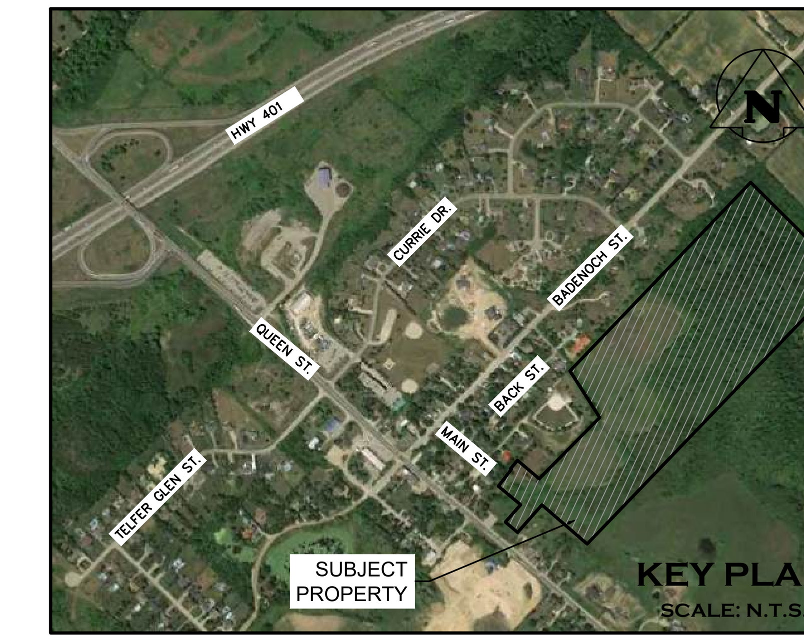
SEWAGE SYSTEM NOTES

1. PROPOSED SEWAGE SYSTEM CONSTRUCTION TO BE UNDERTAKEN IN ACCORDANCE WITH THE ONTARIO BUILDING CODE, ONTARIO MINISTRY OF ENVIRONMENT, AND THE MANUFACTURER'S RECOMMENDATIONS.
2. INSTALLATION OF ALL COMPONENTS OF THE SEWAGE SYSTEM TO BE COMPLETED BY A LICENSED AND REGISTERED ONSITE SEWAGE SYSTEM INSTALLER IN THE PROVINCE OF ONTARIO.
3. THE CONTRACTOR SHALL COORDINATE AND PAY FOR ALL NECESSARY INSPECTIONS WITH THE TOWN AND OTHER AUTHORITIES PERTAINING TO THE INSTALLATION OF THEIR WORK.
4. CONTRACTOR TO LOCATE ALL UNDERGROUND UTILITIES AND EXISTING SEWAGE WORKS PRIOR TO CONSTRUCTION.
5. ALL COMPONENT LOCATIONS SHALL BE FIELD VERIFIED WITH THE ENGINEER PRIOR TO INSTALLATION.
6. ALL EARTHWORKS, INCLUDING PLACEMENT OF FILL ARE TO BE UNDERTAKEN WITH TRACK MOUNTED EQUIPMENT TO KEEP COMPACTION TO A MINIMUM. KEEP ALL TRAFFIC IN THE AREA OF THE PROPOSED LEACHING BED TO A MINIMUM.
7. ALL TOPSOIL AND ORGANICS TO BE REMOVED FROM LEACHING BED AREA.
8. IF HIGH GROUNDWATER CONDITIONS ARE EVIDENT AT THE TIME OF CONSTRUCTION, THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY. ALL VERTICAL CLEARANCE DISTANCES AS REQUIRED BY THE ONTARIO BUILDING CODE MUST BE MAINTAINED.
9. GRAVITY SEWERS TO HAVE MINIMUM 0.6 M COVER AND SHALL BE INSULATED WHERE LESS THAN 1.0M COVER IS PROVIDED. FORCEMAIN SHALL BE INSULATED WHERE LESS THAN 1.5 M COVER IS PROVIDED. BEDDING, COVER AND BACKFILL TO BE IN ACCORDANCE WITH OPSS.
10. UNLESS OTHERWISE NOTED PE FORCEMAIN TO BE HDPE SERIES 100 OR DR 13.5 PE AND PVC FORCEMAIN TO BE SCHEDULE 40. GRAVITY SEWERS TO BE SDR-35. FORCE MAIN TO BE PROVIDED WITH TRACER WIRE, SECURED TO THE TOP OF THE PIPE WITH WATER PROOF TAPE OR ZIP TIES.
11. ALL PIPES SUBJECT TO VEHICULAR TRAFFIC SHALL BE ADEQUATELY PROTECTED.
12. ALL METAL IN TANKS OR PUMP CHAMBERS TO BE GLAVANIZED OR STAINLESS STEEL
13. ALL JOINTS BELOW THE HIGH WATER LEVEL IN PRECAST TANKS TO BE SEALED WITH MASTIC SEALANT IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS FOR WATERTIGHT SEAL. ALL TANK INLETS AND OUTLETS TO BE EQUIPPED WITH CAST IN RUBBER BOOT FOR WATER TIGHT SEAL. UNLESS OTHERWISE NOTED ALL TANK INLETS AND OUTLETS TO BE EQUIPPED WITH TEES.
14. ALL TANKS TO BE PROVIDED WITH PRECAST CONCRETE OR PVC ACCESS RISERS TO GRADE. HATCHES TO BE BOLTED AND GASKETED AND ACCESSIBLE AT GRADE. ALL CIRCULAR HATCHES TO BE 600 MM DIAMETER POLYLOK RISER WITH CAST IN ADAPTOR. ALL SQUARE ACCESS OPENINGS TO BE EQUIPPED WITH CONCRETE RISERS. VENTED HATCHES TO BE PROVIDED ON TANKS CONTAINING PUMPS.
15. EXISTING SOILS SHALL BE SCARIFIED AT A RIGHT ANGLE TO THE DIRECTION OF LATERAL SEWAGE FLOW IN THE LEACHING BED PRIOR TO IMPORTING FILL OR INSTALLING DISTRIBUTION PIPE STONE LAYER.
16. WHEN THE IMPORTATION OF FILL IS REQUIRED, FILL SHOULD BE END-DUMPED AND GRADED PROGRESSIVELY OVER THE PREPARED SITE AREA WITH TRACK MOUNTED EQUIPMENT.
17. ALL ELEVATIONS TO BE VERIFIED PRIOR TO BACKFILL
18. ALL FILL MATERIAL PLACED BENEATH TANKS TO BE COMPACTED TO 95%.
19. ALL DISTURBED AREAS TO BE TOPSOILED (100MM MINIMUM) AND SEEDED COMPLETE WITH FERTILIZER AND MULCH IN ACCORDANCE WITH OPSS
20. THE INSTALLING CONTRACTOR SHALL INSTALL THE SEWAGE SYSTEM USING A TRANSIT/LEVEL AND SHALL PROVIDE SAME FOR INSPECTION OF ANY COMPONENT.
21. MAXIMUM BURIAL DEPTH OF TANKS NOT TO EXCEED TO MANUFACTURERS RECOMMENDATIONS
22. CLEARANCE DISTANCES FROM PROPERTY LINES, STRUCTURES, WELLS, AND SURFACE WATER WILL ADHERE TO THE REQUIREMENTS OF OBC 8.2.1.6.A
23. A LEACHING BED SHALL NOT BE LOCATED ON AN AREA WITH A SLOPE OF GREATER THAN 4 UNITS HORIZONTALLY TO 1 UNIT VERTICALLY.
24. THE HEADER LINE, DISTRIBUTION PIPES AND LEACHING BED SHALL BE EQUIPPED WITH MEANS OF DETECTION AS REQUIRED BY OBC 8.7.2.2. (2). LIGHT COLOURED PLASTIC COATED 14 GAUGE TRACER WIRE OR EPOXY COATED, 10m REBAR LAID HORIZONTALLY AT EACH CORNER OF THE BED IS ACCEPTABLE.
25. STONE TRENCH OR LAYER TO BE COVERED WITH PERMEABLE GEOTEXTILE PRIOR TO BACKFILL.
26. STONE TO CONFORM WITH OBC 8.7.3.3.
27. ALL IMPORTED SAND FILL TO HAVE A T-TIME OF 6 TO 10 MIN/CM AND A SILT/CLAY CONTENT OF NO MORE THAN 5% AND SHALL BE VERIFIED IN WRITING BY A SOIL TESTING FIRM AND APPROVED BY THE ENGINEER PRIOR TO PLACEMENT.
28. ANAEROBIC DIGESTER AND BIOFILTER BASKET PUMPS AS DESIGNED AND SUPPLIED BY WATERLOO BIOFILTER.
29. PUMP CHAMBER TO BE VENTED AND EQUIPPED WITH AUDIBLE AND VISUAL HIGH LEVEL ALARM
30. ALL VALVES TO PROVIDE NO OBSTRUCTION TO FLOW WHEN FULLY OPENED. ALL VALVES AND COUPLINGS TO BE ACCESSIBLE AT GRADE.
31. ALL PUMP FLOATS TO BE SECURED TO A REMOVABLE PVC FLOAT TREE
32. ALL PUMP CONTROL PANELS TO BE EQUIPPED WITH SEPARATE CIRCUIT BREAKERS FOR PUMP CIRCUIT
33. NO JUNCTION BOXES IN RISERS
34. ALL BURIED ELECTRICAL WIRING TO BE IN PVC CONDUIT
35. PRIOR TO ACCEPTANCE CONTRACTOR TO PROVIDE DOCUMENTATION THAT ALL ELECTRICAL WORK HAS BEEN INPSECTED AND APPROVED BY THE ELECTRICAL AUTHORITY HAVING JURISDICTION

ONSITE SEWAGE SYSTEM DESIGN TYPICAL LOT NOTES

PROPOSED 4 BEDROOM, 360 m^2 HOME WITH FORTY-FIVE (45) FIXTURE UNITS	BASE FLOW (4 BEDROOMS)= 2,000 L/DAY ADDITIONAL FLOOR AREA (160 m2)= 1,600 L/DAY ADDITIONAL FIXTURE UNITS (25)= 1,250 L/DAY Q TOTAL (2,000+1,600)= 3,600 L/DAY
SOIL PERCOLATION RATE	T = 30 min/cm (ESTIMATED BY C.F. CROZIER)
PROPOSED TREATMENT UNIT	WATERLOO BIOFILTER AD-BA40
TYPE A DISPERSAL BED STONE AREA	MINIMUM SIZE=Q/50=3,600/50 = 72 m^2 PROVIDED 12m x 6m = 72 m^2
TYPE A DISPERSAL BED SAND AREA	MINIMUM SIZE=QT/400= 3,600*30/400= 270 m^2 PROVIDED 23m x 16m = 368 m^2





LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (1.0m)
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- REGIONAL FLOODPLAIN (CONSERVATION HALTON)
- REGIONAL FLOODPLAIN 15.0m BUFFER
- STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
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- 30.0m SETBACK FROM LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF AUGUST 18, 2023
- MEANDER BELT 38m BUFFER (19m EACH SIDE)
- CONCEPTUAL 360 m^2 BUILDING ENVELOPE
- PROPOSED TYPE A DISPERSAL BED 368 m^2
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- PROPOSED STORM MANHOLE
- PROPOSED MANHOLE CATCHBASIN
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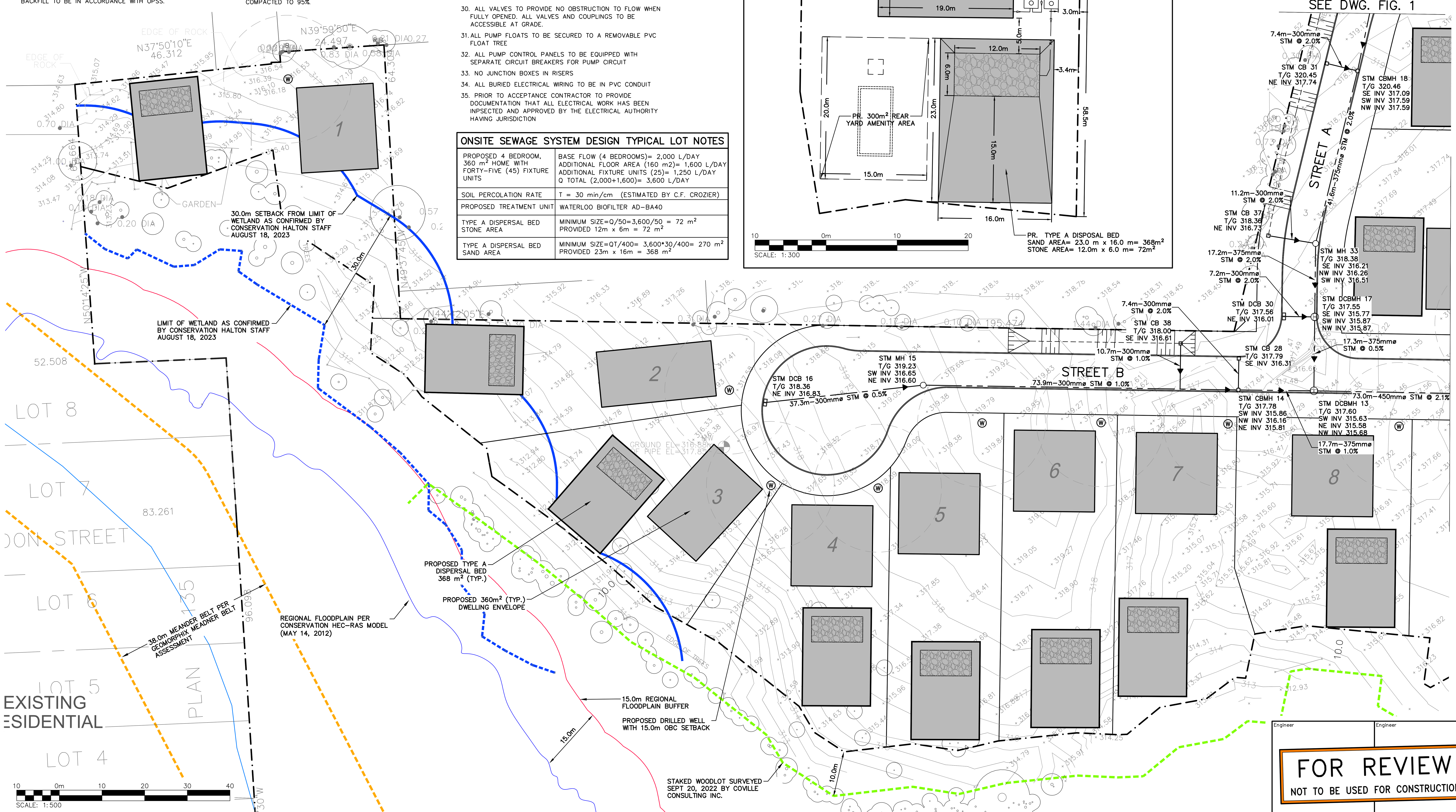

NOTES:

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SEE DWG. FIG. 1

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Project

11 MAIN STREET TOWN OF PUSLINCH

Drawing

PRELIMINARY SITE SERVICING PLAN (WEST)

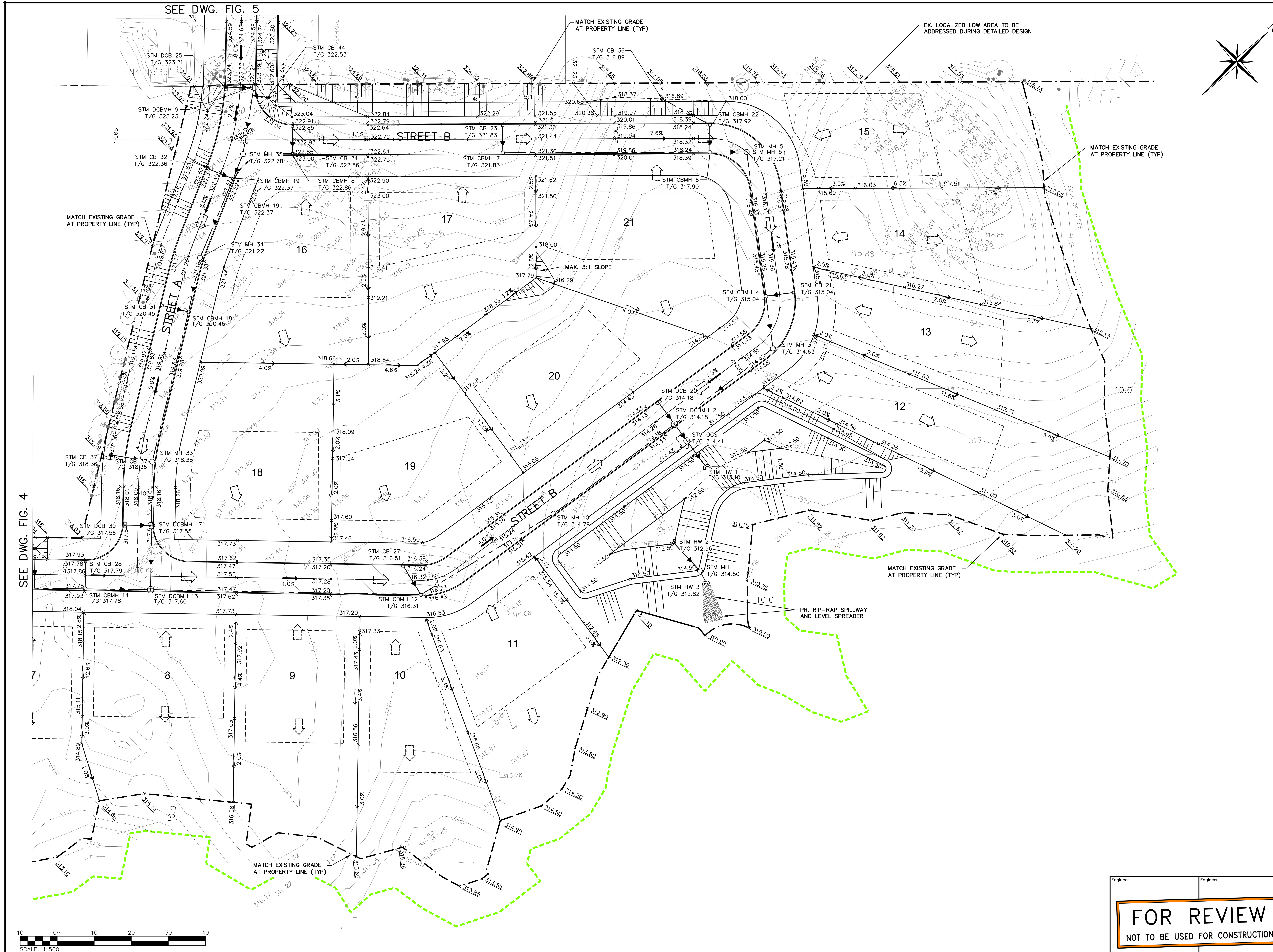
Engineer

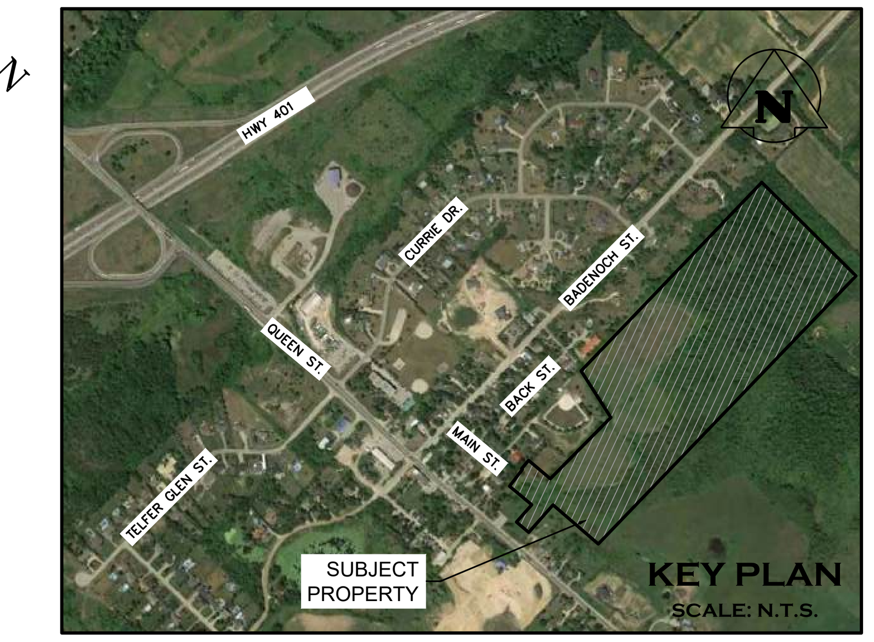
Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905.875.0026 T
905.875.4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn M.I.M	Design M.I.M.	Project No.	2366-6537
Check B.W.	Check B.W.	Scale 1:500	Dwg. FIG. 2





LEGEND

PROPERTY LINE
EXISTING CONTOUR (0.50m)
EXISTING CONTOUR (1.0m)
EXISTING GRADE
PROPOSED GRADE
PROPOSED GRADE (TO MATCH EXISTING)
PROPOSED MINOR FLOW DIRECTION
PROPOSED SLOPE (3:1 MAX.)
PROPOSED MAJOR OVERLAND FLOW DIRECTION
STAKED WOODLOT BY COLVILLE CONSULTING INC.
PROPOSED STORM MANHOLE
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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

SITE GRADING PLAN (EAST)

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905.875.0026 T
905.875.4915 F
WWW.CFCROZIER.CA
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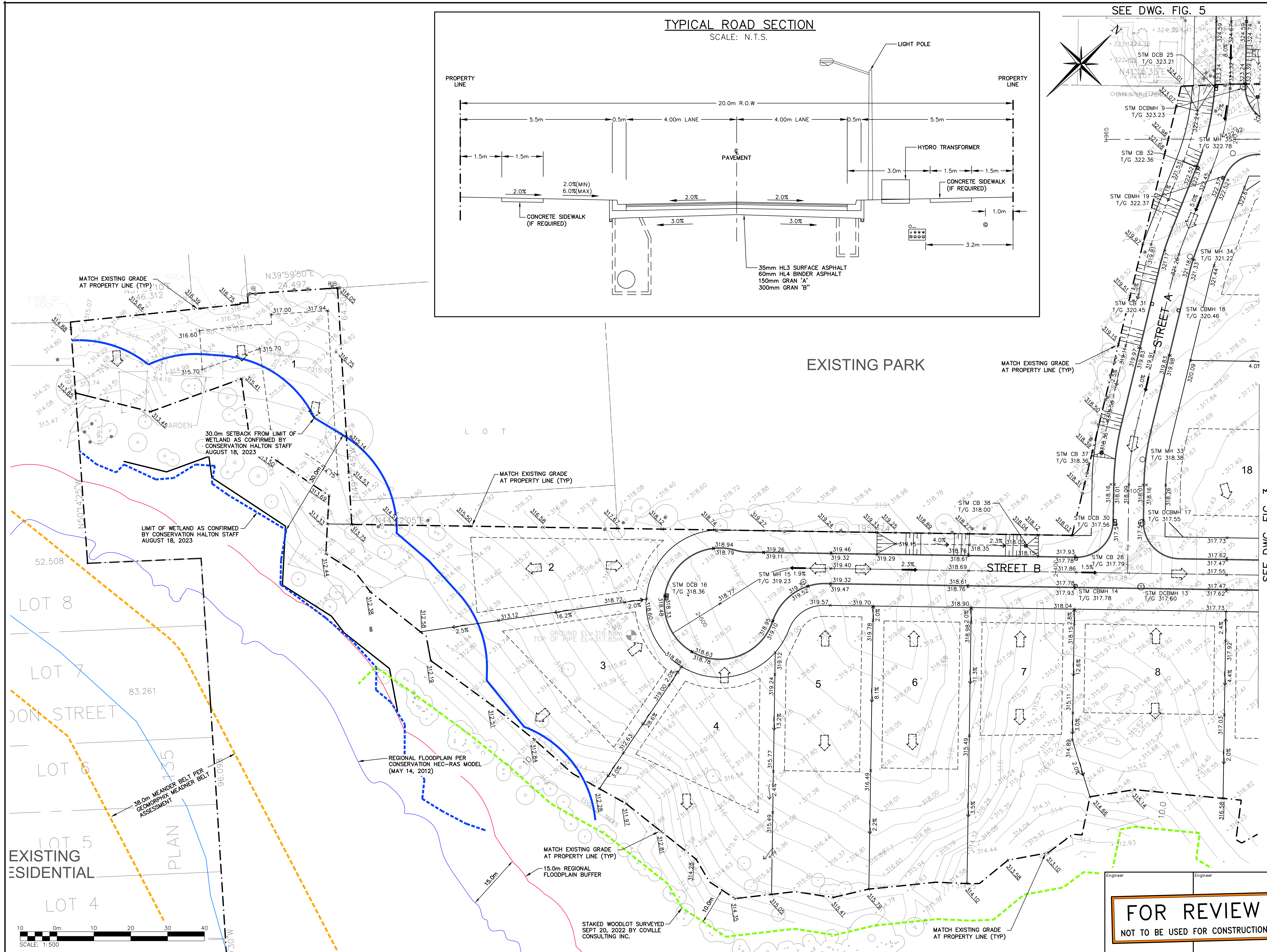
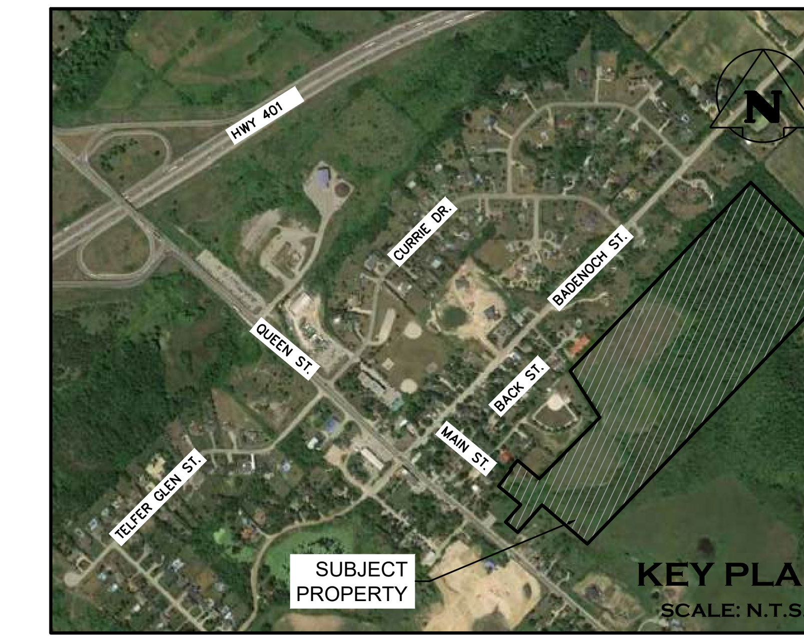
Check	B.W.	Check	B.W.	Scale 1:500	Dwg. FIG. 3





LEGEND

	PROPERTY LINE
	EXISTING CONTOUR (0.50m)
	EXISTING CONTOUR (1.0m)
×215.00	EXISTING GRADE
×215.00	PROPOSED GRADE
×215.00	PROPOSED GRADE (TO MATCH EXISTING)
2.0%	PROPOSED MINOR FLOW DIRECTION
	PROPOSED SLOPE (3:1 MAX.)
	PROPOSED MAJOR OVERLAND FLOW DIRECTION
	STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

SITE GRADING PLAN (WEST)

Engineer

Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
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SUITE 100
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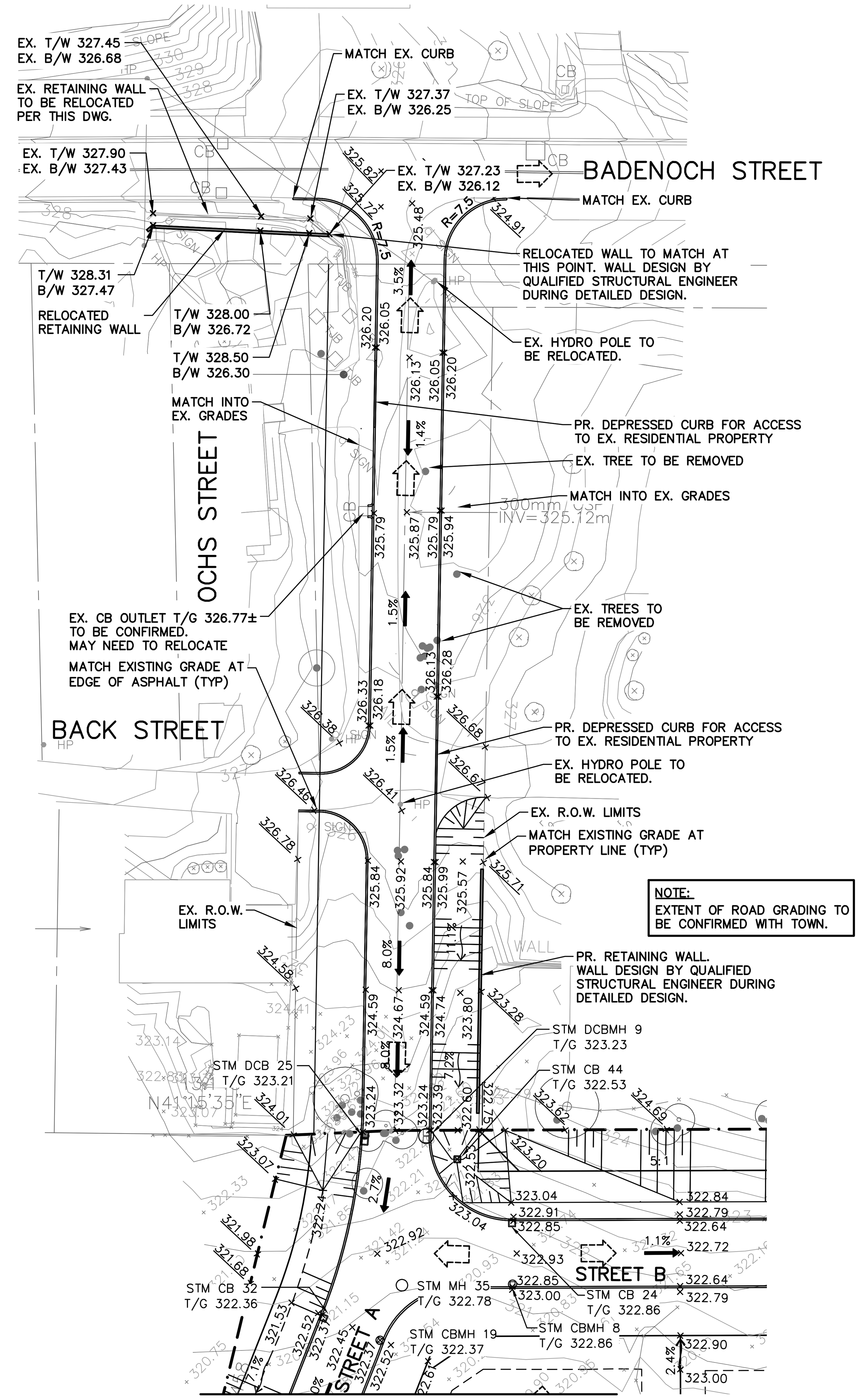

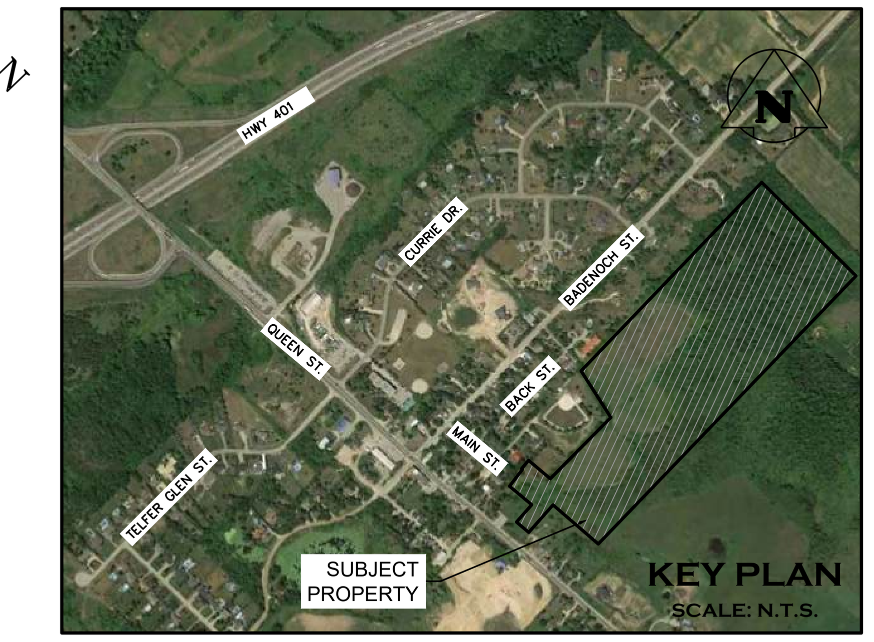

LEGEND

— — · —	PROPERTY LINE
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x215.00	EXISTING GRADE
x215.00	PROPOSED GRADE
x<u>215.00</u>	PROPOSED GRADE (TO MATCH EXISTING)
2.0% →	PROPOSED MINOR FLOW DIRECTION
	PROPOSED SLOPE (3:1 MAX.)
⇨	PROPOSED MAJOR OVERLAND FLOW DIRECTION

NOTE:

EXTERNAL OF OCHS STREET IS FOR SCHEMATIC PURPOSES ONLY. DETAILED DESIGN OF OCHS STREET TO BE COMPLETED THROUGH CONSULTATION WITH THE TOWNSHIP DURING SUBSEQUENT PLANNING APPLICATION.

EXTERNAL DRAINAGE FROM PRIVATE LOTS TO BE CONVEYED AS PART OF THESE ROAD IMPROVEMENTS.

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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

EXTERNAL GRADING PLAN
(OCHS STREET)

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
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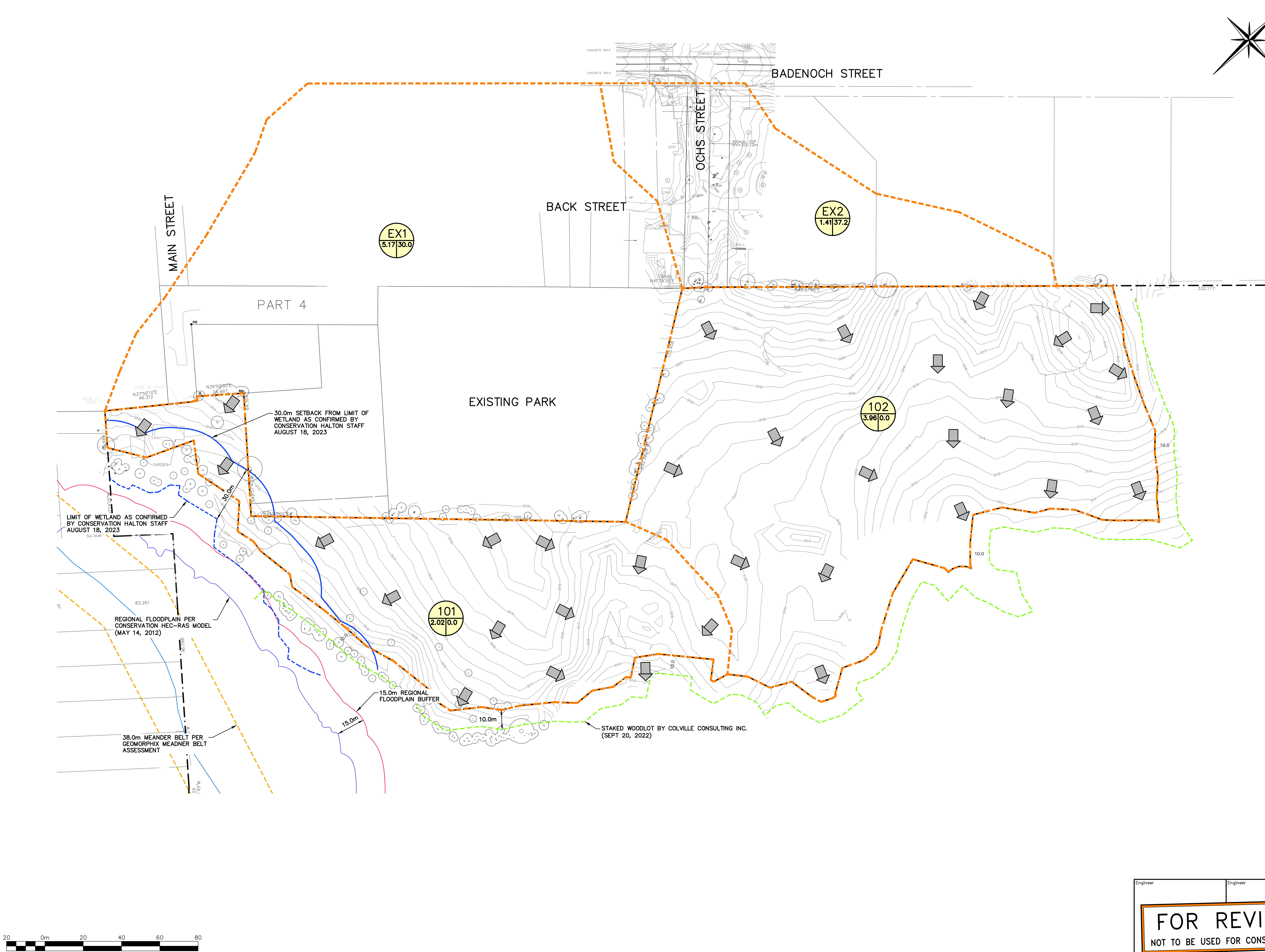
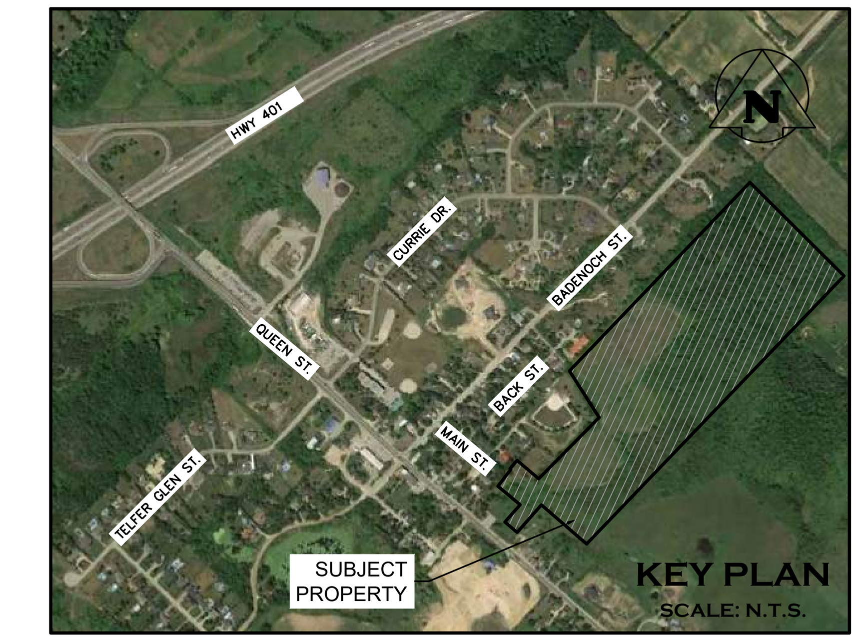
Drawn	M.I.M	Design	M.I.M.	Project No.	2366-6537
Check	B.W.	Check	B.W.	Scale 1:500	Dwg. FIG. 5

10 0m 10 20 30 40
SCALE: 1:500





LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING DITCH
- EXISTING OVERLAND FLOW DIRECTION
- PRE-DEVELOPMENT STORM DRAINAGE CATCHMENT
- REGIONAL FLOODPLAIN (CONSERVATION HALTON)
- REGIONAL FLOODPLAIN 15.0m BUFFER
- STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
- LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF (AUGUST 18, 2023)
- 30.0m SETBACK FROM LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF AUGUST 18, 2023
- MEANDER BELT 38m BUFFER (19m EACH SIDE)
- CATCHMENT I.D. — ID / A / %IMP — AREA (ha) | PERCENT IMPERVIOUS

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/DEC/20
0	ISSUED ZBA AND DPS APPLICATIONS	2023/FEB/17

ELEVATION NOTE:

ELEVATIONS HEREON ARE GEODETIC (CGVD-1928:78) AND ARE DERIVED FROM GNSS OBSERVATIONS USING NATURAL RESOURCES CANADA'S GEOID MODEL HT_2.0 ON.

SURVEY NOTES:

SURVEY COMPLETED BY J.D. BARNES LTD. (2023/JAN/31)
DRAWING FILE No.: 22-14-718-00-TOPO

BEARINGS ARE UTM GRID, DERIVED FROM RTN OBSERVATIONS
UTM ZONE 17, NAD83 (GSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9996781

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON SITE PLAN BY WESTON CONSULTING INC.
DRAWING No. 10779 CONCEPTS/C2_2022-03-16
DATE RECEIVED 2023/FEB/06

DRAWING NOTES:

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ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

PRE-DEVELOPMENT DRAINAGE PLAN

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON, L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn	M.I.M	Design	M.I.M.	Project No.	2366-6537
Check	B.W.	Check	B.W.	Scale 1:1000	Dwg. FIG. 6

LEGEND

	PROPERTY LINE
	EXISTING CONTOUR (0.5m)
	EXISTING CONTOUR (1.0m)
	EXISTING DITCH
x 215.00	EXISTING GRADE
	PROPOSED OVERLAND FLOW DIRECTION
	POST-DEVELOPMENT STORM DRAINAGE CATCHMENT
	REGIONAL FLOODPLAIN (CONSERVATION HALTON)
	REGIONAL FLOODPLAIN 15.0m BUFFER
	STAKED WOODLOT BY COLVILLE CONSULTING INC. (SEPT 20, 2022)
	LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF (AUGUST 18, 2023)
	30.0m SETBACK FROM LIMIT OF WETLAND AS CONFIRMED BY CONSERVATION HALTON STAFF AUGUST 18, 2023
	MEANDER BELT 38m BUFFER (19m EACH SIDE)
	PROPOSED STORM SEWER & MANHOLE
	PROPOSED SINGLE / DOUBLE CATCHBASIN
	PROPOSED SINGLE CATCHBASIN MANHOLE
ID	CATCHMENT I.D.
A | %IMP	AREA (ha) | PERCENT IMPERVIOUS

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION (ZBA)	2023/DEC/20
0	ISSUED ZBA AND DPS APPLICATIONS	2023/FEB/17

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SURVEY NOTES:

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DRAWING FILE No.: 22-14-718-00-TOPO

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Project

11 MAIN STREET
TOWN OF PUSLINCH

Drawing

POST-DEVELOPMENT DRAINAGE PLAN

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
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INFO@CFCROZIER.CA

Drawn	M.I.M	Design	M.I.M.	Project No.	2366-6537
Check	B.W.	Check	B.W.	Scale 1:1000	Dwg. FIG. 7

Traffic Impact Study

Part of Lots 7 & 8 North of Queen Street and Part of Lot 31 Concession Road 8

WDD Main Street

22 December 2023

→ The Power of Commitment

Executive summary

GHD Limited is pleased to provide the following updated Traffic Impact Study in support of the proposed residential development located on part of lots 7 & 8 North of Queen Street and Part of lot 31 Concession 8, located generally southeast of the intersection of Highway 6 and Badenoch Street in the Township of Puslinch. This updated report addresses comments received from the first submission.

This report determines the site related traffic and subsequent traffic related impacts on the adjacent road network during the weekday a.m. and p.m. peak hours. These impacts are based on the projected future background traffic and road network conditions derived for a 2024, 2029 and 2034 future planning horizon year.

The proposed Draft Plan of Subdivision has been prepared by Weston Consulting and consists of 23 detached dwelling units.

Access to the development is proposed via an extension of Ochs Street, providing a direct connection to Badenoch Street at an existing full moves unsignalized intersection.

The study intersections included in the analysis include:

- Highway 6 and Badenoch Street/Calfass Road
- Badenoch Street and Ochs Street
- Ochs Street and Back Street

Based on ITE Trip Generation rates, the proposed development is expected to generate a total of 20 new two-way trips during the weekday a.m. peak hour consisting of 5 inbound and 15 outbound trips and 25 new two-way trips during the weekday p.m. peak hour consisting of 16 inbound and 9 outbound trips.

Under existing conditions, all study intersections are operating with acceptable v/c ratios and delays.

The planned Morriston Bypass was not included in the analysis of future traffic scenarios, as a result, the analysis presented in this report is conservative as it does not account for any reduction in traffic volumes along the existing Highway 6 alignment that will occur once the new alignment is completed.

In the future 2024, 2029 and 2034 horizon years, the intersections continue to operate at mostly satisfactory levels with the intersection of Hwy 6 and Badenoch Street/Calfass Road operating with some critical movements however all movements operating with v/c ratios of less 1.0. The unsignalized intersections of Badenoch Street with Ochs Street and Ochs Street with Back Street are reported to operate with low v/c ratios and delays and no critical movements up to the 2034 horizon year.

The overall impact of the development generated traffic was found to be negligible to the operation of the study area intersections and traffic flow along Highway 6 and Badenoch Street. The site traffic does not result in any turning movements increasing to critical levels, all critical movements under the future traffic scenarios are a result of the assumed corridor growth rate.

Application of the current Township of Puslinch's Comprehensive Zoning By-Law parking rates to the subject site results in a requirement of a minimum of 2 parking spaces per dwelling unit. The minimum By-law parking requirement of 2 spaces per dwelling unit will be satisfied with the provision of garage and driveway parking.

A sightline assessment of vehicles exiting from Och Street onto Badenoch Street was completed in the field, it confirmed that there is sufficient sightlines to satisfy the TAC requirements for a 60 km/h design speed.

The existing intersection of Badenoch Street and Och Street has an existing retaining wall within the County right-of-way that limits sightline visibility for outbound traffic exiting Och Street to see an oncoming vehicle travelling eastbound on Badenoch Street. It is recommended that the retaining wall be relocated to provide the required sightline. A design for the relocation of the retaining wall has been prepared by Crozier Consulting Engineers.

The subject site proposes a modified rural cross-section along Street "A" and Street "B" with an 18 metre right-of-way, which is expected to provide two travel lanes and allow visitor parking on both sides of the road.

We trust that this satisfies your requirements, but do not hesitate to contact the undersigned if you have any questions.

Sincerely,

GHD

[redacted]

William Maria, P. Eng.

Transportation Planning Lead

Contents

Table index

Figure index

Appendices

1. Introduction

1.1 Retainer and Objective

GHD Limited was retained to prepare a Traffic Impact Study in support of the proposed residential development located on part of lots 7 & 8 North of Queen Street and Part of lot 31 Concession 8, located generally southeast of the intersection of Highway 6 and Badenoch Street in the Township of Puslinch.

The updated TIS report, dated December 2023, is in response to comments provided by the MTO, County of Wellington, and the Township of Puslinch from their review of the first submission, dated February 2023. This letter presents the MTO's comments and GHD's respective responses. The County and Township expressed concern with having the site's access on Ochs Street due to potential sightline concerns at the intersection of Badenoch Street and Ochs Street. The TIS has also been updated to address the concern related to the sightline issues at the existing intersection. The response to the MTO comments are provided in **Appendix E.**

The site location is illustrated in **Figure 1**.

The purpose of this study is to:

- Establish baseline traffic conditions for the study area in 2023 and determine future background operating conditions for a future planning horizon in 2024, 2029, and 2034.
- Utilize Institute of Transportation Engineer's (ITE) Trip Generation data and first principles to estimate the site trips generated by the proposed development and distribute the traffic to the adjacent road network.
- Determine future operating traffic conditions during the weekday peek periods through intersection capacity analysis.

1.2 Study Team

The GHD team involved in the preparation of the study are:

- William Maria, P. Eng., Transportation Planning Lead
- Rafael Andrenacci, B.Eng., Transportation Planner

Figure 1 Site Location

2. Site Characteristics

2.1 Study Area

The following intersections were included in the study area:

- Highway 6 and Badenoch Street/Calfass Road
- Badenoch Street and Ochs Street
- Ochs Street and Back Street

2.2 Proposed Development Content

A draft plan of subdivision was prepared by Weston Consulting, dated February 2023 and is shown in **Figure 2**. The proposed residential development consists of 23 single detached lots.

Access to the proposed development is proposed primarily an extension of Ochs Street south of its intersection with Back Street. Lot 1 will be the only lot that will have a connection onto Main Street.

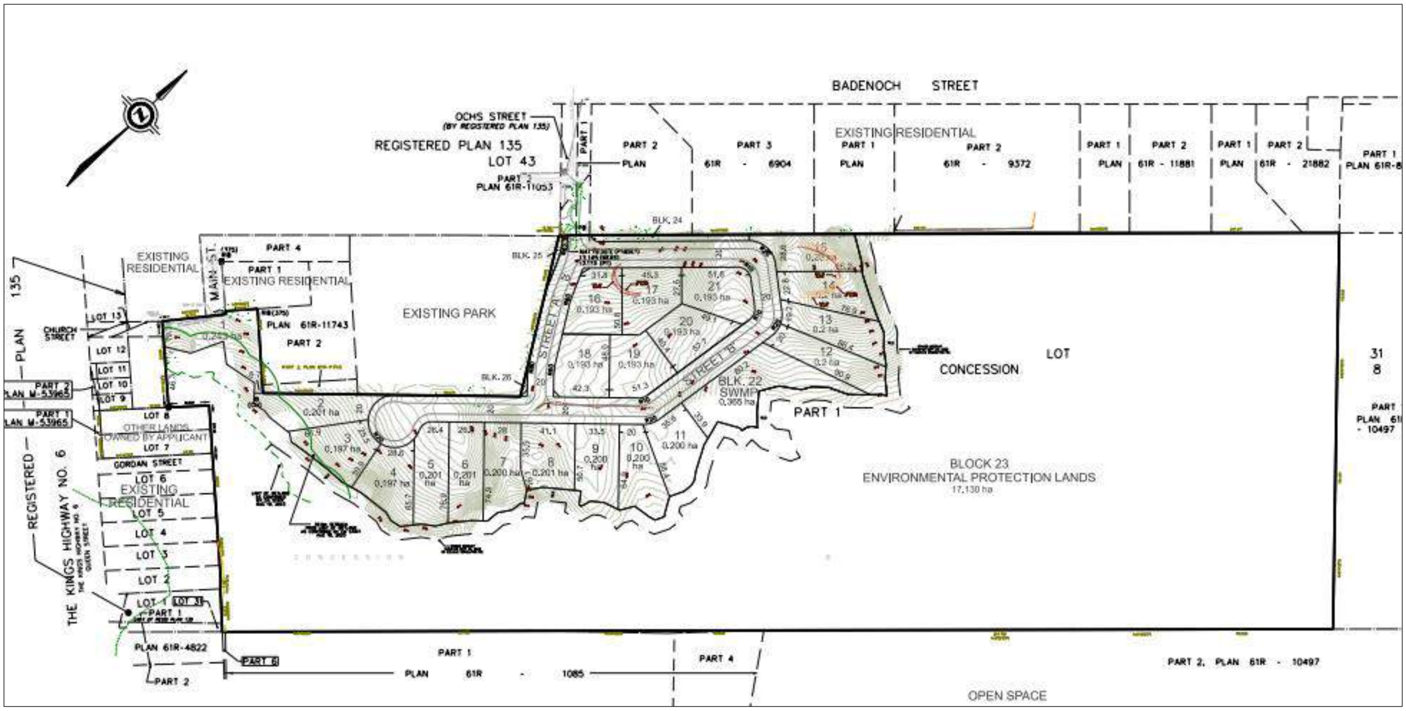


Figure 2 *Proposed Draft Plan*

3. Existing Conditions

3.1 Existing Road Network

Highway 6 is a north/south 2B arterial road under the jurisdiction of the Ministry of Transportation. Within the study area it has a three-lane cross-section north of its intersection with Badenoch Street/Calfass Road and a two-lane cross-section south of it, with the three-lane cross-section including a two-way left-turn lane in the centre lane. Its intersection with Badenoch Street/Calfass Road is signalized, with an auxiliary left-turn lane in both the northbound and southbound directions. Within the study area, Highway 6 has a posted speed limit of 50 km/h.

Badenoch Street (Wellington Road 36) is an east/west County Road under the jurisdiction of the County of Wellington. Within the study area it has a two-lane cross-section. Its intersection with Highway 6 is signalized with an auxiliary right-turn lane provided in the westbound direction. Its intersection with Ochs Street is unsignalized with the stop-control only provided on the minor approach onto Badenoch Street. West of its intersection with Highway 6, Badenoch Street continues as Calfass Road. The posted speed limit along Badenoch Street is 50 km/h.

Ochs Street is a north/south local road under the jurisdiction of the Township of Puslinch with a two-lane cross-section within the study area. Its intersection with Badenoch Street is unsignalized with the stop-control only provided on the minor approach onto Badenoch Street. Ochs Street currently terminates in the south at Back Street and continues towards the west as Back Street with no stop-controls. The assumed posted speed limit along Ochs Street is 50 km/h.

Back Street is an east/west local road under the jurisdiction of the Township of Puslinch with a two-lane cross-section within the study area. Back Street terminates in the west at Ochs Street and continues towards the north along Ochs Street with no stop-controls at the intersection of Ochs Street and Back Street. The assumed posted speed limit along Back Street is 50 km/h.

The existing lane configuration within the study area is shown in the figure below

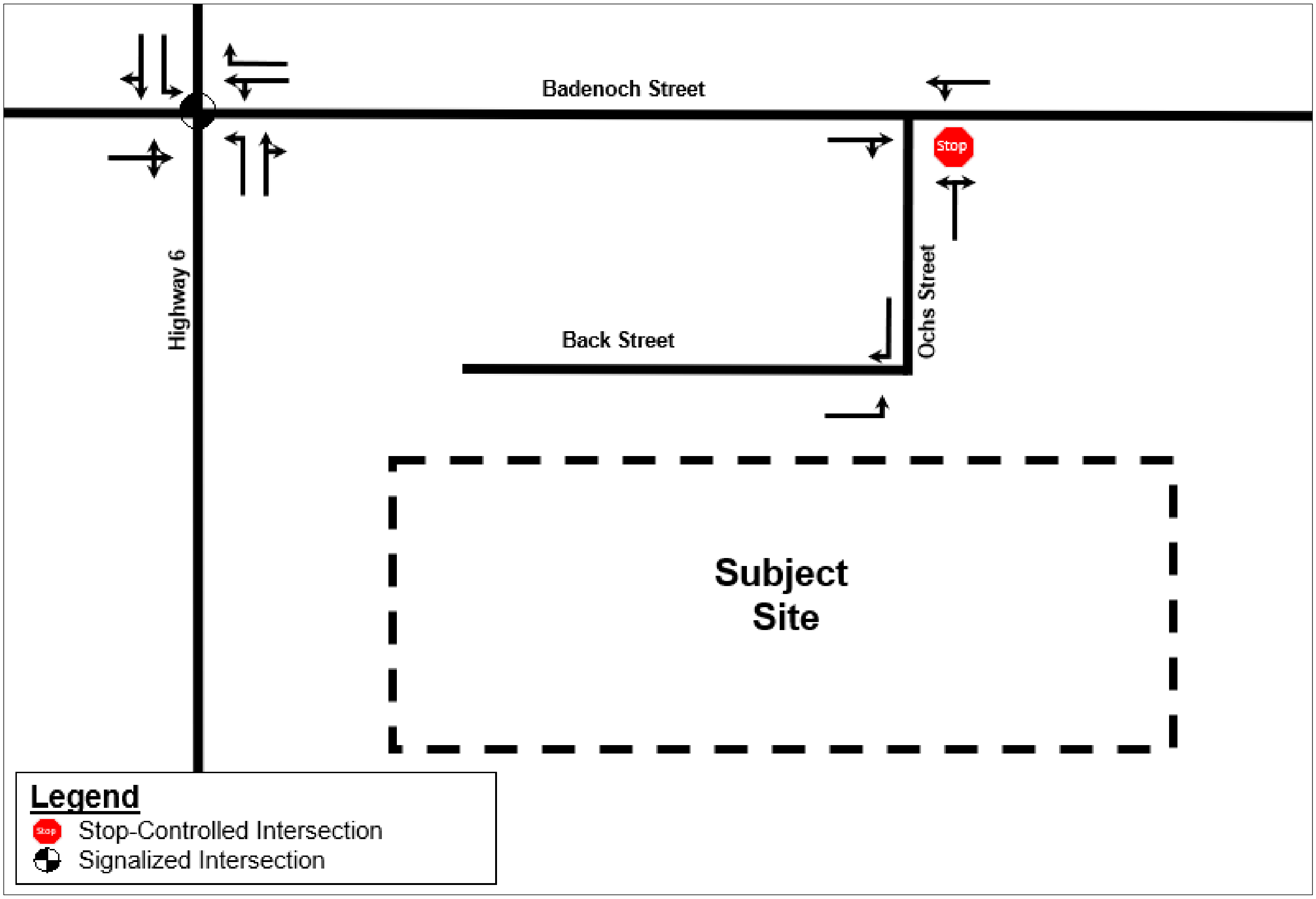


Figure 3 Existing Lane Configuration

3.2 Existing Pedestrian and Cycling Network

Pedestrian sidewalks are available along Highway 6, Badenoch Street, and Calfass Road within the study area.

- Highway 6
  - West side of Highway 6, from Calfass Road to Church Street
  - East side of Highway 6, from approximately 100 metres north of Badenoch Street and continues towards the south beyond the study area.
- Badenoch Street
  - Along both sides of the road from Highway 6 to Ochs Street
- Calfass Road
  - Along the south side of the road from Victoria Street to Highway 6

There are currently no cycling provisions within the study area.

All existing pedestrian and cycling amenities within the study area are shown on **Figure 4**.

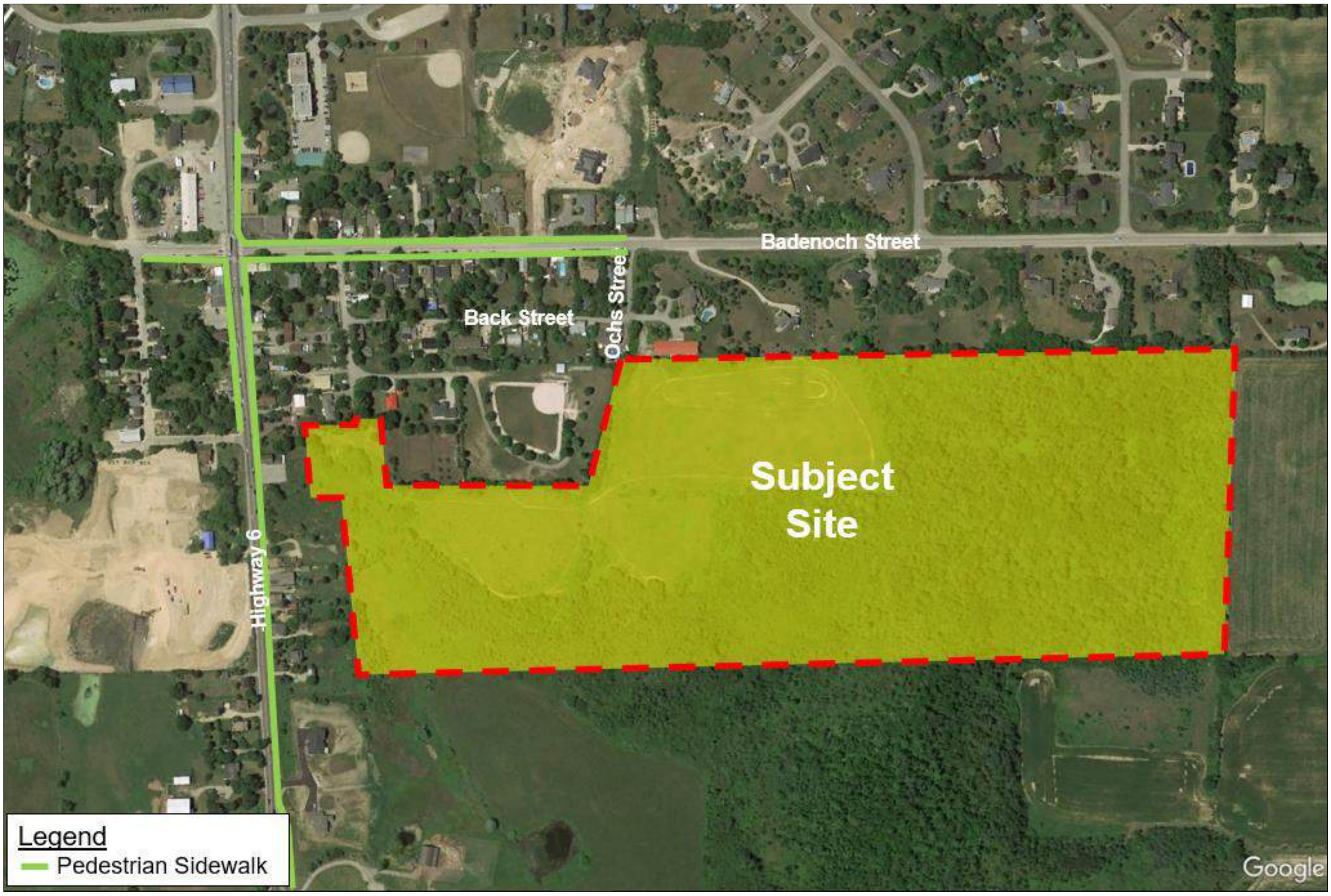


Figure 4 Existing Sidewalk

3.3 Existing Transit Service

With the study area there is currently no public transit service available. However, on October 1, 2019, Wellington County initiated a county-wide demand-responsive public transit service available to all inhabitants and visitors. This project is a pilot service sponsored by the Ontario Government and provides a safe and cost-effective means of transportation throughout the County. The pilot program has been granted two additional years of funding and is expected to conclude in 2025.

RIDE WELL is a public transit service that utilizes a rideshare operational model that uses software to optimize shared rides to ensure that as many individuals as possible are transported to their destination in a reliable manner with minimal vehicles. It provides an alternative means of transportation for regular needs in rural settings and for those who are unable to access personal vehicles.

The service runs from Monday to Friday between 6:00am and 7:00pm. Bookings can be made from or to any location within Wellington County or Guelph.

3.4 Existing Traffic Data

GHD contracted Spectrum Traffic Solutions Inc. to collect turning movement counts at the existing study intersections, with the counts completed in February 2023.

The existing 2023 traffic volumes for the a.m. and p.m. peak hours are summarized in **Figure 5** with the full turning movement count data provided in **Appendix A**.

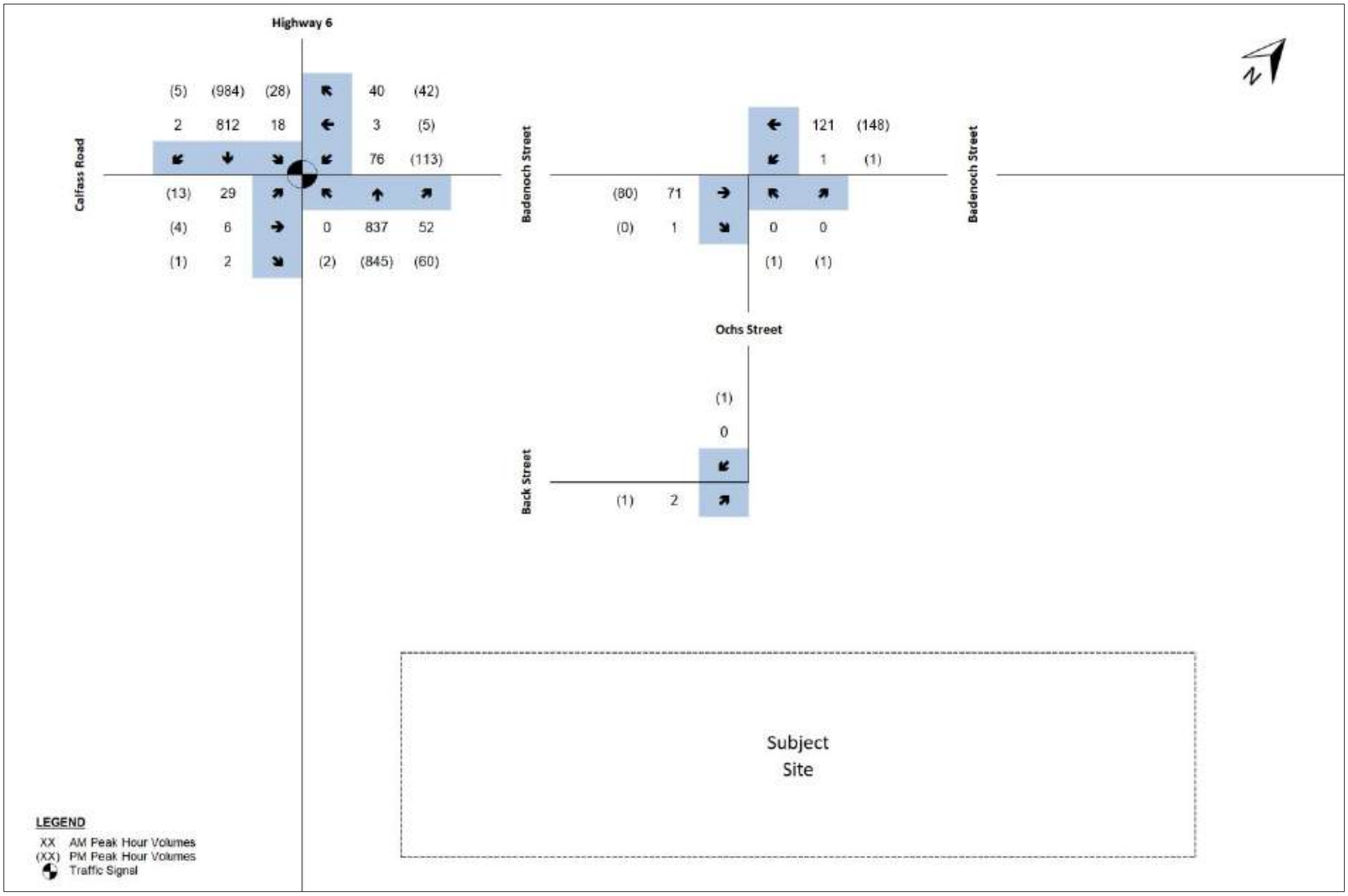


Figure 5 Existing 2022 Traffic Volumes

4. Future Background Traffic

4.1 Study Horizon Year

The future horizon years selected for analysis includes the full build-out year in 2024 along with 5- and 10-years post build-out corresponding to a 2029 and 2034 planning horizon years. This is also consistent with the MTO's Traffic Impact Study Guidelines.

4.2 Road Network Improvements

An environmental assessment was completed and approved by the provincial government for improvements within the Highway 401 and Highway 6 corridor in 1995, with a Notice of Approval to Proceed with the Undertaking being granted in 2009. The proposal included the Morriston Bypass, which will consist of a new four-lane alignment of Highway 6 west of the current alignment from Highway 401 in the north to Maddaugh Road in the south. The new four-lane alignment will provide additional capacity within the corridor with the current alignment through Morriston being restrained to a two-lane cross-section as a result of no additional space to widen the road.

In May 2022, the Ontario government announced that they will be moving forward with the construction of the new interchange and the re-alignment of Highway 6 with the earliest completion date set for 2025 for the interchange.

The updated plan for the project is provided in **Figure 6** below, and identifies the current location of Highway 6, the new alignment of Highway 6, and the location of the subject site with respect to the study area.

Once this road project is constructed, a reduction of vehicular traffic is expected along the current Highway 6 alignment through the study area with the Morriston Bypass providing a new connection from Highway 401 to the southern portion of Highway 6 towards Hamilton.

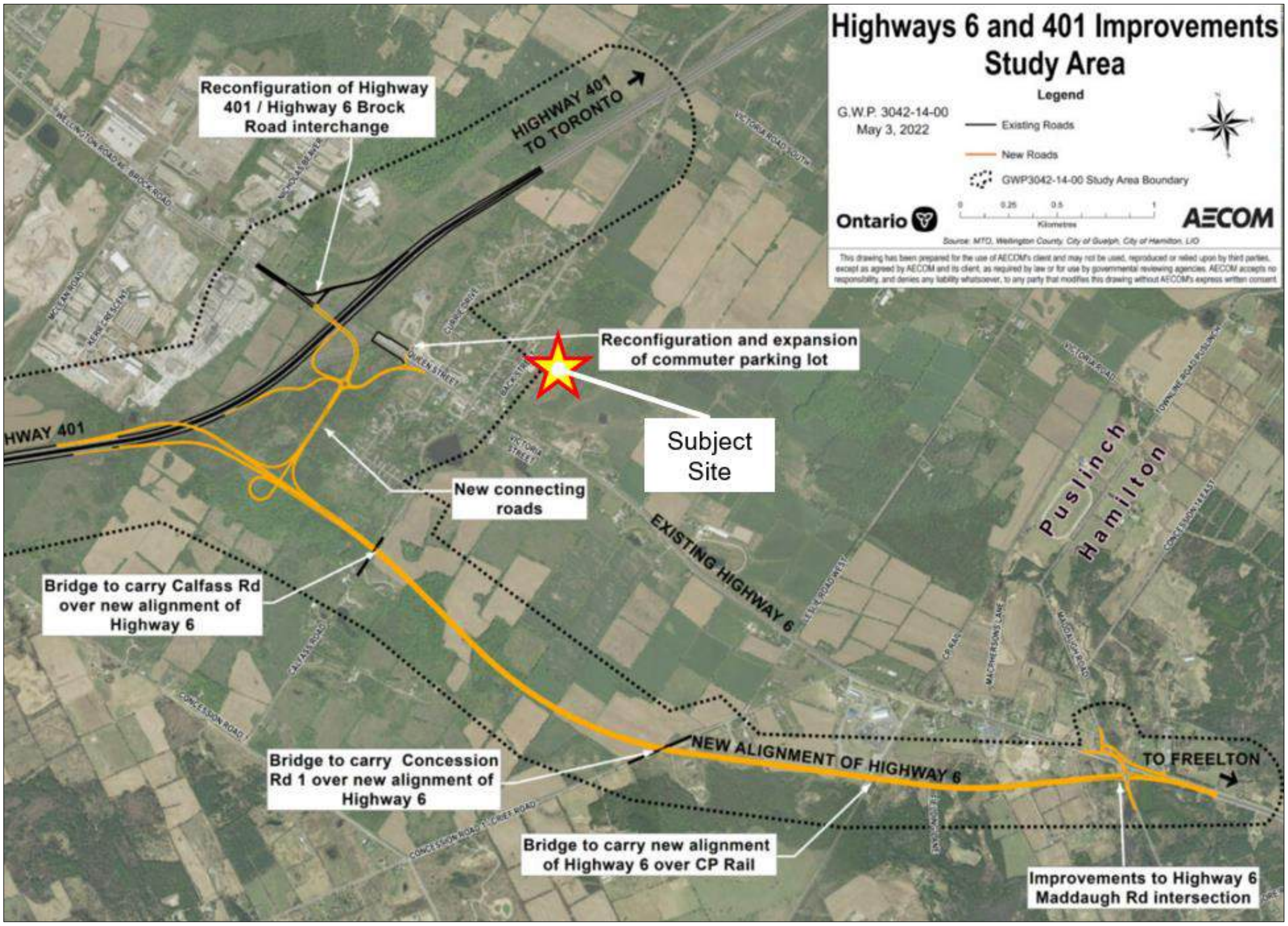


Figure 6 Morriston Bypass (highways6and401hamiltontoguelph.ca)

The Wellington County Road Master Action Plan, dated December 2021, has included an assessment of Badenoch Street within the study area that included a recommendation to consider urbanizing the road between Back Street and Ochs Drive. It is also suggested that a cycling facility assessment be completed prior to the urbanization of the road.

For the purpose of this report, neither of these road improvements have been assumed to be in place by the 2034 horizon year, as a result the analysis presented in this report is conservative as it does not account for any reduction in traffic volumes along the existing Highway 6 alignment that will occur once the new alignment is completed.

4.3 Corridor Growth

GHD applied a 2% per annum growth rate along all study area roads, consistent with the growth rate typically provided by the MTO for roadways under their jurisdiction.

4.4 Background Developments

No background developments were identified near the site that would contribute to additional traffic along the study area roads.

4.5 Future Background Traffic Volumes

The background traffic volumes for the 2024, 2029, and 2034 horizon years were derived by applying the 2% per annum corridor growth rate to the baseline 2023 traffic volumes.

The resulting 2024, 2029, and 2034 future background traffic volumes are summarized in **Figure 7**, **Figure 8**, and **Figure 9**..

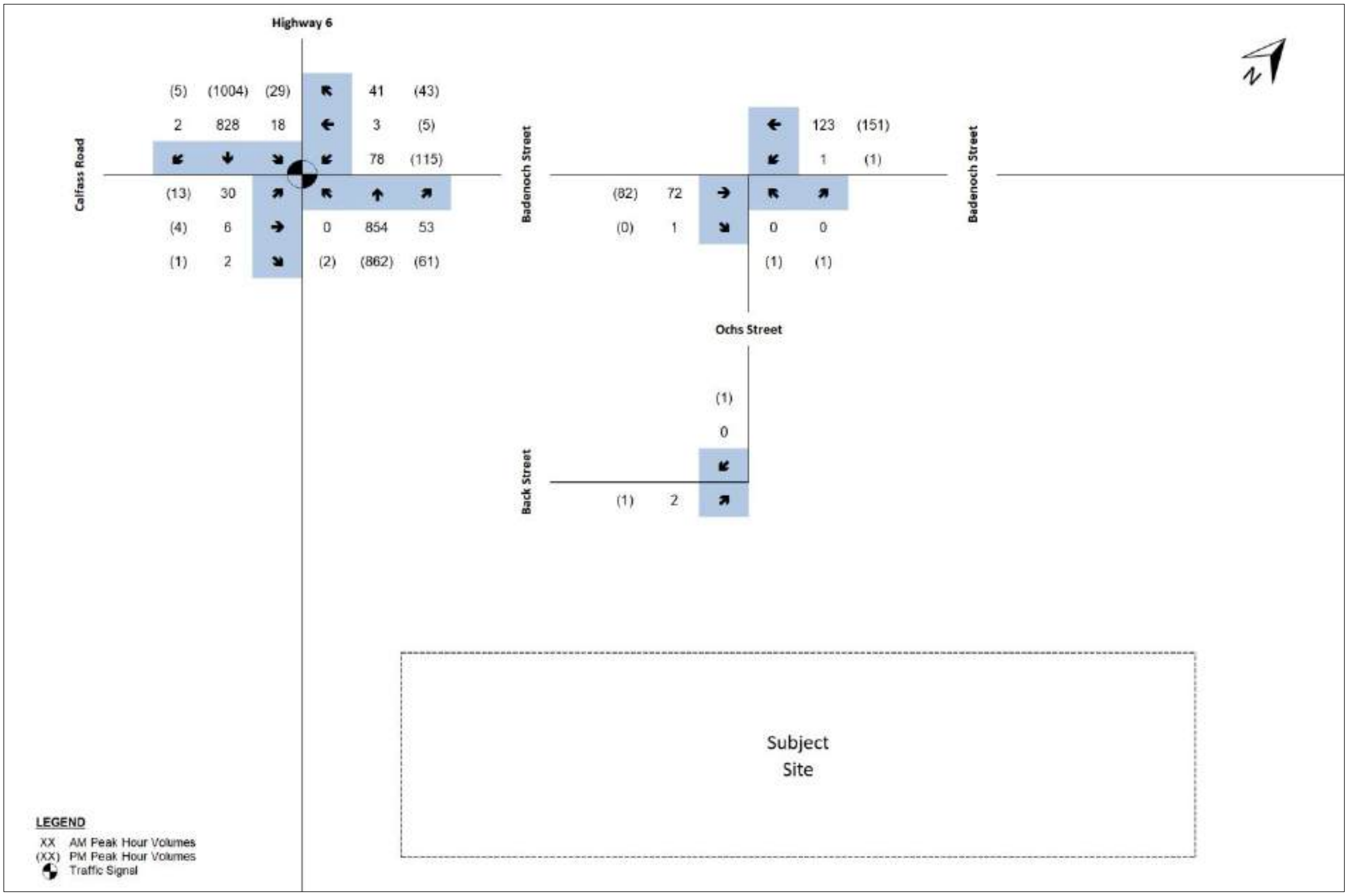


Figure 7 2024 Future Background Traffic Volumes

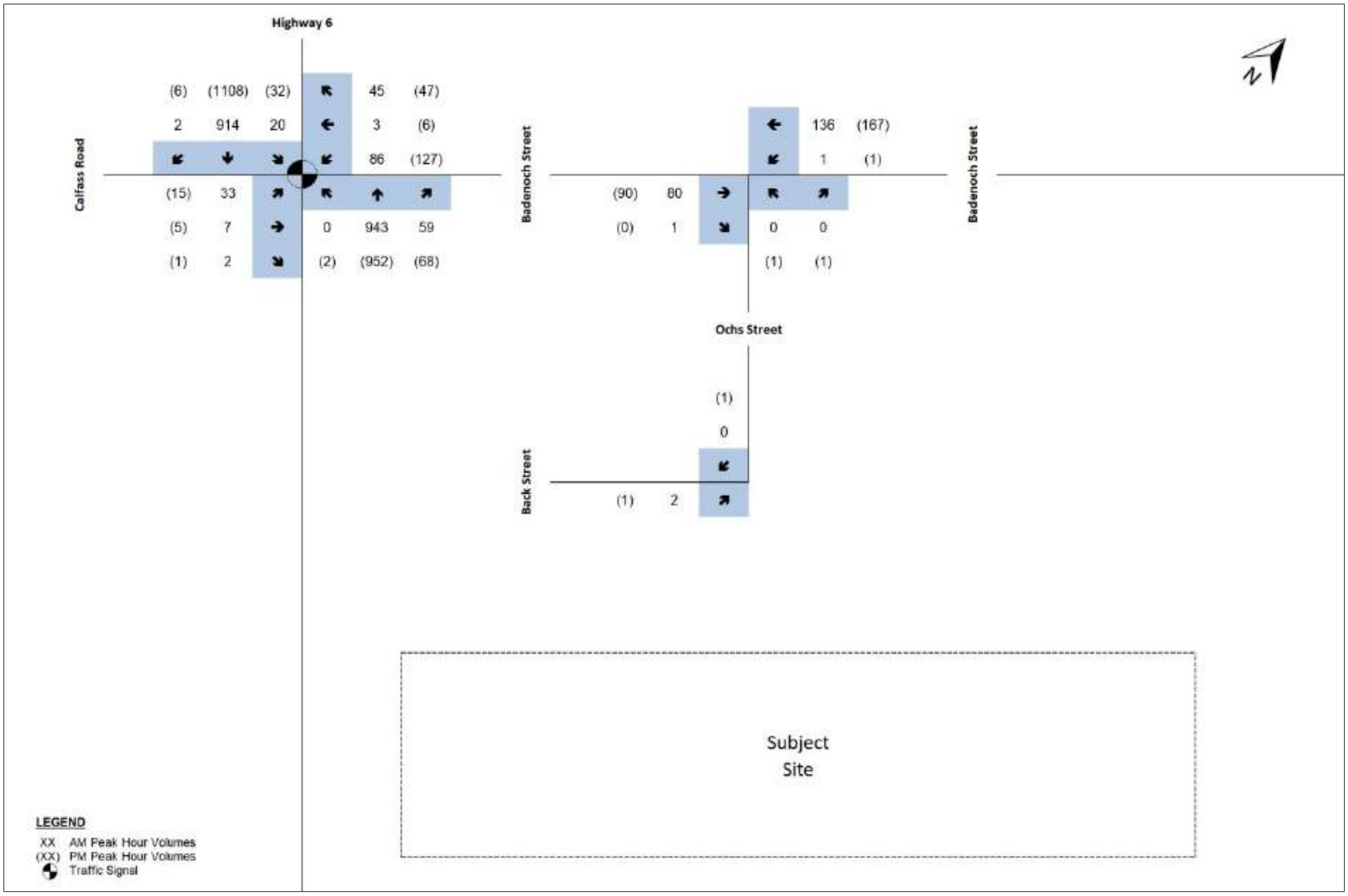


Figure 8 2029 Future Background Traffic Volumes

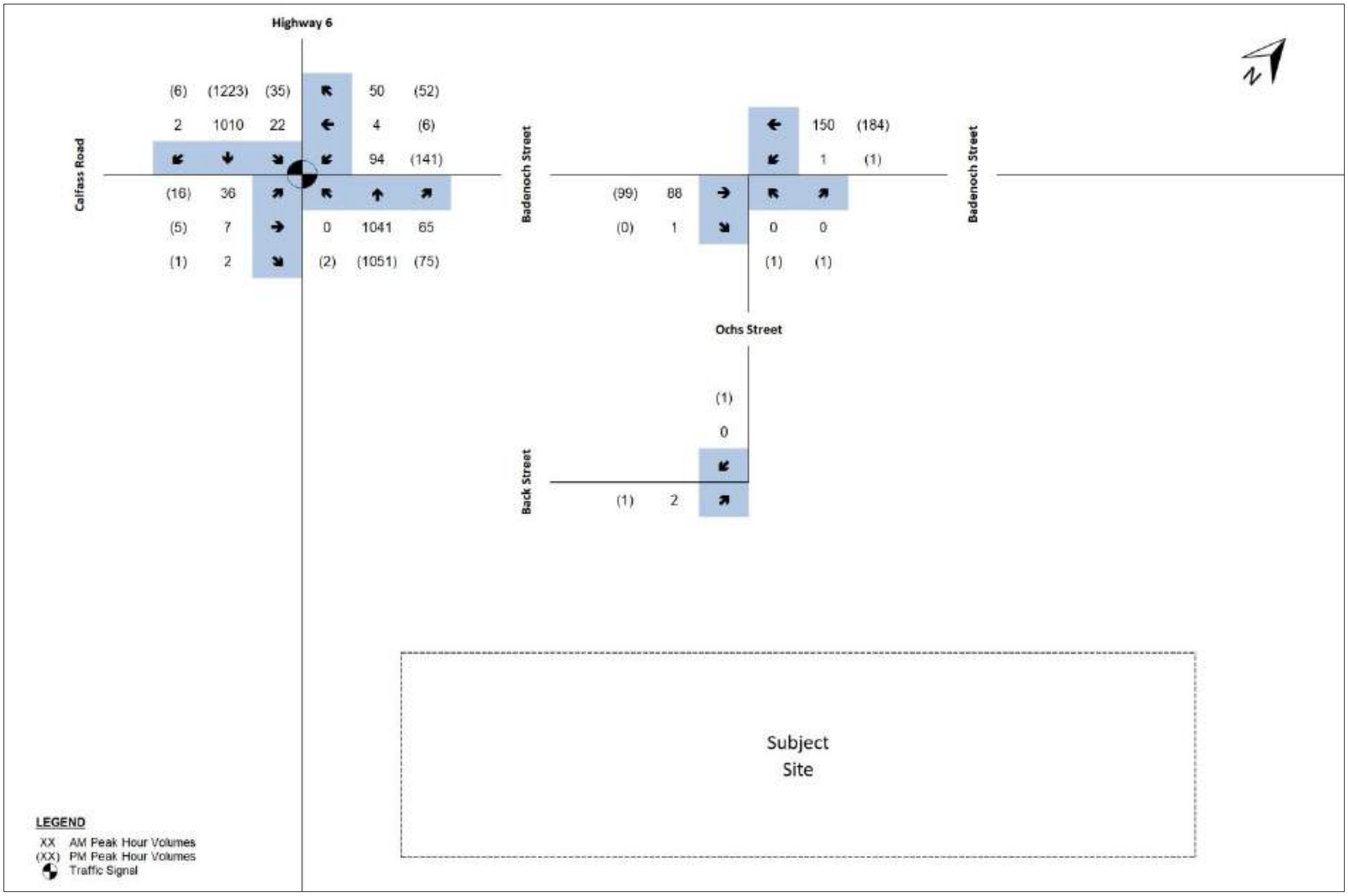


Figure 9 2034 Future Background Traffic Volumes

5. Site Generated Traffic

5.1 Site Traffic Generation

The subject site consists of a total of 23 detached residential lots.

Estimates of trip generation were calculated using rates provided in the Institute of Transportation Engineer's (ITE) Trip Generation Manual, 11th Edition using Land Use Code (LUC) 210 (Single-Family Detached Housing).

GHD compared the average rates to the fitted curve equation and adopted the rate that generated the highest volume of site trips for a more conservative analysis.

No transit modal split reduction was applied to the ITE trip rates given the lack of transit options available in the area.

Table 1 below summarizes the estimated trip generation for the proposed subdivision.

Table 1 Estimated Site Trips

Land Uses	Dwelling Units	Parameters	Peak Hour					
			Weekday AM			Weekday PM		
			In	Out	Total	In	Out	Total
Detached Units (LUC 215)	21 units	Trip Ratio	25%	75%	100%	63%	37%	100%
		Gross Trips	5	15	20	16	9	25
		Total Primary Trips	***5***	***15***	***20***	***16***	***9***	***25***

The proposed residential development is expected to generate a total of 20 new two-way trips during the weekday a.m. peak hour consisting of 5 inbound and 11 outbound trips and 25 new two-way trips during the weekday p.m. peak hour consisting of 16 inbound and 9 outbound trips.

5.2 Site Traffic Distribution and Assignment

The distribution of the site-generated traffic was based primarily on a review of the existing travel patterns along the study area roadways and the 2016 Transportation Tomorrow Survey (TTS). Due to a low number of survey results within the subject site's zone (8315) and the next nearest zone with a considerable number of dwelling units (8307), the existing travel patterns derived from the turning movement counts provided a better representation of travel patterns to be used by future residents within the study area.

It was assumed that the Morriston Bypass would not have an impact on the site traffic distribution once constructed with site generated traffic continuing to use the current Highway 6 alignment to access Highway 401 and Guelph to the north or Hamilton, Highway 403 and the Queen Elizabeth Way to the south.

The proposed trip distribution is summarized in **Table 2** below.

Table 2 Trip Distribution

Origin/Destination	AM Peak Hour		PM Peak Hour	
	Percentage of Inbound Trips	Percentage of Outbound Trips	Percentage of Inbound Trips	Percentage of Outbound Trips
North (Highway 6)	45%	45%	45%	45%
South (Highway 6)	45%	45%	45%	45%
East (Badenoch Street)	10%	10%	10%	10%
Total	**100%**	**100%**	**100%**	**100%**

The estimated site trips generated by the proposed development and distributed to the study area road network for the weekday a.m. and p.m. peak hours is shown in **Figure 10**.

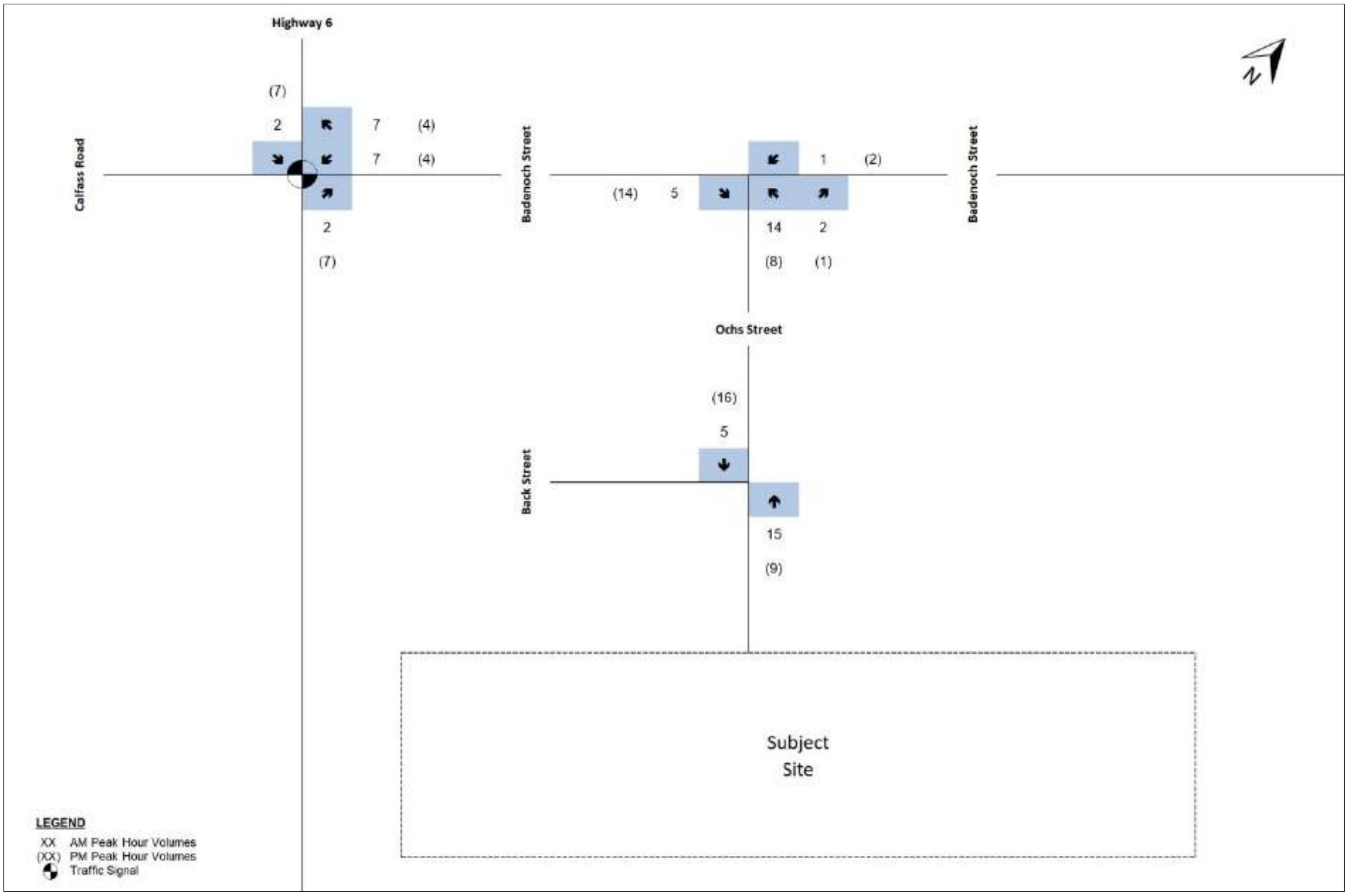


Figure 10 Total Site Trips

6. Future Total Traffic

The future total traffic conditions in the weekday a.m. and p.m. peak hours for the 2024, 2029, and 2034 planning horizons were derived by combining the projected future background traffic with the corresponding estimated site generated traffic. The resulting traffic volumes are presented in **Figure 11**, **Figure 12**, and **Figure 13**.

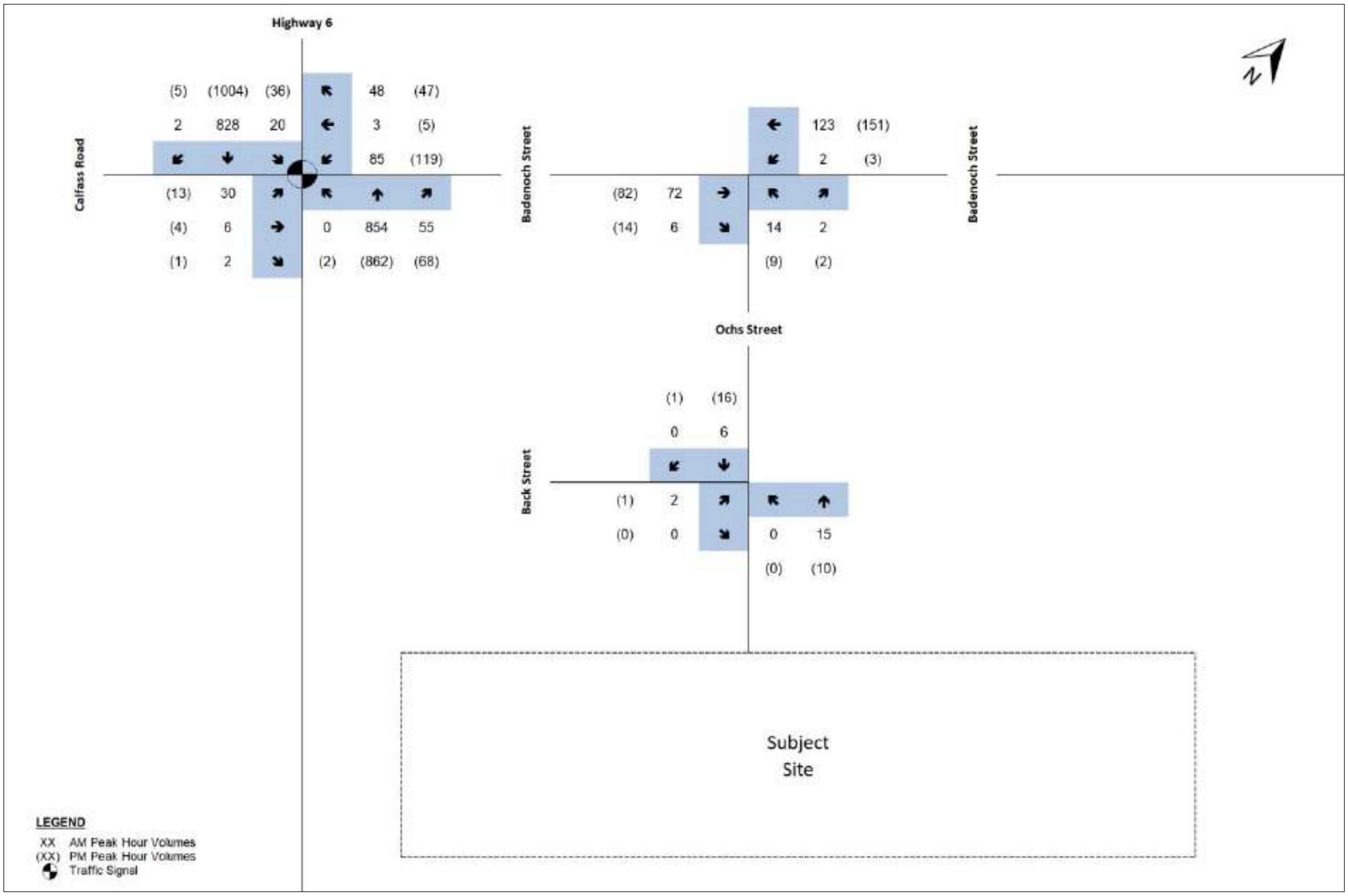


Figure 11 2024 Future Total Traffic Volumes

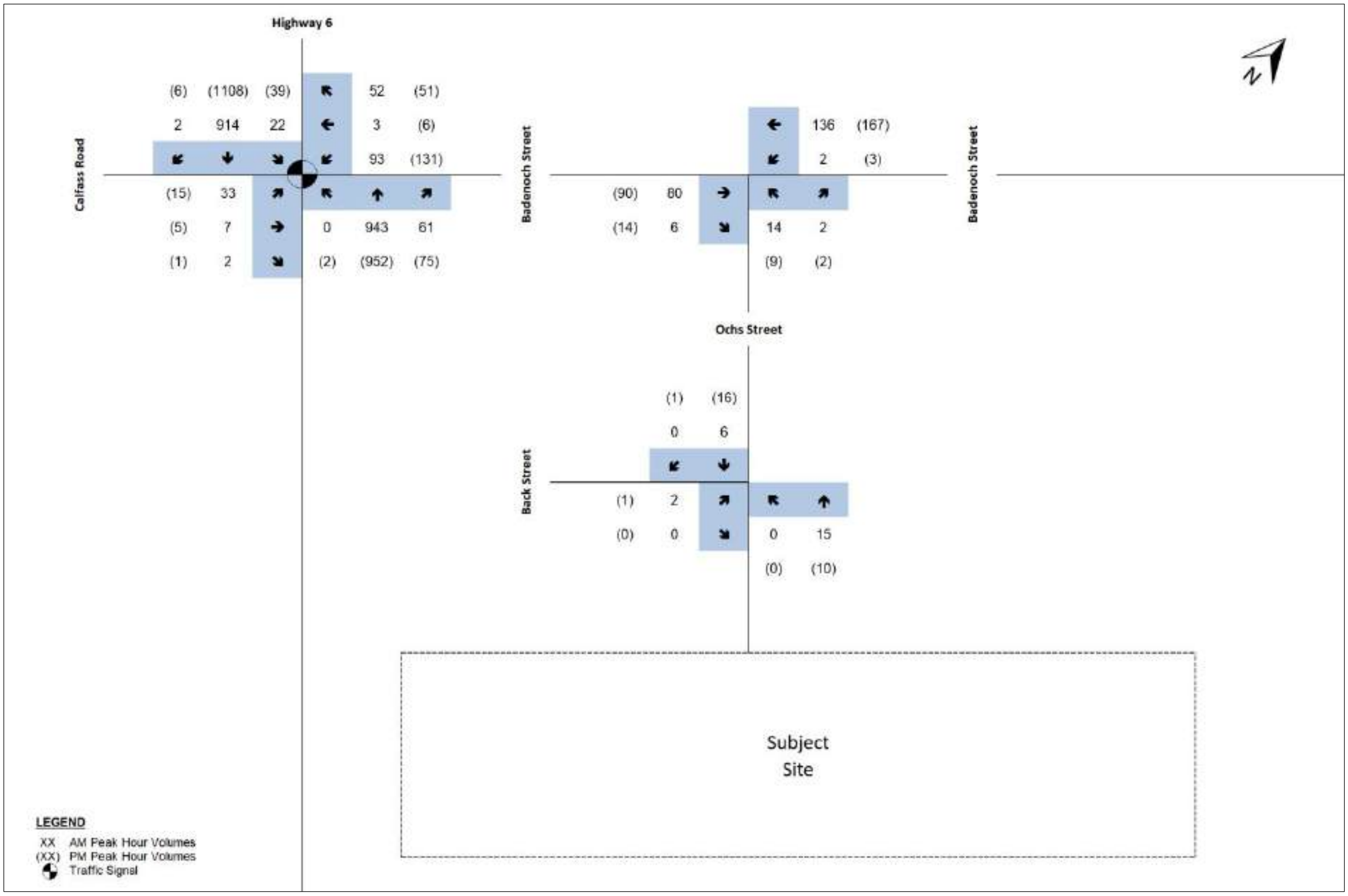


Figure 12 2029 Future Total Traffic Volumes

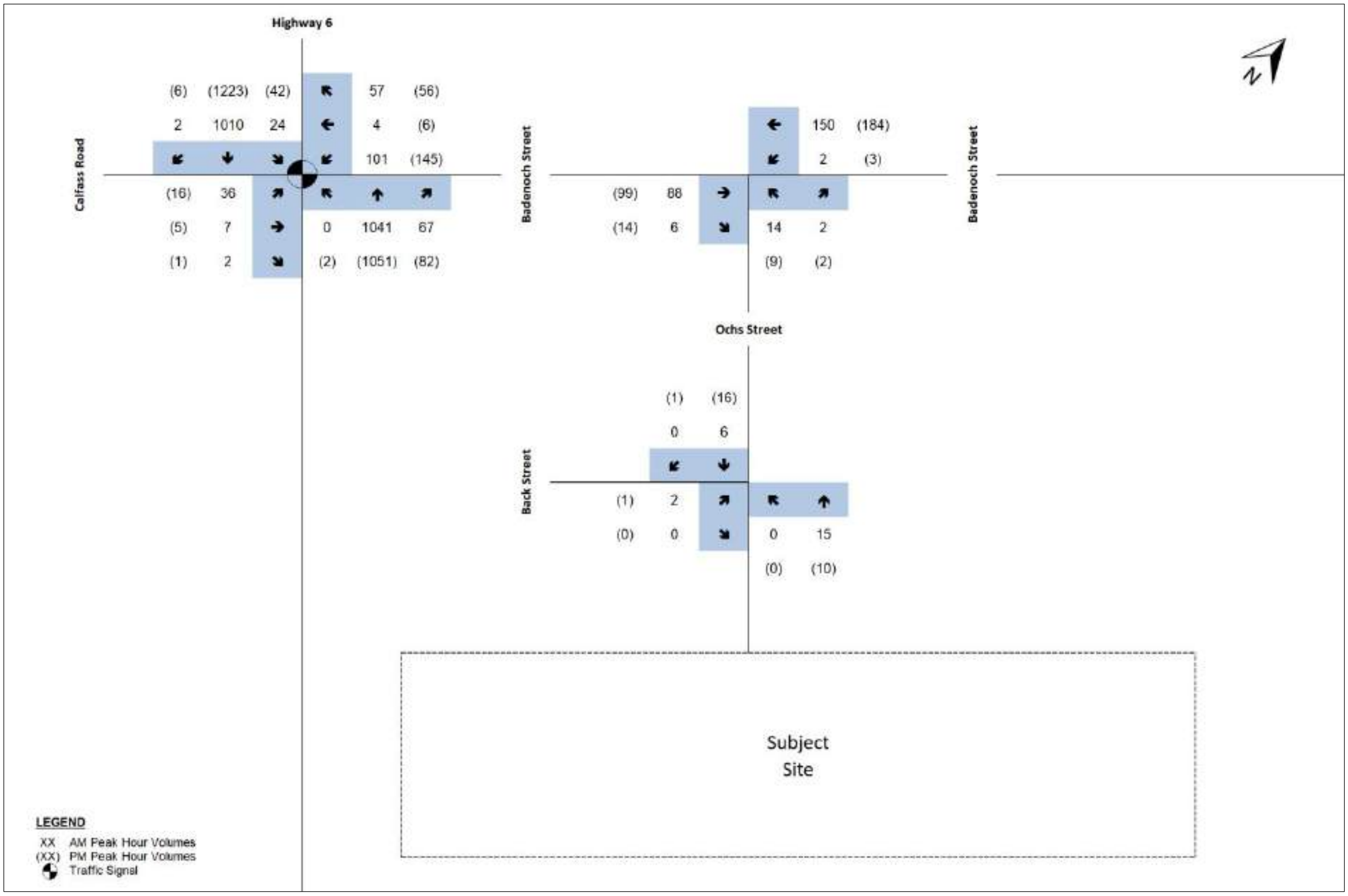


Figure 13 2034 Future Total Traffic Volumes

7. Capacity Analysis

The capacity analysis identifies how well the intersections and driveways are operating. The analysis contained within this report utilized the Highway Capacity Manual (HCM) 2000 procedure within the Synchro Version 10 Software package. The reported intersection volume-to-capacity ratios (v/c) are a measure of the saturation volume for each turning movement, while the levels-of-service (LOS) are a measure of the average delay for each turning movement. Queuing characteristics are reported as the predicted 95th percentile queue for each turning movement. Both pedestrian crossing volumes and heavy vehicle proportions are included in the analyses. The peak hour factors from the traffic counts were used to analyze existing and future traffic conditions.

The analysis includes identification and required modifications and improvements (if any) at intersections where the addition of background growth or background growth plus site-generated traffic volumes causes the following:

'Critical' intersections and movements for a signalized intersection include:

- V/C ratios for overall intersections operations, through movements, or shared through/turning movements increase to 0.85 or above;
- V/C ratios for exclusive movements increase to 0.90 or above; or
- 95th percentile queue length for individual movements that are projected to, or exceed, the storage length.

'Critical' intersections and movements for an unsignalized intersection include:

- Level of Services (LOS), based on average delay per vehicle, on individual movements exceeds LOS "D",
- Queue length for individual movements that exceeds the lesser of 5 vehicles or the available queue storage.

For signalized intersections under the jurisdiction of the MTO, movements with v/c ratios greater than 0.85 are deemed to be "critical".

The following tables summarize the HCM capacity results for the study intersections during the weekday a.m. and p.m. peak hours under existing (2023), future background (2024, 2029 & 2034) and future total (2024, 2029 & 2034) traffic conditions. The detailed calculation sheets are provided in **Appendix B**.

7.1 Highway 6 and Badenoch Street/Calfass Road

Capacity analysis at this intersection during the weekday a.m. and p.m. peak hours for the existing, future background, and future total traffic condition are summarized in the following table.

Table 3 Capacity analysis of Highway 6 and Badenoch Street/Calfass Road

Scenario	AM Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
Existing 2023	Overall: 0.70 (B) 14 EBTLR = 0.21 (D) 37 WBTL = 0.45 (D) 44 WBR = 0.03 (C) 34 NBL = 0 (A) 0 NBTR = 0.75 (B) 12 SBL = 0.08 (A) 4 SBTR = 0.73 (B) 12	EBTLR = 15 m WBTL = 30 m WBR = 10 m NBL = 0 m NBTR = 135 m SBL = 5 m SBTR = 120 m	Overall: 0.79 (B) 16 EBTLR = 0.08 (C) 30 WBTL = 0.57 (D) 36 WBR = 0.03 (C) 30 NBL = 0.01 (A) 4 NBTR = 0.8 (B) 13 SBL = 0.12 (A) 5 SBTR = 0.84 (B) 15	EBTLR = 10 m WBTL = 50 m WBR = 10 m NBL = 5 m NBTR = 170 m SBL = 5 m SBTR = 200 m
Future Background 2024	Overall: 0.71 (B) 13 EBTLR = 0.24 (D) 40 WBTL = 0.54 (D) 50 WBR = 0.03 (D) 36 NBL = 0 (A) 0	EBTLR = 15 m WBTL = 30 m WBR = 10 m NBL = 0 m	Overall: 0.77 (B) 16 EBTLR = 0.1 (D) 46 WBTL = 0.71 (E) 62 WBR = 0.03 (D) 45 NBL = 0.01 (A) 3	EBTLR = 10 m WBTL = 50 m WBR = 10 m NBL = 5 m

Scenario	AM Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
	NBTR = 0.74 (B) 11 SBL = 0.08 (A) 4 SBTR = 0.72 (B) 10	NBTR = 125 m SBL = 5 m SBTR = 115 m	NBTR = 0.74 (B) 11 SBL = 0.09 (A) 4 SBTR = 0.77 (B) 12	NBTR = 180 m SBL = 5 m SBTR = 210 m
Future Total 2024	Overall: 0.72 (B) 14 EBTLR = 0.25 (D) 40 WBTL = 0.59 (D) 53 WBR = 0.03 (D) 36 NBL = 0 (A) 0 NBTR = 0.74 (B) 11 SBL = 0.08 (A) 4 SBTR = 0.72 (B) 10	 EBTLR = 15 m WBTL = 35 m WBR = 10 m NBL = 0 m NBTR = 125 m SBL = 5 m SBTR = 115 m	Overall: 0.77 (B) 16 EBTLR = 0.1 (D) 46 WBTL = 0.73 (E) 64 WBR = 0.03 (D) 45 NBL = 0.01 (A) 4 NBTR = 0.74 (B) 12 SBL = 0.12 (A) 4 SBTR = 0.78 (B) 13	 EBTLR = 10 m WBTL = 50 m WBR = 10 m NBL = 5 m NBTR = 185 m SBL = 5 m SBTR = 210 m
Future Background 2029	Overall: 0.79 (B) 16 EBTLR = 0.27 (D) 41 WBTL = 0.6 (D) 54 WBR = 0.03 (D) 36 NBL = 0 (A) 0 NBTR = 0.82 (B) 14 SBL = 0.11 (A) 4 SBTR = 0.8 (B) 13	 EBTLR = 15 m WBTL = 35 m WBR = 10 m NBL = 0 m NBTR = 165 m SBL = 5 m SBTR = 150 m	Overall: 0.84 (B) 20 EBTLR = 0.1 (D) 46 WBTL = 0.77 (E) 68 WBR = 0.05 (D) 45 NBL = 0.01 (A) 4 NBTR = 0.82 (B) 15 SBL = 0.13 (A) 5 **SBTR = 0.86 (B) 17**	 EBTLR = 15 m WBTL = 60 m WBR = 15 m NBL = 5 m NBTR = 225 m SBL = 5 m SBTR = 275 m
Future Total 2029	Overall: 0.80 (B) 16 EBTLR = 0.27 (D) 41 WBTL = 0.64 (E) 57 WBR = 0.04 (D) 36 NBL = 0 (A) 0 NBTR = 0.82 (B) 14 SBL = 0.12 (A) 4 SBTR = 0.8 (B) 13	 EBTLR = 15 m WBTL = 40 m WBR = 10 m NBL = 0 m NBTR = 165 m SBL = 5 m SBTR = 150 m	Overall: **0.85** (C) 20 EBTLR = 0.1 (D) 46 WBTL = 0.78 (E) 69 WBR = 0.05 (D) 45 NBL = 0.01 (A) 4 NBTR = 0.82 (B) 15 SBL = 0.17 (A) 6 **SBTR = 0.86 (B) 17**	 EBTLR = 15 m WBTL = 60 m WBR = 15 m NBL = 5 m NBTR = 230 m SBL = 10 m SBTR = 275 m
Future Background 2034	Overall: **0.87** (C) 22 EBTLR = 0.31 (D) 42 WBTL = 0.66 (E) 58 WBR = 0.03 (D) 36 NBL = 0 (A) 0 **NBTR = 0.91 (C) 20** SBL = 0.17 (A) 6 **SBTR = 0.88 (B) 18**	 EBTLR = 20 m WBTL = 40 m WBR = 10 m NBL = 0 m NBTR = 265 m SBL = 5 m SBTR = 240 m	Overall: **0.93** (C) 27 EBTLR = 0.13 (D) 46 **WBTL = 0.87 (F) 85** WBR = 0.08 (D) 46 NBL = 0.02 (A) 4 **NBTR = 0.90 (C) 20** SBL = 0.2 (A) 7 **SBTR = 0.94 (C) 26**	 EBTLR = 15 m WBTL = 75 m WBR = 15 m NBL = 5 m NBTR = 340 m SBL = 10 m SBTR = 380 m
Future Total 2034	Overall: **0.88** (C) 22 EBTLR = 0.31 (D) 42 WBTL = 0.71 (E) 62 WBR = 0.04 (D) 36 NBL = 0 (A) 0 NBTR = **0.91** (C) 20 SBL = 0.18 (A) 6 SBTR = **0.88** (B) 18	 EBTLR = 20 m WBTL = 45 m WBR = 10 m NBL = 0 m NBTR = 265 m SBL = 5 m SBTR = 240 m	Overall: **0.94** (C) 28 EBTLR = 0.13 (D) 46 **WBTL = 0.89 (F) 90** WBR = 0.09 (D) 46 NBL = 0.02 (A) 4 NBTR = **0.90** (C) 21 SBL = 0.25 (A) 8 SBTR = **0.94** (C) 26	 EBTLR = 15 m WBTL = 75 m WBR = 15 m NBL = 5 m NBTR = 345 m SBL = 10 m SBTR = 380 m

Under existing conditions, the intersection of Highway 6 and Badenoch Street is operating at acceptable levels with an overall v/c ratio of 0.70 LOS B and 0.79 LOS B during the a.m. and p.m. peak hours, respectively. The longest delays are observed in the westbound through-left movement, reporting delays of 44 and 36 seconds during the a.m. and p.m. peak hours, respectively.

Under the 2024 future background horizon year, including the addition of corridor growth and signal timing improvements to minimize delays, the intersection continues to operate at satisfactory levels with overall v/c ratios of 0.71 LOS B and 0.77 LOS B during the a.m. and p.m. peak hours, respectively. The westbound through-left movement continues to operate with the longest delays with a 50 second delay during the a.m. peak hour and 62 seconds during the p.m. peak hour.

Under the 2024 future total traffic condition, with the addition of the site generated traffic, the overall intersection continues to operate at a satisfactory level with a slight increase to the overall v/c ratio from 0.71 to 0.72 LOS B during the a.m. peak hour and remains unchanged at 0.77 LOS during the p.m. peak hour. With the addition of the site traffic, the delays to the westbound through/left movements reports a nominal increase of 3 seconds during the a.m. peak hour and 2 seconds during the p.m. peak hour.

Under the 2029 future background scenario, which includes corridor growth and signal improvements, the intersection continues to operate at satisfactory levels with an overall v/c ratio of 0.79 LOS B during the a.m. peak hour and 0.84 LOS B during the p.m. peak hour. The delays along the westbound through-left movement have increased to 54 and 68 seconds during the a.m. and p.m. peak hour, respectively, as a result of corridor growth.

With the addition of site generated traffic under the 2029 future total scenario, the overall v/c ratios of the intersection continue to operate satisfactorily and an increase of 0.01 to 0.80 LOS B during the a.m. peak hour and 0.01 to 0.85 LOS C during the p.m. peak hour. With the addition of the proposed development site traffic, the delays along the westbound through-left movement increase by 3 seconds and 1 second during the a.m. and p.m. peak hour, respectively.

Under the 2034 future background scenario, which includes corridor growth and signal improvements, the intersection continues to operate at satisfactory levels with an overall v/c ratio of 0.87 LOS C during the a.m. peak hour and 0.93 LOS C during the p.m. peak hour. The westbound through-left movement continues to operate with the longest delays with a 58 second delay during the a.m. peak hour and 85 second delay during the p.m. peak hour.

With the addition of site generated traffic under the 2034 future total scenario, the overall v/c ratios of the intersection continue to operate satisfactorily and an increase of 0.01 to 0.88 LOS C during the a.m. peak hour and 0.01 to 0.94 LOS C during the p.m. peak hours. The reported delays to the westbound through-left movement increase by 4 seconds to 62 seconds during the a.m. peak hour and 5 seconds to 90 seconds during the p.m. peak hour.

No improvements are recommended at this intersection as a result of the proposed development. The majority of the intersection capacity issues are a result of the 2034 horizon year and are a result of the assumed corridor growth rate along Highway 6. Furthermore, there are limited options to improve the geometry of the intersection given the available right-of-way, proximity to existing buildings and unique configuration of the intersection. The delays are expected to be significantly reduced once the Morriston Bypass is constructed and volumes along the existing Highway 6 alignment are reduced through the study area.

7.1.1 Queuing Analysis – MTO Protocol

As requested by the MTO, a queueing analysis was completed at the intersection of Highway 6 and Badenoch Street/Calfass Road based on the MTO's Protocol using the MTO's Geometric Design Standards.

The findings are summarized in the table below and are based on the Future Total 2034 volumes for the auxiliary southbound left-turn. The recommended storage length (in vehicles) has been retrieved from the MTO's Geometric Design Standards for Ontario Highways, Chapter B, Table B7-5 for urban/commuter intersections.

Table 4 MTO Queuing Protocol - Highway 6 and Badenoch Street/Calfass Road (FB 2034)

Lane	Future Total Volumes (2034)	Heavy Vehicle%	PCU	Cycle Length (in seconds)	Arrival Rate (vehicles/cycle)	Recommended Storage, MTO Table B7-5 (vehicles)	Recommended Storage (in metres, 7.5 m/vehicle)	Available Storage (metres)
AM Peak Hour								
SBL	22	27.8%	28	91	0.7	2	15	40
PM Peak Hour								
SBL	35	0%	35	120	1.2	3	22.5	40

Table 5 MTO Queuing Protocol - Highway 6 and Badenoch Street/Calfass Road (FT 2034)

Lane	Future Total Volumes (2034)	Heavy Vehicle%	PCU	Cycle Length (in seconds)	Arrival Rate (vehicles/cycle)	Recommended Storage, MTO Table B7-5 (vehicles)	Recommended Storage (in metres, 7.5 m/vehicle)	Available Storage (metres)
AM Peak Hour								
SBL	24	27.8%	31	91	0.8	2	15	40
PM Peak Hour								
SBL	42	0%	42	120	1.4	4	30	40

As summarized in the table above, under the Future Total 2034 scenario, the auxiliary southbound left-turn and would have a recommended storage length of 30 metres based on the MTO's protocol. The southbound left-turn lane has 40 metres of available storage satisfying the recommended storage length.

As a result, no improvements are recommended for the southbound left-turn lane at this intersection as a result of the proposed development.

7.1.2 Queuing Analysis – SimTraffic

GHD reviewed the MTO's Protocol provided in the Geometric Design Standards for Ontario Highways Chapter B (as used for the southbound left-turn) for a corresponding calculation methodology for right-turn lanes but was unable to find one. As a result, GHD ran a SimTraffic analysis of the intersection using a 15-minute seed time, 60-minute run time, and an average of 5 runs. The results of the analysis are provided in the table below.

Table 6 Highway 6 and Badenoch Street/Calfass Road SimTraffic Queueing Analysis (2034)

Scenario	SimTraffic 95th Percentile Queue Length	
	AM Peak Hour	PM Peak Hour
Future Background 2034	EBTLR = 22 m WBTL = 44 m WBR = 25 m NBL = 0 m NBTR = 213 m SBL = 25 m SBTR = 126 m	EBTLR = 14 m WBTL = 66 m WBR = 28 m NBL = 3 m NBTR = 242 m SBL = 27 m SBTR = 125 m

Future Total 2034	EBTLR = 27 m WBTL = 46 m WBR = 26 m NBL = 0 m NBTR = 231 m SBL = 28 m SBTR = 122 m	EBTLR = 14 m WBTL = 68 m WBR = 27 m NBL = 3 m NBTR = 276 m SBL = 40 m SBTR = 120 m

As summarized in the table above, the westbound right-turn lane operates with a 95th percentile queue length of 25 metres during the a.m. peak hour and 28 metres during the p.m. peak hour under the 2034 future background conditions.

With the addition of site generated traffic under the 2034 future total condition, the queuing in the westbound right-turn lane is reported to increase by one 1 metre during the a.m. peak hour to 26 metres and is not reported to increase during the p.m. peak hour.

There is approximately 30 metres of available storage for the westbound right turn lane on Badenoch Street, as a result, no improvements are recommended for the westbound right-turn lane at this intersection as a result of the proposed development.

7.2 Badenoch Street and Ochs Street

Capacity analysis for this intersection during the weekday a.m. and p.m. peak hours for the existing, future background, and future total traffic conditions out are summarized in the following table.

Table 7 Capacity analysis of Badenoch Street and Ochs Street

Scenario	AM Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
Existing 2023	EBTR = 0.05 (A) 0 WBTL = 0 (A) 0 NBLR = 0 (A) 0	EBTR = 0 m WBTL = 0 m NBLR = 0 m	EBTR = 0.05 (A) 0 WBTL = 0 (A) 0 NBLR = 0 (A) 9	EBTR = 0 m WBTL = 0 m NBLR = 5 m
Future Background 2024	EBTR = 0.05 (A) 0 WBTL = 0 (A) 0 NBLR = 0.02 (A) 0	EBTR = 0 m WBTL = 0 m NBLR = 0 m	EBTR = 0.05 (A) 0 WBTL = 0 (A) 0 NBLR = 0 (A) 9	EBTR = 0 m WBTL = 0 m NBLR = 5 m
Future Total 2024	EBTR = 0.05 (A) 0 WBTL = 0 (A) 0 NBLR = 0.02 (A) 10	EBTR = 0 m WBTL = 0 m NBLR = 5 m	EBTR = 0.06 (A) 0 WBTL = 0 (A) 0 NBLR = 0.02 (A) 10	EBTR = 0 m WBTL = 0 m NBLR = 5 m
Future Background 2029	EBTR = 0.05 (A) 0 WBTL = 0 (A) 0 NBLR = 0 (A) 0	EBTR = 0 m WBTL = 0 m NBLR = 0 m	EBTR = 0.06 (A) 0 WBTL = 0 (A) 0 NBLR = 0 (A) 9	EBTR = 0 m WBTL = 0 m NBLR = 5 m
Future Total 2029	EBTR = 0.06 (A) 0 WBTL = 0 (A) 0 NBLR = 0.02 (A) 10	EBTR = 0 m WBTL = 0 m NBLR = 5 m	EBTR = 0.07 (A) 0 WBTL = 0 (A) 0 NBLR = 0.02 (A) 10	EBTR = 0 m WBTL = 0 m NBLR = 5 m
Future Background 2034	EBTR = 0.06 (A) 0 WBTL = 0 (A) 0 NBLR = 0 (A) 0	EBTR = 0 m WBTL = 0 m NBLR = 0 m	EBTR = 0.06 (A) 0 WBTL = 0 (A) 0 NBLR = 0 (A) 10	EBTR = 0 m WBTL = 0 m NBLR = 5 m
Future Total 2034	EBTR = 0.06 (A) 0 WBTL = 0 (A) 0 NBLR = 0.02 (B) 10	EBTR = 0 m WBTL = 0 m NBLR = 5 m	EBTR = 0.07 (A) 0 WBTL = 0 (A) 0 NBLR = 0.02 (B) 10	EBTR = 0 m WBTL = 0 m NBLR = 5 m

Under existing conditions, the intersection of Badenoch Street and Ochs Street is operating at acceptable levels with no delays during the a.m. peak hour and a 9 second delay during the p.m. peak hour along the northbound approach.

Under all three future background conditions, with the addition of corridor growth along Badenoch Street, the northbound approach from Ochs Street continues to operate with only a 9 second delay during the p.m. peak hour and increases to 10 seconds during the 2034 horizon year.

With the addition of site generated traffic under the three future horizon years, nominal changes to the intersection delays are reported with the northbound approach showing a maximum delay of ten seconds during both the a.m. and p.m. peak hours.

No improvements are recommended at this intersection as a result of the proposed development.

7.3 Ochs Street and Back Street

Capacity analysis for this intersection during the weekday a.m. and p.m. peak hours for the existing, future background, and future total traffic conditions are summarized in the following table.

Table 8 Capacity analysis of Ochs Street and Back Street

Scenario	AM Peak Hour		PM Peak Hour	
	V/C (LOS) seconds	95th % Que.	V/C (LOS) seconds	95th % Que
Future Total 2024	EBLR = 0 (A) 9 NBTL = 0 (A) 0 SBTR = 0 (A) 0	EBLR = 0 m NBTL = 0 m SBTR = 0 m	EBLR = 0 (A) 9 NBTL = 0 (A) 0 SBTR = 0.01 (A) 0	EBLR = 0 m NBTL = 0 m SBTR = 0 m
Future Total 2029	EBLR = 0 (A) 9 NBTL = 0 (A) 0 SBTR = 0 (A) 0	EBLR = 0 m NBTL = 0 m SBTR = 0 m	EBLR = 0 (A) 9 NBTL = 0 (A) 0 SBTR = 0.01 (A) 0	EBLR = 0 m NBTL = 0 m SBTR = 0 m
Future Total 2034	EBLR = 0 (A) 9 NBTL = 0 (A) 0 SBTR = 0 (A) 0	EBLR = 0 m NBTL = 0 m SBTR = 0 m	EBLR = 0 (A) 9 NBTL = 0 (A) 0 SBTR = 0.01 (A) 0	EBLR = 0 m NBTL = 0 m SBTR = 0 m

With the addition of the south leg and site generated traffic under all three future total scenarios, a maximum delay of 9 seconds is expected along the eastbound approach during each peak hour.

No improvements are recommended at this intersection as a result of the proposed development as the subject site is expected to introduce a very low volume of additional traffic to this intersection.

8. Parking Provision

Application of the current Township of Puslinch's Comprehensive Zoning By-Law parking rates to the subject site results in a requirement of a minimum of 2 parking spaces per dwelling unit. The minimum By-law parking requirement of 2 spaces per dwelling unit will be satisfied with the provision of garage and driveway parking.

The subject site proposes a modified rural cross-section along Street "A" and Street "B" as discussed in Section 9.0 with an 18 metre right-of-way. The proposed cross-section is expected to provide two travel lanes and will allow visitor parking on both sides of the road.

9. Sightline Assessment

Adjacent to the proposed site, Badenoch Street has a posted speed limit of 50 km/h with a crest in the road located between Main Street and Ochs Street. For the purpose of Stopping Sight Distance requirements a design speed of 60 km/h was used for the assessment on Badenoch Street based on the 50 km/h posted speed limit. Per Transportation Association of Canada's Geometric Design Guide for Canadian Roads (TAC GDGCR) Table 2.5.2, the minimum stopping sight-distance for level roadways with a design speed of 60 km/h is 85 metres for level roadways.

Section 9.9 of the TAC GDCR provides intersection sight distances for different scenarios, with the following scenarios used to complete the intersection sight distance analysis:

- Case B1 – Left turn from the minor road
- Case B2 – Right turn from the minor road
- Case F – Left turns from the major road

For the purpose of the assessment, the minor road is assumed to be Ochs Street for the assessment. A vehicle entering the major road (Badenoch Street) from Ochs Street is assumed to stop a distance of approximately 4.5 to 5.4 metres to the pavement edge of Badenoch Street as recommended by TAC. In this stopped position, the driver will be required to look left and right in order to perceive and react to approaching vehicles prior to initiating a turning movement onto the intersecting drive aisle.

The required intersection sight distances are provided in TAC GDGCR Tables 9.9.4, 9.9.6 and 9.9.12 for passenger vehicles turning left from stop, turning right from stop, or turning left from the major road, respectively, and are summarized in the following table. The required intersection sight distances summarized in the tables below are based on a 60 km/h design speed along the major road. As requested by Township and County staff, the assessment was completed for both passenger vehicles and single unit trucks in order to complete an assessment of a snowplow entering Badenoch Street from Ochs Street.

Table 9 Intersection Sight Distance Requirement

Case (Design Speed of 60 km/h)	Required Intersection Sight Distance for Passenger Cars (TAC 2017)	Required Intersection Sight Distance for Single Unit Trucks (TAC 2017)	TAC Reference
B1: Vehicles turning left from stop	125.1 m	158.4 m	Table 9.9.4
B2: Vehicles turning right from stop	108.4 m	141.8 m	Table 9.9.6
F: Left turns from the major road	91.7 m	108.4.5 m	Table 9.9.12

The required intersection sight distance is calculated from the equation:

$$ISD = 0.278\, V_{major}\, t_g$$

Where:

$$ISD = intersection\ sight\ distance$$

$$V_{major} = design\ speed\ of\ the\ major\ road\ \left(\frac{km}{h}\right)$$

$$t_g = time\ gap\ for\ the\ minor\ road\ vehicle\ to\ enter\ the\ major\ road\ (s)$$

The intersection sight distance requirement for passenger cars was determined by the equation above, where the time gap for the minor road vehicle to enter the major road for trucks is 7.5 seconds for vehicles turning left from stop, 6.5 seconds for vehicles turning right from a stop and 5.5 seconds for left turns from the major road.

The intersection sight distance requirement for trucks was determined by the equation above, where the time gap for the minor road vehicle to enter the major road for trucks is 9.5 seconds for vehicles turning left from stop, 8.5 seconds for vehicles turning right from a stop and 6.5 seconds for left turns from the major road.

The available sight distances along Badenoch Street to the west of Ochs Street meet the minimum required stopping sight distance for a 60 km/h design speed. Due to the crest in the road along Badenoch Street located between Main Street and Ochs Street, the sightline assessment was completed using the vertical profile for Badenoch Street contained within the “Approved for Construction” drawings which was provided by the County and was confirmed through measurements taken on site.

The use of the vertical profile drawings is considered less accurate as it is based on “Approved Construction Drawings” and not “As Builts” which measure the actual vertical profile of what was constructed in the field which can differ significantly. Based on the vertical profile, there should be 129 metres of sightline available, however, the sightline measured in the field confirmed that there is currently 136.5 metres of available sight distance looking to the west from Och Street, satisfying the required intersection sight distance requirement for passenger vehicles.

The sightline assessment was also completed for a single unit truck to consider a snowplow truck exiting onto Badenoch Street. Based on the vertical profile, there should be 145 metres of sightline available, however, the sightline measured in the field confirmed that at a driver’s eye height of 1.8 metres (as outlined by TAC for single unit trucks), there is 155.5 metres of available sightline to the west. Despite the field measurement having a small shortfall from the 158.4 metres required by TAC, the TAC guidelines do state that “Intersection sight distance is also a function of design vehicles. The design vehicle is typically defined as a vehicle that uses a given intersection daily or on a regular basis. It does not include a vehicle that may occur irregularly”. As a result, despite the shortfall of 2.9 metres from the suggested sightline requirements for a single unit truck, a snowplow truck is not expected to operate through the intersection on a regular basis and should not be given significant consideration in regards to the sightline assessment. Additionally, while GHD was not able to confirm through a measurement of the County’s existing snowplow fleet, it is likely that the drivers eye height as outlined by TAC for a single unit truck is slightly lower than the driver eye height when sitting in a snowplow. Any additional height given the drivers eye will result in increased sightlines to cover the 2.9 metre shortfall.

The sightline assessment completed using the vertical profile drawings in provided in **Appendix D**, while the results from the field observations are provided in **Figure 14**.

Figure 14 Field Observations

As can be seen in Figure 14, the existing retaining wall in the southwest corner of the intersection is located within the right-of-way and limits the sightline visibility along Badenoch Street. To provide the required sightline measured 4.4 metres back from the edge of pavement, it is recommended that the existing retaining wall on the west side of the intersection be shifted to be further away from sidewalk as illustrated in **Figure 15**.

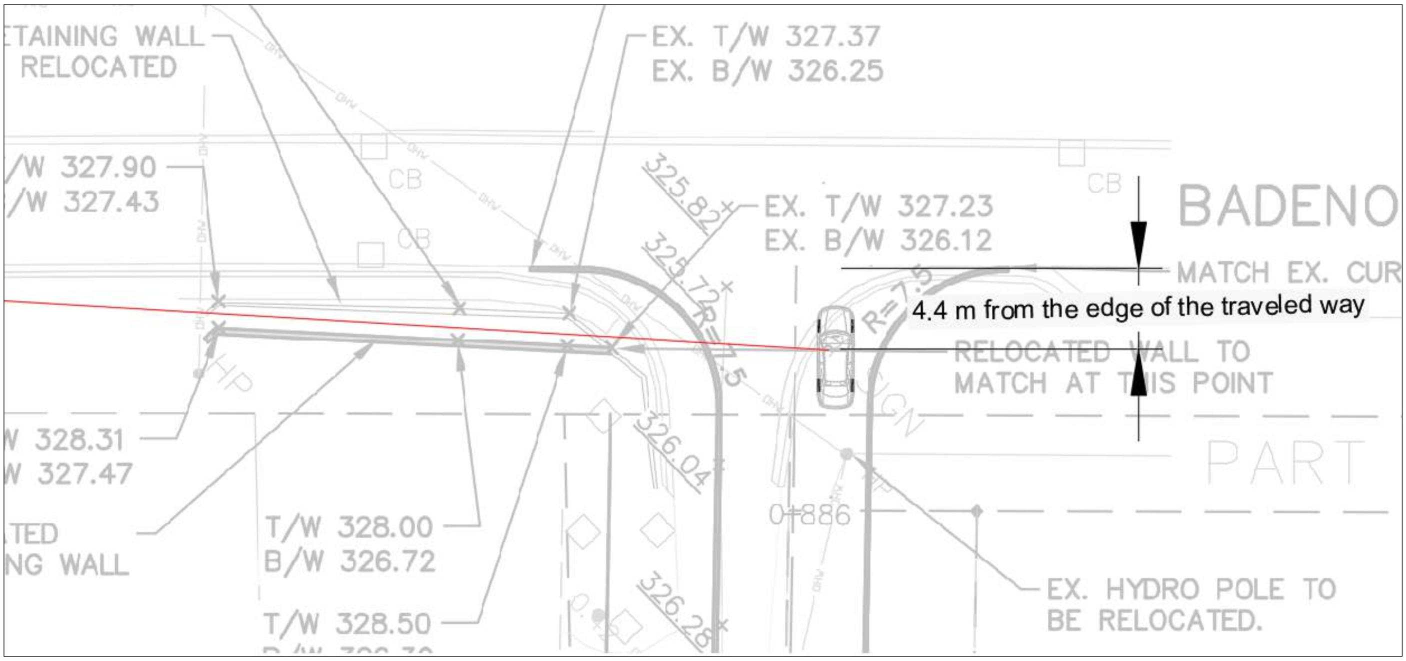


Figure 15   Recommended Retaining Wall Relocation

10. Internal Road Geometric Review

The subject site proposes a modified rural cross-section along Street “A” and Street “B”. The proposed cross-section consists of an 18-metre right-of-way with a pavement width of 6.5 metres and a 1.25 metre shoulder on each side of the road.

The proposed modified cross-section for the subject site is provided in **Figure 16**

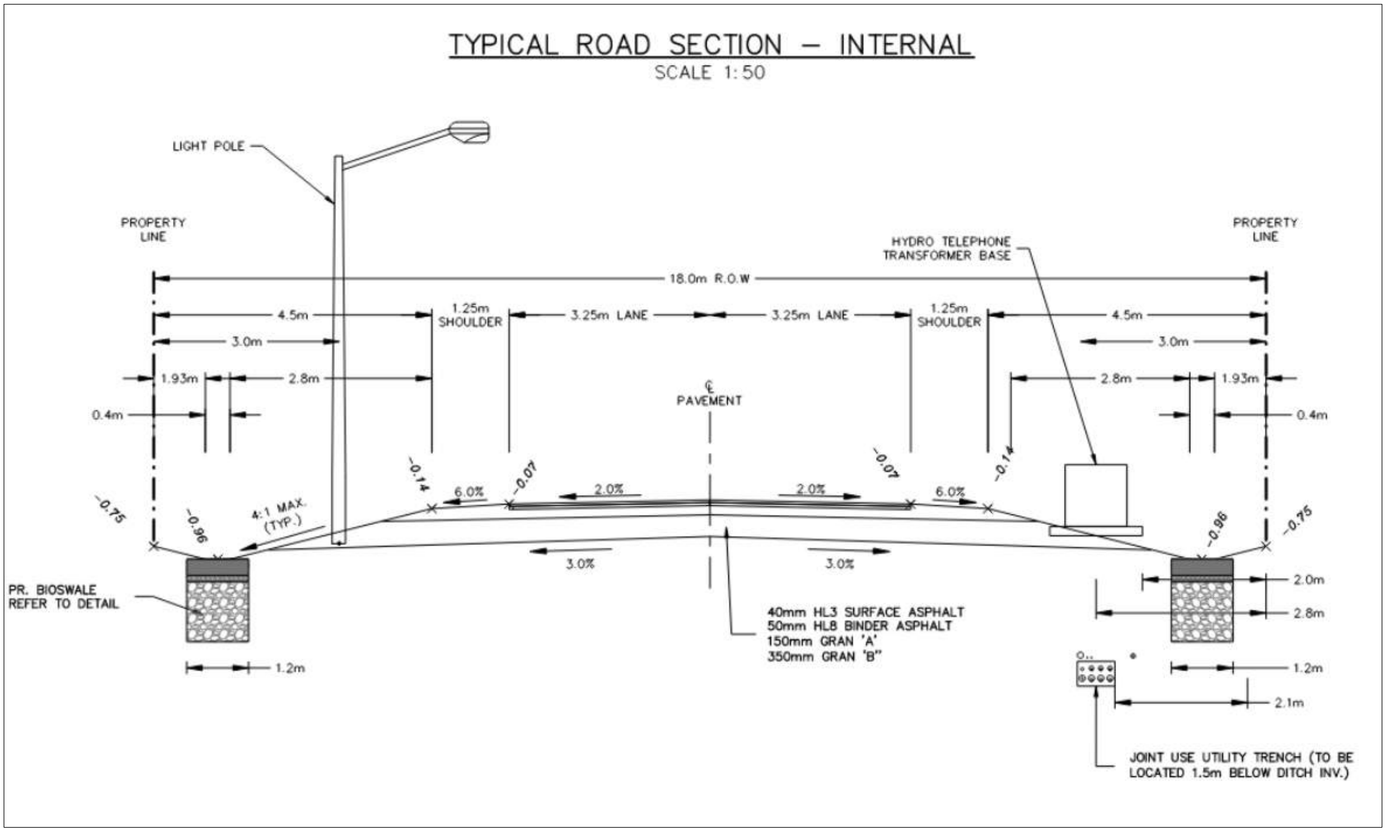


Figure 16 Modified Rural Cross-Section

11. Conclusion

The proposed Draft Plan of Subdivision has been prepared by Weston Consulting and consists of 23 detached dwelling units

Access to the development is proposed via an extension of Ochs Street to the south from Back Street and provides access to Badenoch Street and the external road network.

The proposed development is expected to generate a total of 20 new two-way trips during the weekday a.m. peak hour consisting of 5 inbound and 15 outbound trips and 25 new two-way trips during the weekday p.m. peak hour consisting of 16 inbound and 9 outbound trips.

Access to the development is proposed via an extension of Ochs Street, providing a direct connection to Badenoch Street at an existing full moves unsignalized intersection.

The study intersections included in the analysis include:

- Highway 6 and Badenoch Street/Calfass Road
- Badenoch Street and Ochs Street
- Ochs Street and Back Street

Based on ITE Trip Generation rates, the proposed development is expected to generate a total of 20 new two-way trips during the weekday a.m. peak hour consisting of 5 inbound and 15 outbound trips and 25 new two-way trips during the weekday p.m. peak hour consisting of 16 inbound and 9 outbound trips.

Under existing conditions, all study intersections are operating with acceptable v/c ratios and delays.

In the future 2024, 2029 and 2034 horizon years, the intersections continue to operate at mostly satisfactory levels with the intersection of Hwy 6 and Badenoch Street/Calfass Road operating with some critical movements however all movements operating with v/c ratios of less 1.0. The unsignalized intersections of Badenoch Street with Ochs Street and Ochs Street with Back Street are reported to operate with low v/c ratios and delays and no critical movements up to the 2034 horizon year.

The overall impact of the development generated traffic was found to be negligible to the operation of the study area intersections and traffic flow along Highway 6 and Badenoch Street. The site traffic does not result in any turning movements increasing to critical levels, all critical movements under the future traffic scenarios are a result of the assumed corridor growth rate.

Application of the current Township of Puslinch's Comprehensive Zoning By-Law parking rates to the subject site results in a requirement of a minimum of 2 parking spaces per dwelling unit. The minimum By-law parking requirement of 2 spaces per dwelling unit will be satisfied with the provision of garage and driveway parking.

A sightline assessment of vehicles exiting from Och Street onto Badenoch Street was completed in the field, it confirmed that there is sufficient sightlines to satisfy the TAC requirements for a 60 km/h design speed.

The existing intersection of Badenoch Street and Och Street has an existing retaining wall within the County right-of-way that limits sightline visibility for outbound traffic exiting Och Street to see an oncoming vehicle travelling eastbound on Badenoch Street. It is recommended that the retaining wall be relocated to provide the required sightline. A design for the relocation of the retaining wall has been prepared by Crozier Consulting Engineers.

The subject site proposes a modified rural cross-section along Street "A" and Street "B" with an 18 metre right-of-way, which is expected to provide two travel lanes and allow visitor parking on both sides of the road.

Appendices

Appendix A

Traffic Data

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Turning Movement Count (1 . BADENOCH ST & OCHS ST)

Start Time	E Approach BADENOCH ST					S Approach OCHS ST					W Approach BADENOCH ST					Int. Total (15 min)	Int. Total (1 hr)
	Thru E:W	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Left S:W	UTurn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	UTurn W:W	Peds W:	Approach Total		
07:00:00	32	0	0	0	32	0	0	0	0	0	0	12	0	0	12	44	
07:15:00	30	0	0	0	30	1	0	0	0	1	1	11	0	0	12	43	
07:30:00	18	0	0	0	18	0	0	0	0	0	0	18	0	0	18	36	
07:45:00	30	1	0	0	31	0	0	0	0	0	1	24	0	0	25	56	179
08:00:00	23	0	0	0	23	0	0	0	0	0	0	16	0	0	16	39	174
08:15:00	38	0	0	0	38	0	0	0	0	0	0	16	0	0	16	54	185
08:30:00	30	0	0	0	30	0	0	0	0	0	0	15	0	0	15	45	194
08:45:00	18	0	0	0	18	0	0	0	1	0	0	13	0	0	13	31	169
BREAK																	
16:00:00	36	0	0	0	36	0	0	0	0	0	1	21	0	0	22	58	
16:15:00	34	1	0	0	35	1	0	0	0	1	0	18	0	0	18	54	
16:30:00	34	0	0	0	34	0	1	0	0	1	0	18	0	0	18	53	
16:45:00	38	0	0	0	38	0	0	0	0	0	0	23	0	0	23	61	226
17:00:00	42	0	0	1	42	0	0	0	1	0	0	21	0	0	21	63	231
17:15:00	26	0	0	0	26	0	1	0	0	1	0	18	0	0	18	45	222
17:30:00	18	0	0	0	18	0	0	0	0	0	1	24	0	0	25	43	212
17:45:00	27	0	0	0	27	0	0	0	0	0	0	24	0	0	24	51	202
Grand Total	474	2	0	1	476	2	2	0	2	4	4	292	0	0	296	**776**	-
Approach%	99.6%	0.4%	0%		-	50%	50%	0%		-	1.4%	98.6%	0%		-	-	-
Totals %	61.1%	0.3%	0%		61.3%	0.3%	0.3%	0%		0.5%	0.5%	37.6%	0%		38.1%	-	-
Heavy	14	1	0		-	0	0	0		-	1	13	0		-	-	-
Heavy %	3%	50%	0%		-	0%	0%	0%		-	25%	4.5%	0%		-	-	-
Bicycles	-	-	-		-	-	-	-		-	-	-	-		-	-	-
Bicycle %	-	-	-		-	-	-	-		-	-	-	-		-	-	-

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:45 AM - 08:45 AM Weather: Overcast Clouds (-2.89 °C)

Start Time	E Approach BADENOCH ST					S Approach OCHS ST					W Approach BADENOCH ST					Int. Total (15 min)
	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	Right	Thru	UTurn	Peds	Approach Total	
07:45:00	30	1	0	0	31	0	0	0	0	0	1	24	0	0	25	56
08:00:00	23	0	0	0	23	0	0	0	0	0	0	16	0	0	16	39
08:15:00	38	0	0	0	38	0	0	0	0	0	0	16	0	0	16	54
08:30:00	30	0	0	0	30	0	0	0	0	0	0	15	0	0	15	45
Grand Total	121	1	0	0	122	0	0	0	0	0	1	71	0	0	72	**194**
Approach%	99.2%	0.8%	0%		-	0%	0%	0%		-	1.4%	98.6%	0%		-	-
Totals %	62.4%	0.5%	0%		62.9%	0%	0%	0%		0%	0.5%	36.6%	0%		37.1%	-
PHF	0.8	0.25	0		0.8	0	0	0		0	0.25	0.74	0		0.72	-
Heavy	5	1	0		6	0	0	0		0	1	7	0		8	-
Heavy %	4.1%	100%	0%		4.9%	0%	0%	0%		0%	100%	9.9%	0%		11.1%	-
Lights	116	0	0		116	0	0	0		0	0	64	0		64	-
Lights %	95.9%	0%	0%		95.1%	0%	0%	0%		0%	0%	90.1%	0%		88.9%	-
Single-Unit Trucks	3	0	0		3	0	0	0		0	0	2	0		2	-
Single-Unit Trucks %	2.5%	0%	0%		2.5%	0%	0%	0%		0%	0%	2.8%	0%		2.8%	-
Buses	2	1	0		3	0	0	0		0	1	5	0		6	-
Buses %	1.7%	100%	0%		2.5%	0%	0%	0%		0%	100%	7%	0%		8.3%	-
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
Pedestrians%	-	-	-	0%		-	-	-	0%		-	-	-	0%		-

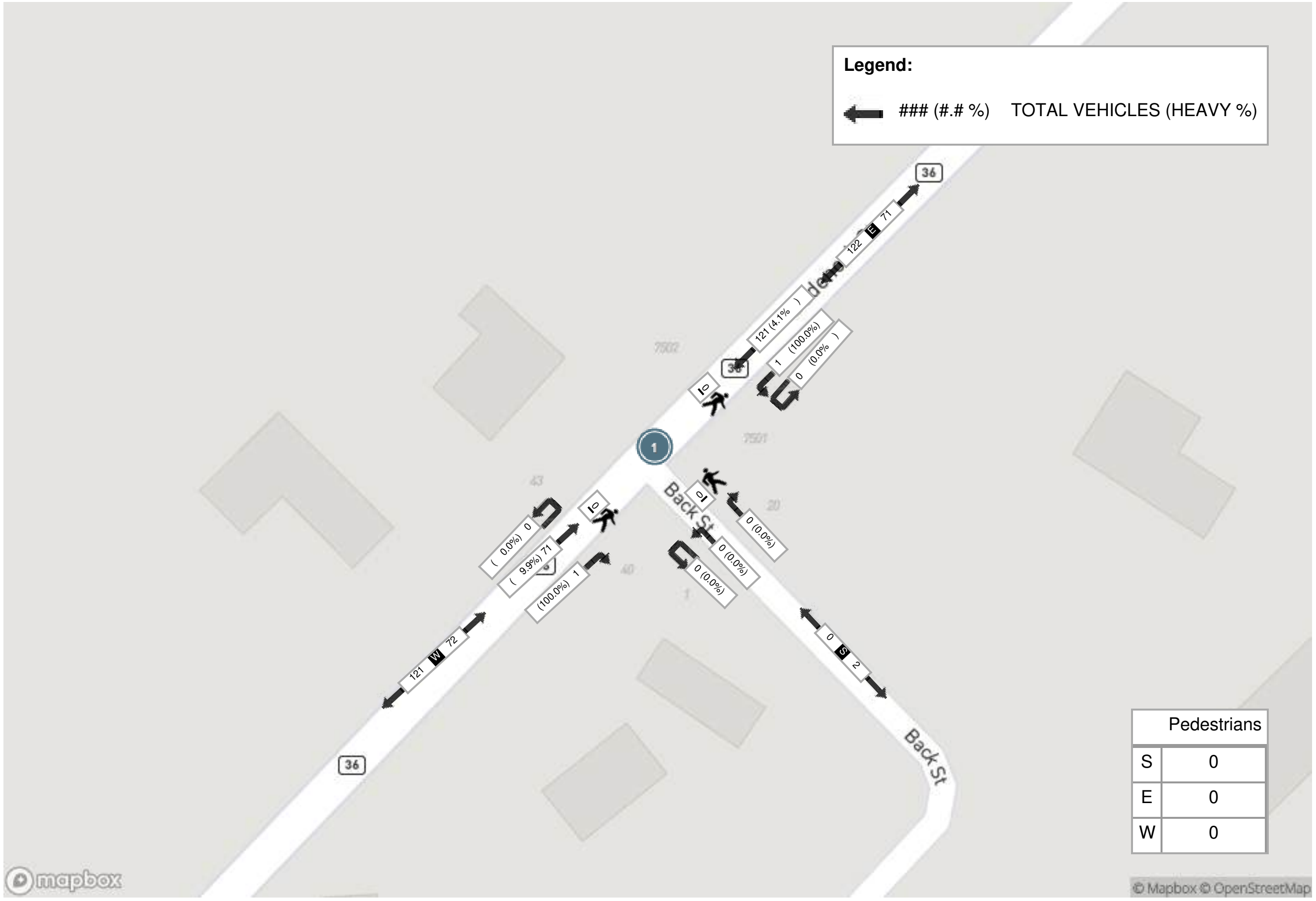
GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (6.07 °C)

Start Time	E Approach BADENOCH ST					S Approach OCHS ST					W Approach BADENOCH ST					Int. Total (15 min)
	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	Right	Thru	UTurn	Peds	Approach Total	
16:15:00	34	1	0	0	35	1	0	0	0	1	0	18	0	0	18	54
16:30:00	34	0	0	0	34	0	1	0	0	1	0	18	0	0	18	53
16:45:00	38	0	0	0	38	0	0	0	0	0	0	23	0	0	23	61
17:00:00	42	0	0	1	42	0	0	0	1	0	0	21	0	0	21	63
Grand Total	148	1	0	1	149	1	1	0	1	2	0	80	0	0	80	**231**
Approach%	99.3%	0.7%	0%		-	50%	50%	0%		-	0%	100%	0%		-	-
Totals %	64.1%	0.4%	0%		64.5%	0.4%	0.4%	0%		0.9%	0%	34.6%	0%		34.6%	-
PHF	0.88	0.25	0		0.89	0.25	0.25	0		0.5	0	0.87	0		0.87	-
Heavy	3	0	0		3	0	0	0		0	0	1	0		1	-
Heavy %	2%	0%	0%		2%	0%	0%	0%		0%	0%	1.3%	0%		1.3%	-
Lights	145	1	0		146	1	1	0		2	0	79	0		79	-
Lights %	98%	100%	0%		98%	100%	100%	0%		100%	0%	98.8%	0%		98.8%	-
Single-Unit Trucks	1	0	0		1	0	0	0		0	0	0	0		0	-
Single-Unit Trucks %	0.7%	0%	0%		0.7%	0%	0%	0%		0%	0%	0%	0%		0%	-
Buses	2	0	0		2	0	0	0		0	0	1	0		1	-
Buses %	1.4%	0%	0%		1.3%	0%	0%	0%		0%	0%	1.3%	0%		1.3%	-
Pedestrians	-	-	-	1	-	-	-	-	1	-	-	-	-	0	-	-
Pedestrians%	-	-	-	50%		-	-	-	50%		-	-	-	0%		-

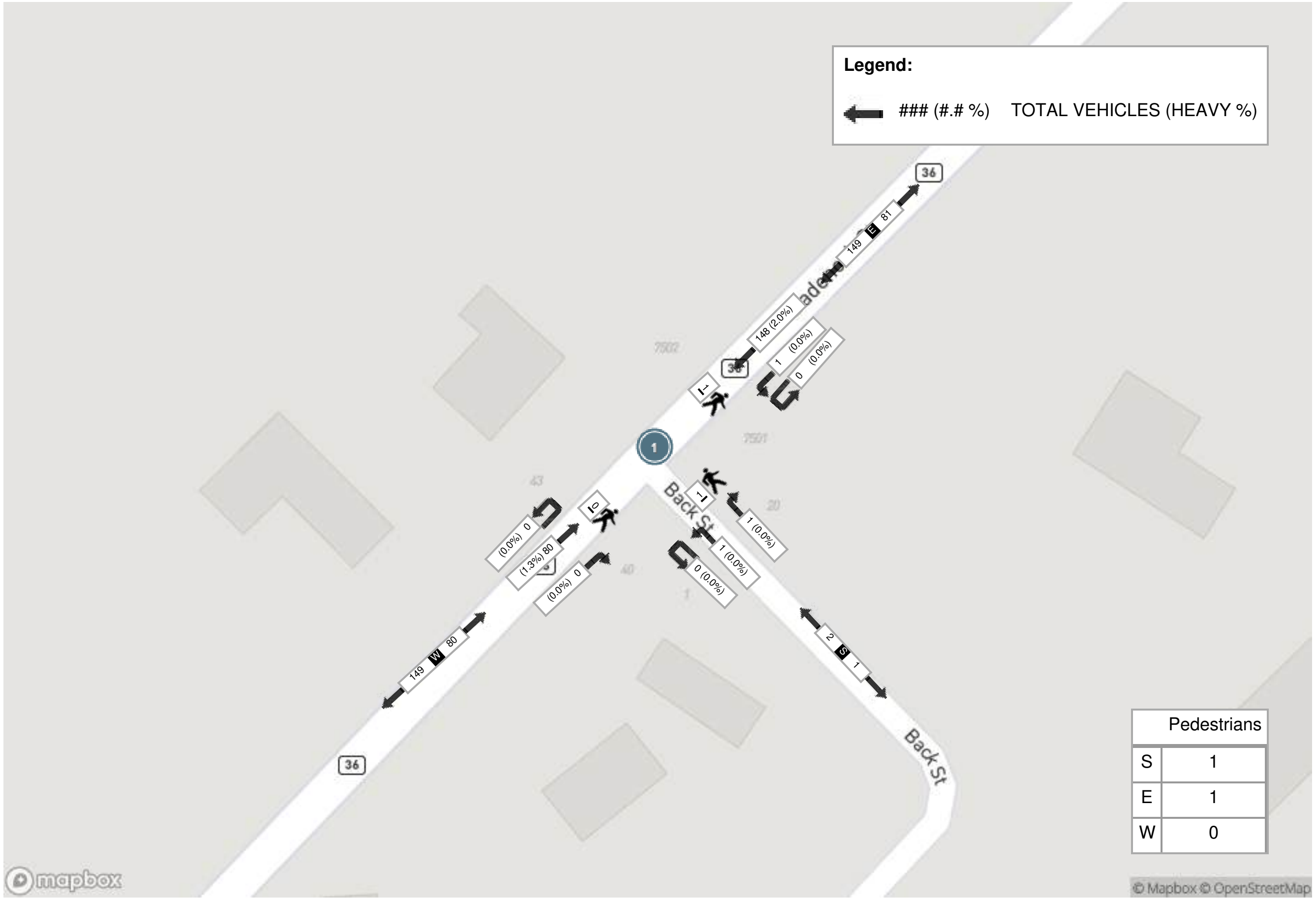
GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:45 AM - 08:45 AM Weather: Overcast Clouds (-2.89 °C)



GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:15 PM - 05:15 PM   Weather: Overcast Clouds (6.07 °C)



GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Turning Movement Count (3 . HWY 6 & CALFASS RD / BADENOCH ST)

Start Time	N Approach HWY 6						E Approach BADENOCH ST						S Approach HWY 6						W Approach CALFASS RD						Int. Total (15 min)	Int. Total (1 hr)
	Right N:W	Thru N:S	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Thru E:W	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	Left S:W	UTurn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	Left W:N	UTurn W:W	Peds W:	Approach Total		
07:00:00	1	179	3	0	0	183	7	1	28	0	0	36	7	156	0	0	0	163	0	1	2	0	0	3	385	
07:15:00	0	187	0	0	0	187	13	1	19	0	0	33	10	187	0	0	0	197	0	2	1	0	0	3	420	
07:30:00	0	202	7	0	0	209	10	0	13	0	0	23	11	226	0	0	2	237	1	0	2	0	0	3	472	
07:45:00	1	192	3	0	0	196	5	0	25	0	0	30	13	189	0	0	0	202	1	5	14	0	0	20	448	1725
08:00:00	1	210	5	0	1	216	11	1	11	0	0	23	13	208	0	0	2	221	0	0	6	0	1	6	466	1806
08:15:00	0	208	3	0	0	211	14	2	27	0	0	43	15	214	0	0	0	229	0	1	7	0	0	8	491	1877
08:30:00	1	219	2	0	0	222	12	1	18	0	0	31	11	193	0	0	0	204	0	0	2	0	0	2	459	1864
08:45:00	1	191	7	0	0	199	7	1	15	0	0	23	9	174	0	0	2	183	1	0	3	0	1	4	409	1825
BREAK																										
16:00:00	6	207	10	0	0	223	12	2	16	0	0	30	15	185	1	0	1	201	1	1	1	0	1	3	457	
16:15:00	0	244	6	0	0	250	11	1	22	0	0	34	18	204	1	0	2	223	0	0	6	0	1	6	513	
16:30:00	4	260	9	0	1	273	10	2	32	0	0	44	9	225	0	0	0	234	0	2	2	0	0	4	555	
16:45:00	0	251	7	0	0	258	9	0	27	0	0	36	14	230	1	0	0	245	0	2	4	0	1	6	545	2070
17:00:00	1	229	6	0	0	236	12	2	32	0	0	46	19	186	0	0	0	205	1	0	1	0	0	2	489	2102
17:15:00	5	248	9	0	0	262	12	1	14	0	0	27	15	188	0	0	0	203	0	1	2	0	0	3	495	2084
17:30:00	3	247	8	0	0	258	4	1	15	0	0	20	16	174	1	0	0	191	0	1	3	0	1	4	473	2002
17:45:00	2	252	13	0	0	267	7	2	15	0	0	24	11	176	0	0	0	187	0	0	2	0	0	2	480	1937
Grand Total	26	3526	98	0	2	3650	156	18	329	0	0	503	206	3115	4	0	9	3325	5	16	58	0	6	79	**7557**	-
Approach%	0.7%	96.6%	2.7%	0%		-	31%	3.6%	65.4%	0%		-	6.2%	93.7%	0.1%	0%		-	6.3%	20.3%	73.4%	0%		-	**-**	-
Totals %	0.3%	46.7%	1.3%	0%		48.3%	2.1%	0.2%	4.4%	0%		6.7%	2.7%	41.2%	0.1%	0%		44%	0.1%	0.2%	0.8%	0%		1%	**-**	-
Heavy	0	459	5	0		-	3	1	9	0		-	3	372	0	0		-	3	4	1	0		-	**-**	-
Heavy %	0%	13%	5.1%	0%		-	1.9%	5.6%	2.7%	0%		-	1.5%	11.9%	0%	0%		-	60%	25%	1.7%	0%		-	**-**	-
Bicycles	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	**-**	-
Bicycle %	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	**-**	-

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:30 AM - 08:30 AM Weather: Overcast Clouds (-2.89 °C)

Start Time	N Approach HWY 6						E Approach BADENOCH ST						S Approach HWY 6						W Approach CALFASS RD						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
07:30:00	0	202	7	0	0	209	10	0	13	0	0	23	11	226	0	0	2	237	1	0	2	0	0	3	472
07:45:00	1	192	3	0	0	196	5	0	25	0	0	30	13	189	0	0	0	202	1	5	14	0	0	20	448
08:00:00	1	210	5	0	1	216	11	1	11	0	0	23	13	208	0	0	2	221	0	0	6	0	1	6	466
08:15:00	0	208	3	0	0	211	14	2	27	0	0	43	15	214	0	0	0	229	0	1	7	0	0	8	491
Grand Total	2	812	18	0	1	832	40	3	76	0	0	119	52	837	0	0	4	889	2	6	29	0	1	37	**1877**
Approach%	0.2%	97.6%	2.2%	0%		-	33.6%	2.5%	63.9%	0%		-	5.8%	94.2%	0%	0%		-	5.4%	16.2%	78.4%	0%		-	-
Totals %	0.1%	43.3%	1%	0%		44.3%	2.1%	0.2%	4%	0%		6.3%	2.8%	44.6%	0%	0%		47.4%	0.1%	0.3%	1.5%	0%		2%	-
PHF	0.5	0.97	0.64	0		0.96	0.71	0.38	0.7	0		0.69	0.87	0.93	0	0		0.94	0.5	0.3	0.52	0		0.46	-
Heavy	0	153	5	0		158	2	0	3	0		5	1	99	0	0		100	2	1	1	0		4	-
Heavy %	0%	18.8%	27.8%	0%		19%	5%	0%	3.9%	0%		4.2%	1.9%	11.8%	0%	0%		11.2%	100%	16.7%	3.4%	0%		10.8%	-
Lights	2	659	13	0		674	38	3	73	0		114	51	738	0	0		789	0	5	28	0		33	-
Lights %	100%	81.2%	72.2%	0%		81%	95%	100%	96.1%	0%		95.8%	98.1%	88.2%	0%	0%		88.8%	0%	83.3%	96.6%	0%		89.2%	-
Single-Unit Trucks	0	44	2	0		46	0	0	2	0		2	0	27	0	0		27	0	0	0	0		0	-
Single-Unit Trucks %	0%	5.4%	11.1%	0%		5.5%	0%	0%	2.6%	0%		1.7%	0%	3.2%	0%	0%		3%	0%	0%	0%	0%		0%	-
Buses	0	0	3	0		3	2	0	1	0		3	1	1	0	0		2	2	1	1	0		4	-
Buses %	0%	0%	16.7%	0%		0.4%	5%	0%	1.3%	0%		2.5%	1.9%	0.1%	0%	0%		0.2%	100%	16.7%	3.4%	0%		10.8%	-
Articulated Trucks	0	109	0	0		109	0	0	0	0		0	0	71	0	0		71	0	0	0	0		0	-
Articulated Trucks %	0%	13.4%	0%	0%		13.1%	0%	0%	0%	0%		0%	0%	8.5%	0%	0%		8%	0%	0%	0%	0%		0%	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	4	-	-	-	-	-	1	-	-
Pedestrians%	-	-	-	-	16.7%		-	-	-	-	0%		-	-	-	-	66.7%		-	-	-	-	16.7%		-

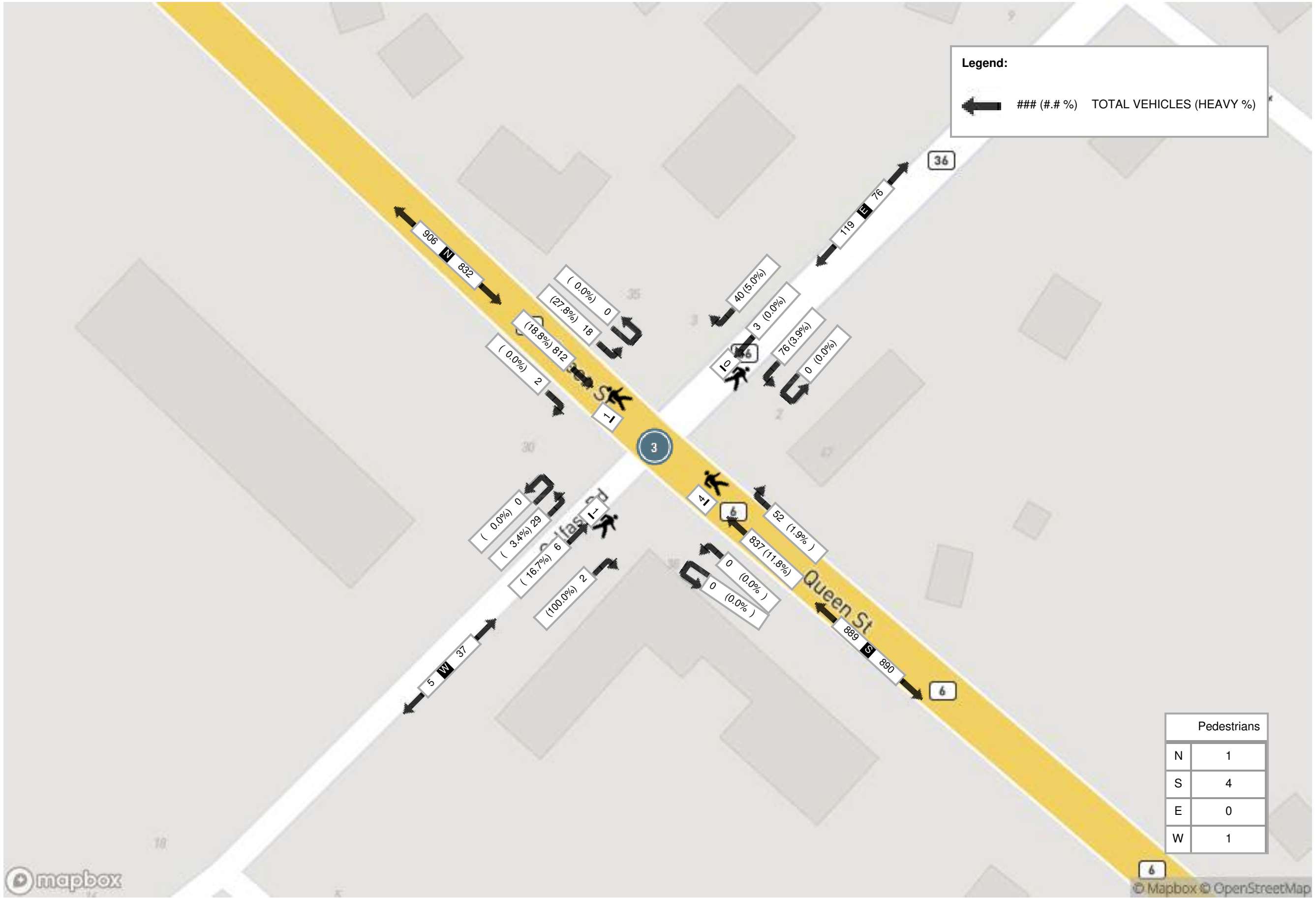
GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (6.07 °C)

Start Time	N Approach HWY 6						E Approach BADENOCH ST						S Approach HWY 6						W Approach CALFASS RD						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
16:15:00	0	244	6	0	0	250	11	1	22	0	0	34	18	204	1	0	2	223	0	0	6	0	1	6	513
16:30:00	4	260	9	0	1	273	10	2	32	0	0	44	9	225	0	0	0	234	0	2	2	0	0	4	555
16:45:00	0	251	7	0	0	258	9	0	27	0	0	36	14	230	1	0	0	245	0	2	4	0	1	6	545
17:00:00	1	229	6	0	0	236	12	2	32	0	0	46	19	186	0	0	0	205	1	0	1	0	0	2	489
Grand Total	5	984	28	0	1	1017	42	5	113	0	0	160	60	845	2	0	2	907	1	4	13	0	2	18	**2102**
Approach%	0.5%	96.8%	2.8%	0%		-	26.3%	3.1%	70.6%	0%		-	6.6%	93.2%	0.2%	0%		-	5.6%	22.2%	72.2%	0%		-	-
Totals %	0.2%	46.8%	1.3%	0%		48.4%	2%	0.2%	5.4%	0%		7.6%	2.9%	40.2%	0.1%	0%		43.1%	0%	0.2%	0.6%	0%		0.9%	-
PHF	0.31	0.95	0.78	0		0.93	0.88	0.63	0.88	0		0.87	0.79	0.92	0.5	0		0.93	0.25	0.5	0.54	0		0.75	-
Heavy	0	72	0	0		72	1	0	2	0		3	1	94	0	0		95	0	0	0	0		0	-
Heavy %	0%	7.3%	0%	0%		7.1%	2.4%	0%	1.8%	0%		1.9%	1.7%	11.1%	0%	0%		10.5%	0%	0%	0%	0%		0%	-
Lights	5	912	28	0		945	41	5	111	0		157	59	751	2	0		812	1	4	13	0		18	-
Lights %	100%	92.7%	100%	0%		92.9%	97.6%	100%	98.2%	0%		98.1%	98.3%	88.9%	100%	0%		89.5%	100%	100%	100%	0%		100%	-
Single-Unit Trucks	0	21	0	0		21	0	0	1	0		1	0	36	0	0		36	0	0	0	0		0	-
Single-Unit Trucks %	0%	2.1%	0%	0%		2.1%	0%	0%	0.9%	0%		0.6%	0%	4.3%	0%	0%		4%	0%	0%	0%	0%		0%	-
Buses	0	4	0	0		4	1	0	1	0		2	1	2	0	0		3	0	0	0	0		0	-
Buses %	0%	0.4%	0%	0%		0.4%	2.4%	0%	0.9%	0%		1.3%	1.7%	0.2%	0%	0%		0.3%	0%	0%	0%	0%		0%	-
Articulated Trucks	0	47	0	0		47	0	0	0	0		0	0	56	0	0		56	0	0	0	0		0	-
Articulated Trucks %	0%	4.8%	0%	0%		4.6%	0%	0%	0%	0%		0%	0%	6.6%	0%	0%		6.2%	0%	0%	0%	0%		0%	-
Pedestrians	-	-	-	-	1	-	-	-	-	-	0	-	-	-	-	-	2	-	-	-	-	-	2	-	-
Pedestrians%	-	-	-	-	20%		-	-	-	-	0%		-	-	-	-	40%		-	-	-	-	40%		-

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:30 AM - 08:30 AM Weather: Overcast Clouds (-2.89 °C)

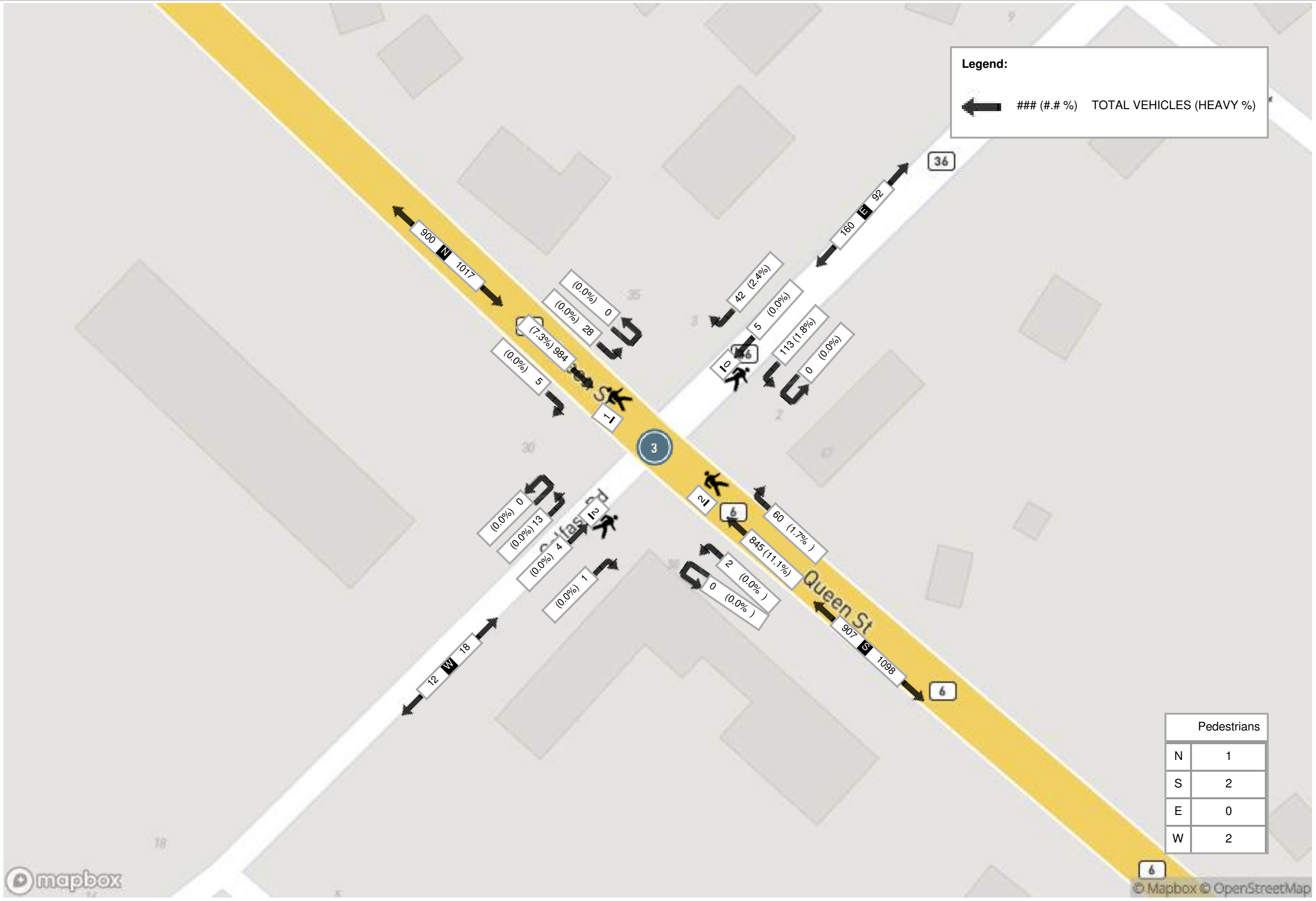


	Pedestrians
N	1
S	4
E	0
W	1

Turning Movement Count
Location Name: HWY 6 & CALFASS RD / BADENOCH ST
Date: Tue, Feb 07, 2023 Deployment Lead: Walter Fugaj

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (6.07 °C)



GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Turning Movement Count (2 . OCHS ST & BACK ST)

Start Time	N Approach OCHS ST							E Approach BACK ST							S Approach OCHS ST						
	Right N:W	Thru N:S	Bear Left N:SE	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Thru E:W	Left E:S	Hard Left E:SE	UTurn E:E	Peds E:	Approach Total	Hard Right S:SE	Right S:E	Thru S:N	Left S:W	UTurn S:S	Peds S:	Approach Total
07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15:00	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0
07:30:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
07:45:00	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
08:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BREAK																					
16:00:00	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15:00	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1
16:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30:00	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45:00	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	5	1	0	1	0	4	7	1	0	0	0	0	0	1	0	0	1	0	0	4	1
Approach%	71.4%	14.3%	0%	14.3%	0%		-	100%	0%	0%	0%	0%		-	0%	0%	100%	0%	0%		-
Totals %	45.5%	9.1%	0%	9.1%	0%		63.6%	9.1%	0%	0%	0%	0%		9.1%	0%	0%	9.1%	0%	0%		9.1%
Heavy	2	0	0	0	0		-	0	0	0	0	0		-	0	0	0	0	0		-
Heavy %	40%	0%	0%	0%	0%		-	0%	0%	0%	0%	0%		-	0%	0%	0%	0%	0%		-
Bicycles	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-
Bicycle %	-	-	-	-	-		-	-	-	-	-	-		-	-	-	-	-	-		-

Start Time	W Approach BACK ST							SE Approach SOUTHEAST DRIVEWAY							Int. Total (15 min)	Int. Total (1 hr)
	Right W:S	Bear Right W:SE	Thru W:E	Left W:N	UTurn W:W	Peds W:	Approach Total	Hard Right SE:E	Bear Right SE:N	Bear Left SE:W	Hard Left SE:S	UTurn SE:SE	Peds SE:	Approach Total		
07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
07:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
07:30:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	
07:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4
08:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
08:15:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
08:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
08:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BREAK																
16:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
16:15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
16:30:00	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	
16:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
17:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
17:15:00	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	2
17:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
17:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Grand Total	0	0	0	2	0	0	2	0	0	0	0	0	4	0	**11**	-
Approach%	0%	0%	0%	100%	0%		-	0%	0%	0%	0%	0%		-	-	-
Totals %	0%	0%	0%	18.2%	0%		18.2%	0%	0%	0%	0%	0%		0%	-	-
Heavy	0	0	0	0	0		-	0	0	0	0	0		-	-	-
Heavy %	0%	0%	0%	0%	0%		-	0%	0%	0%	0%	0%		-	-	-
Bicycles	-	-	-	-	-		-	-	-	-	-	-		-	-	-
Bicycle %	-	-	-	-	-		-	-	-	-	-	-		-	-	-

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 07:15 AM - 08:15 AM   Weather: Overcast Clouds (-2.89 °C)

Start Time	N Approach OCHS ST							E Approach BACK ST							S Approach OCHS ST							W Approach BACK ST							SE Approach SOUTHEAST DRIVEWAY							Int. Total (15 min)
	Right	Thru	Bear Left	Left	UTurn	Peds	Approach Total	Right	Thru	Left	Hard Left	UTurn	Peds	Approach Total	Hard Right	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Bear Right	Thru	Left	UTurn	Peds	Approach Total	Hard Right	Bear Right	Bear Left	Hard Left	UTurn	Peds	Approach Total	
07:15:00	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
07:30:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
07:45:00	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
08:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	2	1	0	0	0	2	3	1	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	**4**
Approach%	66.7%	33.3%	0%	0%	0%		-	100%	0%	0%	0%	0%		-	0%	0%	0%	0%	0%		-	0%	0%	0%	0%	0%		-	0%	0%	0%	0%	0%		-	**-**
Totals %	50%	25%	0%	0%	0%		75%	25%	0%	0%	0%	0%		25%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	**-**
PHF	0.25	0.25	0	0	0		0.38	0.25	0	0	0	0		0.25	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0		0	**-**
Heavy	2	0	0	0	0		2	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0		0	**-**
Heavy %	100%	0%	0%	0%	0%		66.7%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	**-**
Lights	0	1	0	0	0		1	1	0	0	0	0		1	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0		0	**-**
Lights %	0%	100%	0%	0%	0%		33.3%	100%	0%	0%	0%	0%		100%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	**-**
Buses	2	0	0	0	0		2	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0		0	0	0	0	0	0		0	**-**
Buses %	100%	0%	0%	0%	0%		66.7%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%	**-**
Pedestrians	-	-	-	-	-	2	-	-	-	-	-	-	0	-	-	-	-	-	-	2	-	-	-	-	-	-	0	-	-	-	-	-	-	2	-	**-**
Pedestrians%	-	-	-	-	-	33.3%		-	-	-	-	-	0%		-	-	-	-	-	33.3%		-	-	-	-	-	0%		-	-	-	-	-	33.3%		**-**

GHD
UNIT 1 705 MILLCREEK DRIVE
MISSISSAUGA ONTARIO, L5N 5M4
CANADA

Peak Hour: 04:00 PM - 05:00 PM Weather: Overcast Clouds (6.07 °C)

Start Time	N Approach OCHS ST							E Approach BACK ST						
	Right	Thru	Bear Left	Left	UTurn	Peds	Approach Total	Right	Thru	Left	Hard Left	UTurn	Peds	Approach Total
16:00:00	0	0	0	1	0	0	1	0	0	0	0	0	0	0
16:15:00	1	0	0	0	0	0	1	0	0	0	0	0	0	0
16:30:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	1	0	0	1	0	0	2	0	0	0	0	0	0	0
Approach%	50%	0%	0%	50%	0%		-	0%	0%	0%	0%	0%		-
Totals %	25%	0%	0%	25%	0%		50%	0%	0%	0%	0%	0%		0%
PHF	0.25	0	0	0.25	0		0.5	0	0	0	0	0		0
Heavy	0	0	0	0	0		0	0	0	0	0	0		0
Heavy %	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%
Lights	1	0	0	1	0		2	0	0	0	0	0		0
Lights %	100%	0%	0%	100%	0%		100%	0%	0%	0%	0%	0%		0%
Buses	0	0	0	0	0		0	0	0	0	0	0		0
Buses %	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	-	0	-
Pedestrians%	-	-	-	-	-	0%		-	-	-	-	-	0%	

Start Time	S Approach OCHS ST							W Approach BACK ST						
	Hard Right	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Bear Right	Thru	Left	UTurn	Peds	Approach Total
16:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15:00	0	0	1	0	0	0	1	0	0	0	0	0	0	0
16:30:00	0	0	0	0	0	0	0	0	0	0	1	0	0	1
16:45:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	1	0	0	0	1	0	0	0	1	0	0	1
Approach%	0%	0%	100%	0%	0%		-	0%	0%	0%	100%	0%		-
Totals %	0%	0%	25%	0%	0%		25%	0%	0%	0%	25%	0%		25%
PHF	0	0	0.25	0	0		0.25	0	0	0	0.25	0		0.25
Heavy	0	0	0	0	0		0	0	0	0	0	0		0
Heavy %	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%
Lights	0	0	1	0	0		1	0	0	0	1	0		1
Lights %	0%	0%	100%	0%	0%		100%	0%	0%	0%	100%	0%		100%
Buses	0	0	0	0	0		0	0	0	0	0	0		0
Buses %	0%	0%	0%	0%	0%		0%	0%	0%	0%	0%	0%		0%
Pedestrians	-	-	-	-	-	0	-	-	-	-	-	-	0	-
Pedestrians%	-	-	-	-	-	0%		-	-	-	-	-	0%	

Start Time	SE Approach SOUTHEAST DRIVEWAY							Int. Total (15 min)
	Hard Right	Bear Right	Bear Left	Hard Left	UTurn	Peds	Approach Total	
16:00:00	0	0	0	0	0	0	0	1
16:15:00	0	0	0	0	0	0	0	2
16:30:00	0	0	0	0	0	0	0	1
16:45:00	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	**4**
Approach%	0%	0%	0%	0%	0%		-	-
Totals %	0%	0%	0%	0%	0%		0%	-
PHF	0	0	0	0	0		0	-
Heavy	0	0	0	0	0		0	-
Heavy %	0%	0%	0%	0%	0%		0%	-
Lights	0	0	0	0	0		0	-
Lights %	0%	0%	0%	0%	0%		0%	-
Buses	0	0	0	0	0		0	-
Buses %	0%	0%	0%	0%	0%		0%	-
Pedestrians	-	-	-	-	-	0	-	-
Pedestrians%	-	-	-	-	-	0%		-

Turning Movement Count
Location Name: OCHS ST & BACK ST
Date: Tue, Feb 07, 2023   Deployment Lead: Walter Fugaj

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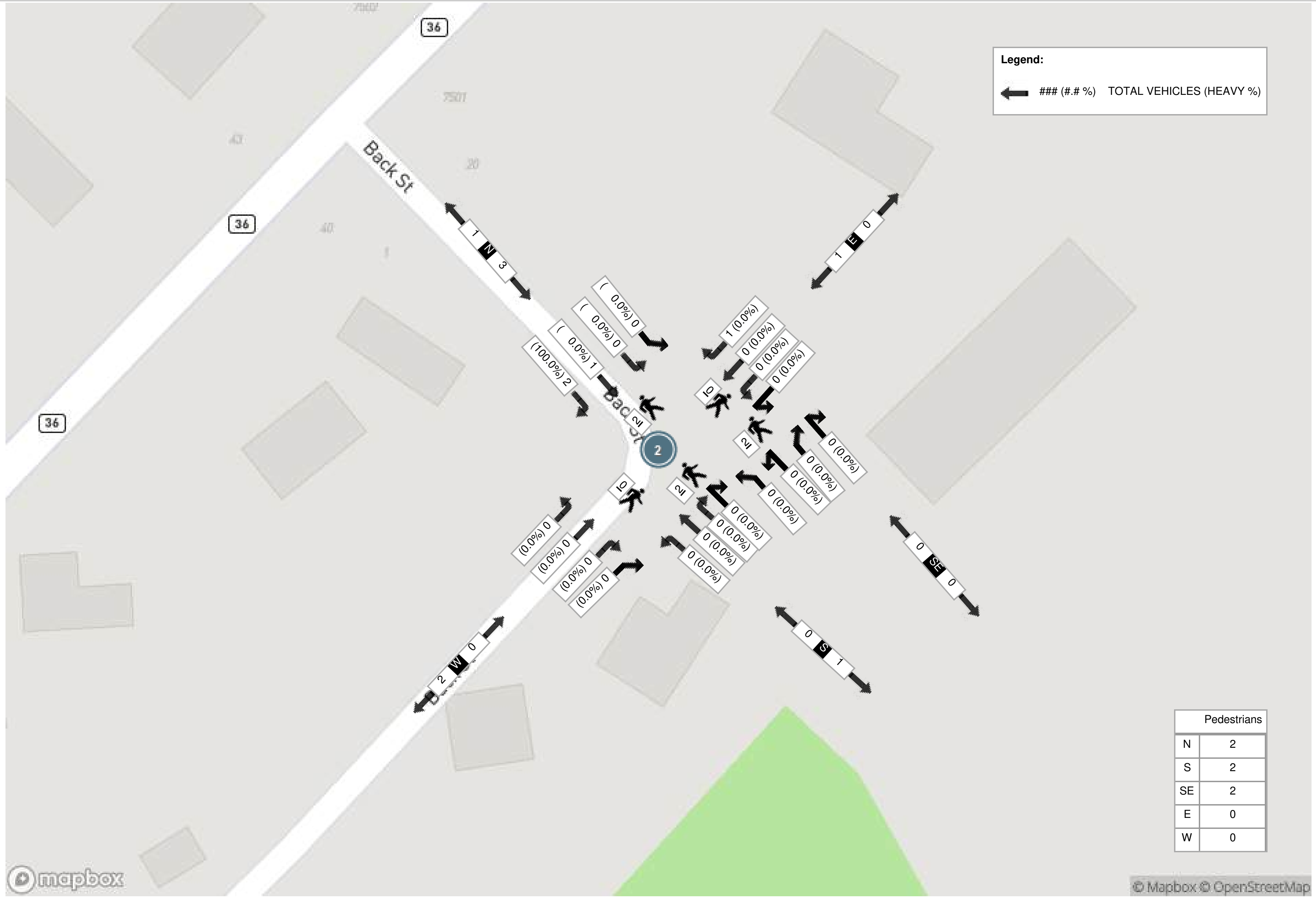
Peak Hour: 07:15 AM - 08:15 AM   Weather: Overcast Clouds (-2.89 °C)



	Pedestrians
N	2
S	2
SE	2
E	0
W	0

Spectrum

Turning Movement Count
Location Name: OCHS ST & BACK ST
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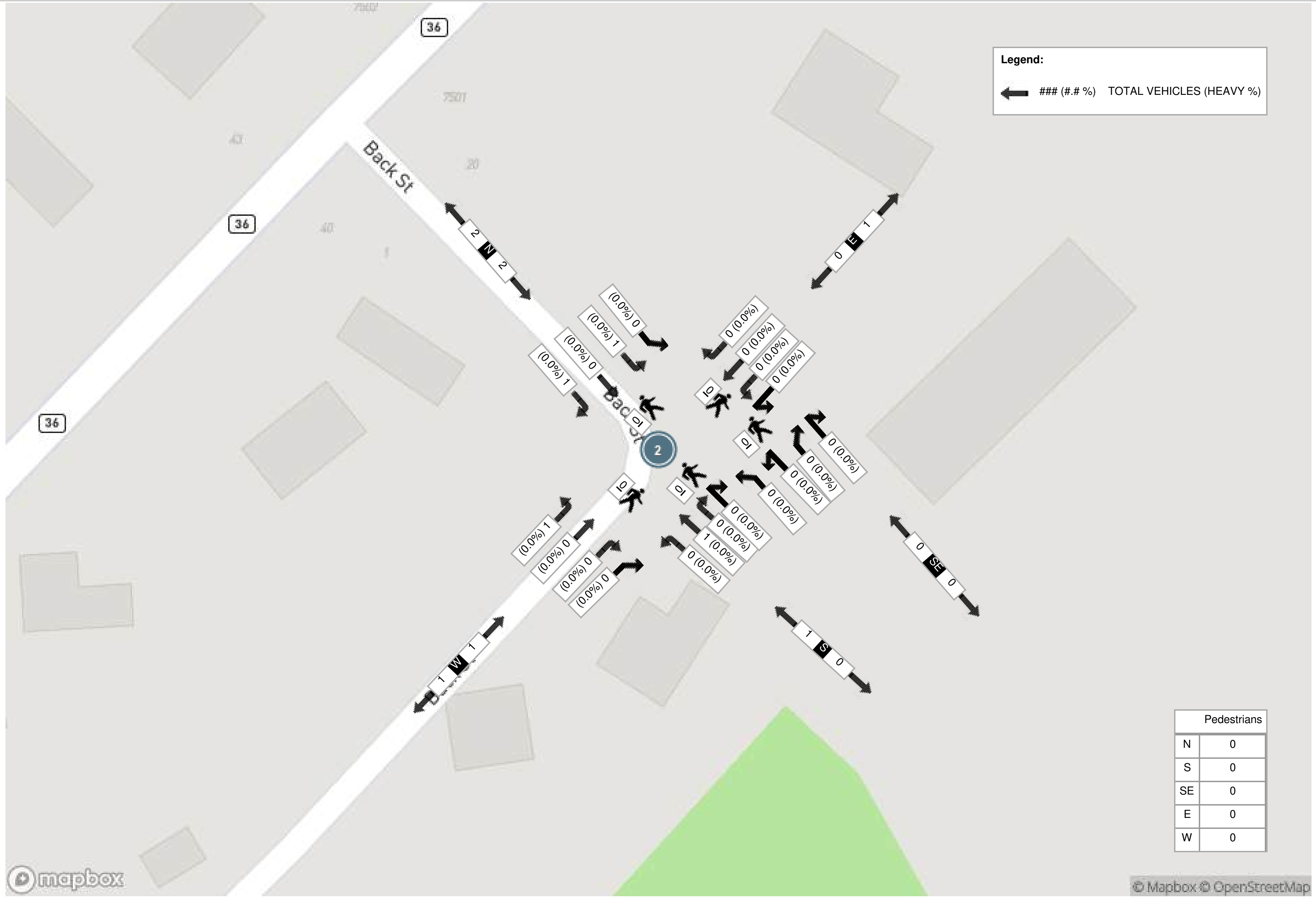
Peak Hour: 04:00 PM - 05:00 PM   Weather: Overcast Clouds (6.07 °C)



Appendix B

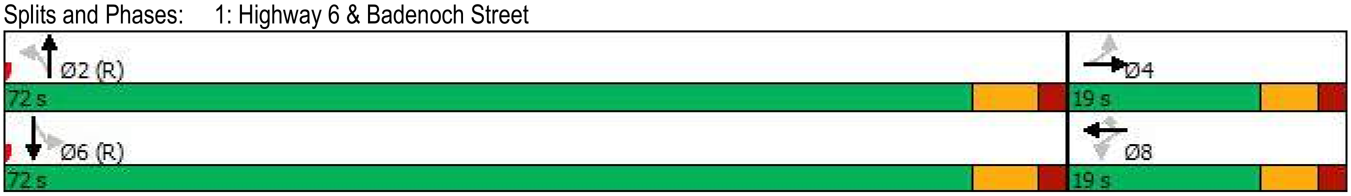
Synchro Outputs

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	6	2	76	3	40	0	837	52	18	812	2
Future Volume (vph)	29	6	2	76	3	40	0	837	52	18	812	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.98	0.98					1.00	
Frt		0.993				0.850		0.991				
Flt Protected		0.962			0.954					0.950		
Satd. Flow (prot)	0	1660	0	0	1765	1555	1921	1709	0	1426	1615	0
Flt Permitted		0.723			0.706					0.222		
Satd. Flow (perm)	0	1244	0	0	1286	1518	1921	1709	0	333	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				42		9				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		4	4		1	1					1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Adj. Flow (vph)	30	6	2	79	3	42	0	872	54	19	846	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	38	0	0	82	42	0	926	0	19	848	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Minimum Split (s)	17.0	17.0		17.0	17.0	17.0	57.5	57.5		57.5	57.5	
Total Split (s)	19.0	19.0		19.0	19.0	19.0	72.0	72.0		72.0	72.0	
Total Split (%)	20.9%	20.9%		20.9%	20.9%	20.9%	79.1%	79.1%		79.1%	79.1%	
Maximum Green (s)	13.0	13.0		13.0	13.0	13.0	65.5	65.5		65.5	65.5	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0	6.0	6.5	6.5		6.5	6.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)		13.0			13.0	13.0		65.5		65.5	65.5	
Actuated g/C Ratio		0.14			0.14	0.14		0.72		0.72	0.72	
v/c Ratio		0.21			0.45	0.17		0.75		0.08	0.73	
Control Delay		36.5			44.4	12.8		12.6		4.7	12.3	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		36.5			44.4	12.8		12.6		4.7	12.3	
LOS		D			D	B		B		A	B	
Approach Delay		36.5			33.7			12.6			12.1	
Approach LOS		D			C			B			B	

Intersection Summary	
Area Type: Other	
Cycle Length: 91	
Actuated Cycle Length: 91	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Pretimed	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 14.2	Intersection LOS: B
Intersection Capacity Utilization 81.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	38	82	42	926	19	848
v/c Ratio	0.21	0.45	0.17	0.75	0.08	0.73
Control Delay	36.5	44.4	12.8	12.6	4.7	12.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.5	44.4	12.8	12.6	4.7	12.3
Queue Length 50th (m)	5.6	13.3	0.0	82.3	0.8	73.5
Queue Length 95th (m)	14.7	27.4	8.8	131.9	2.9	118.4
Internal Link Dist (m)	53.1	355.9		273.6		78.6
Turn Bay Length (m)			20.0		40.0	
Base Capacity (vph)	179	183	252	1232	239	1162
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.45	0.17	0.75	0.08	0.73

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	6	2	76	3	40	0	837	52	18	812	2
Future Volume (vph)	29	6	2	76	3	40	0	837	52	18	812	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.98		1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.98	1.00		1.00		1.00	1.00	
Frt		0.99			1.00	0.85		0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1655			1738	1518		1709		1426	1614	
Flt Permitted		0.72			0.71	1.00		1.00		0.22	1.00	
Satd. Flow (perm)		1245			1286	1518		1709		333	1614	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	30	6	2	79	3	42	0	872	54	19	846	2
RTOR Reduction (vph)	0	2	0	0	0	36	0	3	0	0	0	0
Lane Group Flow (vph)	0	36	0	0	82	6	0	923	0	19	848	0
Confl. Peds. (#/hr)	1		4	4		1	1					1
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		13.0			13.0	13.0		65.5		65.5	65.5	
Effective Green, g (s)		13.0			13.0	13.0		65.5		65.5	65.5	
Actuated g/C Ratio		0.14			0.14	0.14		0.72		0.72	0.72	
Clearance Time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Grp Cap (vph)		177			183	216		1230		239	1161	
v/s Ratio Prot								c0.54			0.53	
v/s Ratio Perm		0.03			c0.06	0.00				0.06		
v/c Ratio		0.21			0.45	0.03		0.75		0.08	0.73	
Uniform Delay, d1		34.4			35.7	33.6		7.8		3.8	7.5	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		2.6			7.7	0.2		4.2		0.6	4.1	
Delay (s)		37.0			43.5	33.8		12.0		4.4	11.6	
Level of Service		D			D	C		B		A	B	
Approach Delay (s)		37.0			40.2			12.0			11.4	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	14.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	81.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	71	1	1	121	0	0
Future Volume (vph)	71	1	1	121	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected						
Satd. Flow (prot)	1743	0	0	1846	1921	0
Flt Permitted						
Satd. Flow (perm)	1743	0	0	1846	1921	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	10%	10%	10%	4%	0%	0%
Adj. Flow (vph)	82	1	1	139	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	83	0	0	140	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 10.5%		ICU Level of Service A
Analysis Period (min) 15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	71	1	1	121	0	0
Future Volume (Veh/h)	71	1	1	121	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	82	1	1	139	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			83		224	82
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			83		224	82
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1465		769	983

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	83	140	0
Volume Left	0	1	0
Volume Right	1	0	0
cSH	1700	1465	1700
Volume to Capacity	0.05	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.1	0.0
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	0.0
Approach LOS			A

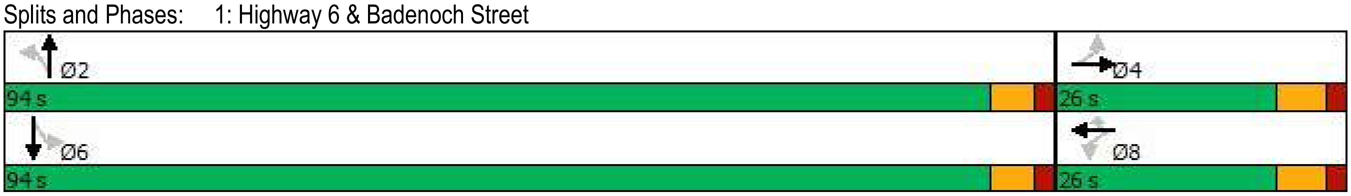
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	10.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	4	1	113	5	42	2	845	60	28	984	5
Future Volume (vph)	13	4	1	113	5	42	2	845	60	28	984	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99	0.97					1.00	
Frt		0.993				0.850		0.990			0.999	
Flt Protected		0.964			0.954		0.950			0.950		
Satd. Flow (prot)	0	1836	0	0	1798	1601	1825	1723	0	1825	1794	0
Flt Permitted		0.758			0.721		0.141			0.189		
Satd. Flow (perm)	0	1439	0	0	1345	1560	271	1723	0	363	1794	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				44		8			1	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Adj. Flow (vph)	14	4	1	119	5	44	2	889	63	29	1036	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	19	0	0	124	44	2	952	0	29	1041	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	25.0	25.0		25.0	25.0	
Minimum Split (s)	17.5	17.5		17.5	17.5	17.5	57.5	57.5		57.5	57.5	
Total Split (s)	26.0	26.0		26.0	26.0	26.0	94.0	94.0		94.0	94.0	
Total Split (%)	21.7%	21.7%		21.7%	21.7%	21.7%	78.3%	78.3%		78.3%	78.3%	
Maximum Green (s)	19.5	19.5		19.5	19.5	19.5	88.0	88.0		88.0	88.0	
Yellow Time (s)	4.5	4.5		4.5	4.5	4.5	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	Min	Min		Min	Min	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		13.8			13.8	13.8	58.7	58.7		58.7	58.7	
Actuated g/C Ratio		0.16			0.16	0.16	0.68	0.68		0.68	0.68	
v/c Ratio		0.08			0.57	0.15	0.01	0.81		0.12	0.85	
Control Delay		37.1			48.9	13.9	4.5	15.7		5.9	18.0	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		37.1			48.9	13.9	4.5	15.7		5.9	18.0	
LOS		D			D	B	A	B		A	B	
Approach Delay		37.1			39.8			15.7			17.7	
Approach LOS		D			D			B			B	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 85.7	
Natural Cycle: 75	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.85	
Intersection Signal Delay: 18.7	Intersection LOS: B
Intersection Capacity Utilization 80.7%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	19	124	44	2	952	29	1041
v/c Ratio	0.08	0.57	0.15	0.01	0.81	0.12	0.85
Control Delay	37.1	48.9	13.9	4.5	15.7	5.9	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.1	48.9	13.9	4.5	15.7	5.9	18.0
Queue Length 50th (m)	2.3	17.2	0.0	0.1	86.3	1.3	101.6
Queue Length 95th (m)	10.6	47.4	10.3	0.8	168.5	4.8	198.5
Internal Link Dist (m)	53.1	355.9			273.6		78.6
Turn Bay Length (m)			20.0	15.0		40.0	
Base Capacity (vph)	347	324	409	250	1590	335	1655
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.38	0.11	0.01	0.60	0.09	0.63

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	4	1	113	5	42	2	845	60	28	984	5
Future Volume (vph)	13	4	1	113	5	42	2	845	60	28	984	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.98	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.99	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1833			1786	1563	1825	1723		1825	1794	
Flt Permitted		0.76			0.72	1.00	0.14	1.00		0.19	1.00	
Satd. Flow (perm)		1440			1349	1563	271	1723		363	1794	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	14	4	1	119	5	44	2	889	63	29	1036	5
RTOR Reduction (vph)	0	1	0	0	0	37	0	2	0	0	0	0
Lane Group Flow (vph)	0	18	0	0	124	7	2	950	0	29	1041	0
Confl. Peds. (#/hr)	1		2	2		1	2					2
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		13.8			13.8	13.8	58.7	58.7		58.7	58.7	
Effective Green, g (s)		13.8			13.8	13.8	58.7	58.7		58.7	58.7	
Actuated g/C Ratio		0.16			0.16	0.16	0.69	0.69		0.69	0.69	
Clearance Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		233			219	253	187	1189		250	1238	
v/s Ratio Prot								0.55			c0.58	
v/s Ratio Perm		0.01			c0.09	0.00	0.01			0.08		
v/c Ratio		0.08			0.57	0.03	0.01	0.80		0.12	0.84	
Uniform Delay, d1		30.2			32.8	30.0	4.1	9.1		4.4	9.7	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.1			3.3	0.0	0.0	3.8		0.2	5.3	
Delay (s)		30.3			36.2	30.0	4.1	12.9		4.6	15.0	
Level of Service		C			D	C	A	B		A	B	
Approach Delay (s)		30.3			34.6			12.9			14.7	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	85.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	80	0	1	148	1	1
Future Volume (vph)	80	0	1	148	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.932	
Flt Protected					0.976	
Satd. Flow (prot)	1902	0	0	1884	1748	0
Flt Permitted					0.976	
Satd. Flow (perm)	1902	0	0	1884	1748	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Confl. Peds. (#/hr)		1	1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	2%	0%	0%
Adj. Flow (vph)	87	0	1	161	1	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	87	0	0	162	2	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 18.9%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	80	0	1	148	1	1
Future Volume (Veh/h)	80	0	1	148	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	0	1	161	1	1
Pedestrians				1	1	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			88		251	89
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			88		251	89
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1519		741	973

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	87	162	2
Volume Left	0	1	1
Volume Right	0	0	1
cSH	1700	1519	841
Volume to Capacity	0.05	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.1	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.3
Approach LOS			A

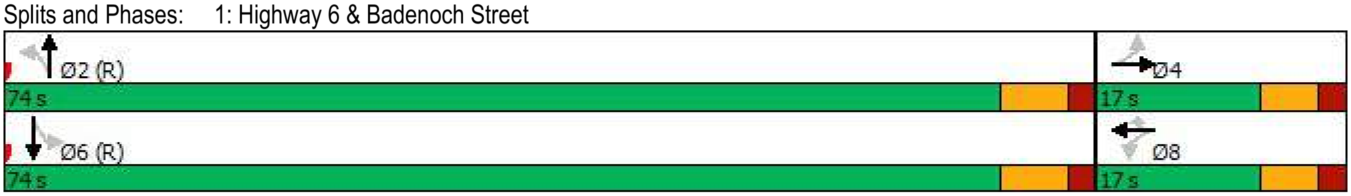
Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	18.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	6	2	77	3	40	0	853	53	18	828	2
Future Volume (vph)	29	6	2	77	3	40	0	853	53	18	828	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.98	0.98					1.00	
Frt		0.993				0.850		0.991				
Flt Protected		0.962			0.954					0.950		
Satd. Flow (prot)	0	1660	0	0	1765	1555	1921	1709	0	1426	1615	0
Flt Permitted		0.716			0.706					0.226		
Satd. Flow (perm)	0	1232	0	0	1286	1518	1921	1709	0	339	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				42		9				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		4	4		1	1					1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Adj. Flow (vph)	30	6	2	80	3	42	0	889	55	19	863	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	38	0	0	83	42	0	944	0	19	865	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Minimum Split (s)	17.0	17.0		17.0	17.0	17.0	57.5	57.5		57.5	57.5	
Total Split (s)	17.0	17.0		17.0	17.0	17.0	74.0	74.0		74.0	74.0	
Total Split (%)	18.7%	18.7%		18.7%	18.7%	18.7%	81.3%	81.3%		81.3%	81.3%	
Maximum Green (s)	11.0	11.0		11.0	11.0	11.0	67.5	67.5		67.5	67.5	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0	6.0	6.5	6.5		6.5	6.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
v/c Ratio		0.25			0.54	0.19		0.74		0.08	0.72	
Control Delay		39.6			51.2	13.9		11.3		4.1	11.0	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		39.6			51.2	13.9		11.3		4.1	11.0	
LOS		D			D	B		B		A	B	
Approach Delay		39.6			38.7			11.3			10.8	
Approach LOS		D			D			B			B	

Intersection Summary	
Area Type:	Other
Cycle Length: 91	
Actuated Cycle Length: 91	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Pretimed	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 13.3	Intersection LOS: B
Intersection Capacity Utilization 81.9%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	38	83	42	944	19	865
v/c Ratio	0.25	0.54	0.19	0.74	0.08	0.72
Control Delay	39.6	51.2	13.9	11.3	4.1	11.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.6	51.2	13.9	11.3	4.1	11.0
Queue Length 50th (m)	5.8	13.9	0.0	77.0	0.8	69.1
Queue Length 95th (m)	15.2	#29.1	9.1	124.1	2.6	111.8
Internal Link Dist (m)	53.1	355.9		273.6		78.6
Turn Bay Length (m)			20.0		40.0	
Base Capacity (vph)	150	155	220	1269	251	1197
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.54	0.19	0.74	0.08	0.72

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	6	2	77	3	40	0	853	53	18	828	2
Future Volume (vph)	29	6	2	77	3	40	0	853	53	18	828	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.98		1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.98	1.00		1.00		1.00	1.00	
Frt		0.99			1.00	0.85		0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1655			1738	1518		1709		1426	1614	
Flt Permitted		0.72			0.71	1.00		1.00		0.23	1.00	
Satd. Flow (perm)		1232			1286	1518		1709		339	1614	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	30	6	2	80	3	42	0	889	55	19	862	2
RTOR Reduction (vph)	0	2	0	0	0	37	0	2	0	0	0	0
Lane Group Flow (vph)	0	36	0	0	83	5	0	942	0	19	865	0
Confl. Peds. (#/hr)	1		4	4		1	1					1
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Effective Green, g (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
Clearance Time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Grp Cap (vph)		148			155	183		1267		251	1197	
v/s Ratio Prot								c0.55			0.54	
v/s Ratio Perm		0.03			c0.06	0.00				0.06		
v/c Ratio		0.24			0.54	0.03		0.74		0.08	0.72	
Uniform Delay, d1		36.2			37.6	35.3		6.8		3.2	6.5	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		3.9			12.6	0.3		4.0		0.6	3.8	
Delay (s)		40.1			50.2	35.6		10.7		3.8	10.3	
Level of Service		D			D	D		B		A	B	
Approach Delay (s)		40.1			45.3			10.7			10.2	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	81.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	72	1	1	123	0	0
Future Volume (vph)	72	1	1	123	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.998					
Flt Protected						
Satd. Flow (prot)	1743	0	0	1846	1921	0
Flt Permitted						
Satd. Flow (perm)	1743	0	0	1846	1921	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	10%	10%	10%	4%	0%	0%
Adj. Flow (vph)	83	1	1	141	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	84	0	0	142	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 10.6%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	72	1	1	123	0	0
Future Volume (Veh/h)	72	1	1	123	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	83	1	1	141	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			84		226	84
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			84		226	84
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1464		766	981

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	84	142	0
Volume Left	0	1	0
Volume Right	1	0	0
cSH	1700	1464	1700
Volume to Capacity	0.05	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.1	0.0
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	0.0
Approach LOS			A

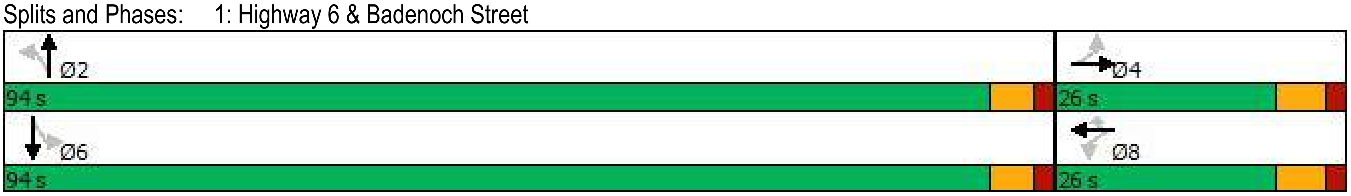
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	10.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	4	1	115	5	42	2	861	61	28	1003	5
Future Volume (vph)	13	4	1	115	5	42	2	861	61	28	1003	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99	0.97					1.00	
Frt		0.993				0.850		0.990			0.999	
Flt Protected		0.964			0.954		0.950			0.950		
Satd. Flow (prot)	0	1836	0	0	1798	1601	1825	1723	0	1825	1794	0
Flt Permitted		0.755			0.721		0.177			0.218		
Satd. Flow (perm)	0	1433	0	0	1345	1560	340	1723	0	419	1794	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				44		8			1	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Adj. Flow (vph)	14	4	1	121	5	44	2	906	64	29	1056	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	19	0	0	126	44	2	970	0	29	1061	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	25.0	25.0		25.0	25.0	
Minimum Split (s)	17.5	17.5		17.5	17.5	17.5	57.5	57.5		57.5	57.5	
Total Split (s)	26.0	26.0		26.0	26.0	26.0	94.0	94.0		94.0	94.0	
Total Split (%)	21.7%	21.7%		21.7%	21.7%	21.7%	78.3%	78.3%		78.3%	78.3%	
Maximum Green (s)	19.5	19.5		19.5	19.5	19.5	88.0	88.0		88.0	88.0	
Yellow Time (s)	4.5	4.5		4.5	4.5	4.5	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		15.7			15.7	15.7	91.1	91.1		91.1	91.1	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
v/c Ratio		0.10			0.71	0.18	0.01	0.74		0.09	0.78	
Control Delay		43.1			70.8	14.4	4.5	12.6		5.1	14.0	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		43.1			70.8	14.4	4.5	12.6		5.1	14.0	
LOS		D			E	B	A	B		A	B	
Approach Delay		43.1			56.2			12.6			13.8	
Approach LOS		D			E			B			B	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 119.3	
Natural Cycle: 75	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 16.7	Intersection LOS: B
Intersection Capacity Utilization 81.6%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	19	126	44	2	970	29	1061
v/c Ratio	0.10	0.71	0.18	0.01	0.74	0.09	0.78
Control Delay	43.1	70.8	14.4	4.5	12.6	5.1	14.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.1	70.8	14.4	4.5	12.6	5.1	14.0
Queue Length 50th (m)	3.7	27.7	0.0	0.1	104.9	1.5	123.9
Queue Length 95th (m)	10.6	48.0	10.3	0.8	177.4	4.6	208.8
Internal Link Dist (m)	53.1	355.9			273.6		78.6
Turn Bay Length (m)			20.0	15.0		40.0	
Base Capacity (vph)	235	219	291	259	1317	320	1369
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.58	0.15	0.01	0.74	0.09	0.78

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	4	1	115	5	42	2	861	61	28	1003	5
Future Volume (vph)	13	4	1	115	5	42	2	861	61	28	1003	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.97	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.99	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1831			1780	1560	1825	1723		1825	1794	
Flt Permitted		0.76			0.72	1.00	0.18	1.00		0.22	1.00	
Satd. Flow (perm)		1433			1345	1560	339	1723		419	1794	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	14	4	1	121	5	44	2	906	64	29	1056	5
RTOR Reduction (vph)	0	1	0	0	0	38	0	2	0	0	0	0
Lane Group Flow (vph)	0	18	0	0	126	6	2	968	0	29	1061	0
Confl. Peds. (#/hr)	1		2	2		1	2					2
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		15.7			15.7	15.7	91.1	91.1		91.1	91.1	
Effective Green, g (s)		15.7			15.7	15.7	91.1	91.1		91.1	91.1	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
Clearance Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		188			177	205	258	1315		319	1369	
v/s Ratio Prot								0.56			c0.59	
v/s Ratio Perm		0.01			c0.09	0.00	0.01			0.07		
v/c Ratio		0.10			0.71	0.03	0.01	0.74		0.09	0.77	
Uniform Delay, d1		45.6			49.6	45.2	3.4	7.6		3.6	8.2	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			12.7	0.1	0.1	3.7		0.6	4.3	
Delay (s)		45.8			62.3	45.2	3.4	11.3		4.1	12.5	
Level of Service		D			E	D	A	B		A	B	
Approach Delay (s)		45.8			57.9			11.3			12.3	
Approach LOS		D			E			B			B	

Intersection Summary			
HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	119.3	Sum of lost time (s)	12.5
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	81	0	1	150	1	1
Future Volume (vph)	81	0	1	150	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.932	
Flt Protected					0.976	
Satd. Flow (prot)	1902	0	0	1884	1748	0
Flt Permitted					0.976	
Satd. Flow (perm)	1902	0	0	1884	1748	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Confl. Peds. (#/hr)		1	1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	2%	0%	0%
Adj. Flow (vph)	88	0	1	163	1	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	88	0	0	164	2	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 19.0%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	81	0	1	150	1	1
Future Volume (Veh/h)	81	0	1	150	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	88	0	1	163	1	1
Pedestrians				1	1	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			89		254	90
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			89		254	90
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1518		738	972

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	88	164	2
Volume Left	0	1	1
Volume Right	0	0	1
cSH	1700	1518	839
Volume to Capacity	0.05	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.1	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.3
Approach LOS			A

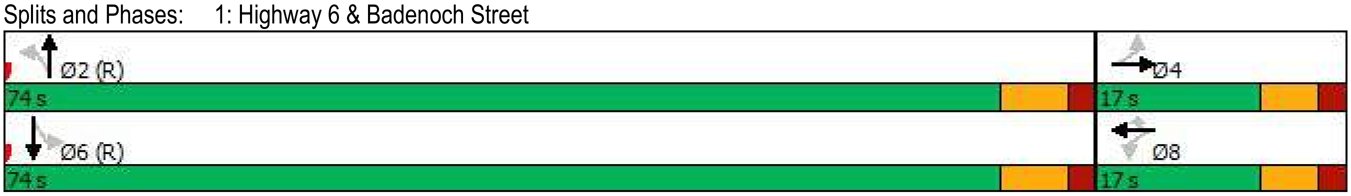
Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	19.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	6	2	84	3	47	0	853	55	20	828	2
Future Volume (vph)	29	6	2	84	3	47	0	853	55	20	828	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.98	0.98					1.00	
Frt		0.993				0.850		0.991				
Flt Protected		0.962			0.954					0.950		
Satd. Flow (prot)	0	1660	0	0	1764	1555	1921	1709	0	1426	1615	0
Flt Permitted		0.711			0.705					0.225		
Satd. Flow (perm)	0	1224	0	0	1284	1518	1921	1709	0	338	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				49		10				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		4	4		1	1					1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Adj. Flow (vph)	30	6	2	88	3	49	0	889	57	21	863	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	38	0	0	91	49	0	946	0	21	865	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Minimum Split (s)	17.0	17.0		17.0	17.0	17.0	57.5	57.5		57.5	57.5	
Total Split (s)	17.0	17.0		17.0	17.0	17.0	74.0	74.0		74.0	74.0	
Total Split (%)	18.7%	18.7%		18.7%	18.7%	18.7%	81.3%	81.3%		81.3%	81.3%	
Maximum Green (s)	11.0	11.0		11.0	11.0	11.0	67.5	67.5		67.5	67.5	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0	6.0	6.5	6.5		6.5	6.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
v/c Ratio		0.26			0.59	0.22		0.74		0.08	0.72	
Control Delay		39.7			54.5	13.6		11.3		4.2	11.0	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		39.7			54.5	13.6		11.3		4.2	11.0	
LOS		D			D	B		B		A	B	
Approach Delay		39.7			40.2			11.3			10.8	
Approach LOS		D			D			B			B	

Intersection Summary	
Area Type: Other	
Cycle Length: 91	
Actuated Cycle Length: 91	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Pretimed	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 13.6	Intersection LOS: B
Intersection Capacity Utilization 82.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	38	91	49	946	21	865
v/c Ratio	0.26	0.59	0.22	0.74	0.08	0.72
Control Delay	39.7	54.5	13.6	11.3	4.2	11.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.7	54.5	13.6	11.3	4.2	11.0
Queue Length 50th (m)	5.8	15.3	0.0	77.3	0.8	69.1
Queue Length 95th (m)	15.2	#34.3	9.8	124.8	2.8	111.8
Internal Link Dist (m)	53.1	355.9		273.6		78.6
Turn Bay Length (m)			20.0		40.0	
Base Capacity (vph)	149	155	226	1270	250	1197
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.59	0.22	0.74	0.08	0.72

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	6	2	84	3	47	0	853	55	20	828	2
Future Volume (vph)	29	6	2	84	3	47	0	853	55	20	828	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.98		1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.98	1.00		1.00		1.00	1.00	
Frt		0.99			1.00	0.85		0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1655			1737	1518		1709		1426	1614	
Flt Permitted		0.71			0.71	1.00		1.00		0.23	1.00	
Satd. Flow (perm)		1223			1285	1518		1709		338	1614	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	30	6	2	88	3	49	0	889	57	21	862	2
RTOR Reduction (vph)	0	2	0	0	0	43	0	3	0	0	0	0
Lane Group Flow (vph)	0	36	0	0	91	6	0	943	0	21	865	0
Confl. Peds. (#/hr)	1		4	4		1	1					1
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Effective Green, g (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
Clearance Time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Grp Cap (vph)		147			155	183		1267		250	1197	
v/s Ratio Prot								c0.55			0.54	
v/s Ratio Perm		0.03			c0.07	0.00				0.06		
v/c Ratio		0.25			0.59	0.03		0.74		0.08	0.72	
Uniform Delay, d1		36.2			37.9	35.3		6.8		3.2	6.5	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		4.0			15.3	0.3		4.0		0.7	3.8	
Delay (s)		40.2			53.1	35.6		10.8		3.9	10.3	
Level of Service		D			D	D		B		A	B	
Approach Delay (s)		40.2			47.0			10.8			10.2	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	82.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	72	6	2	123	14	2
Future Volume (vph)	72	6	2	123	14	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.989				0.985	
Flt Protected				0.999	0.957	
Satd. Flow (prot)	1727	0	0	1844	1811	0
Flt Permitted				0.999	0.957	
Satd. Flow (perm)	1727	0	0	1844	1811	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	10%	10%	10%	4%	0%	0%
Adj. Flow (vph)	83	7	2	141	16	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	90	0	0	143	18	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 18.1%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	72	6	2	123	14	2
Future Volume (Veh/h)	72	6	2	123	14	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	83	7	2	141	16	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			90		232	86
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			90		232	86
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			100		98	100
cM capacity (veh/h)			1456		760	978

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	90	143	18
Volume Left	0	2	16
Volume Right	7	0	2
cSH	1700	1456	779
Volume to Capacity	0.05	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s)	0.0	0.1	9.7
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.7
Approach LOS			A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	18.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	2	0	0	15	6	0
Future Volume (vph)	2	0	0	15	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1825	0	0	1921	1921	0
Flt Permitted	0.950					
Satd. Flow (perm)	1825	0	0	1921	1921	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	145.0			95.3	69.0	
Travel Time (s)	10.9			7.1	5.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	2	0	0	15	6	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	2	0	0	15	6	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	0	0	15	6	0
Future Volume (Veh/h)	2	0	0	15	6	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	0	0	15	6	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	21	6	6			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	21	6	6			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	1001	1083	1628			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	2	15	6
Volume Left	2	0	0
Volume Right	0	0	0
cSH	1001	1628	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

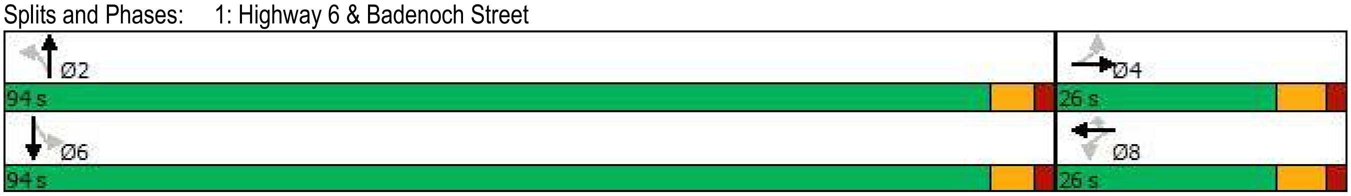
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	4	1	119	5	46	2	861	68	35	1003	5
Future Volume (vph)	13	4	1	119	5	46	2	861	68	35	1003	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99	0.97					1.00	
Frt		0.993				0.850		0.989			0.999	
Flt Protected		0.964			0.954		0.950			0.950		
Satd. Flow (prot)	0	1836	0	0	1798	1601	1825	1722	0	1825	1794	0
Flt Permitted		0.755			0.721		0.176			0.214		
Satd. Flow (perm)	0	1433	0	0	1345	1560	338	1722	0	411	1794	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				48		9			1	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Adj. Flow (vph)	14	4	1	125	5	48	2	906	72	37	1056	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	19	0	0	130	48	2	978	0	37	1061	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	25.0	25.0		25.0	25.0	
Minimum Split (s)	17.5	17.5		17.5	17.5	17.5	57.5	57.5		57.5	57.5	
Total Split (s)	26.0	26.0		26.0	26.0	26.0	94.0	94.0		94.0	94.0	
Total Split (%)	21.7%	21.7%		21.7%	21.7%	21.7%	78.3%	78.3%		78.3%	78.3%	
Maximum Green (s)	19.5	19.5		19.5	19.5	19.5	88.0	88.0		88.0	88.0	
Yellow Time (s)	4.5	4.5		4.5	4.5	4.5	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		15.9			15.9	15.9	91.0	91.0		91.0	91.0	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
v/c Ratio		0.10			0.73	0.19	0.01	0.74		0.12	0.78	
Control Delay		43.0			72.0	14.1	4.5	12.9		5.5	14.2	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		43.0			72.0	14.1	4.5	12.9		5.5	14.2	
LOS		D			E	B	A	B		A	B	
Approach Delay		43.0			56.4			12.9			13.9	
Approach LOS		D			E			B			B	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 119.4
Natural Cycle: 75
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 17.0 Intersection LOS: B
Intersection Capacity Utilization 82.0% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	19	130	48	2	978	37	1061
v/c Ratio	0.10	0.73	0.19	0.01	0.74	0.12	0.78
Control Delay	43.0	72.0	14.1	4.5	12.9	5.5	14.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.0	72.0	14.1	4.5	12.9	5.5	14.2
Queue Length 50th (m)	3.7	28.7	0.0	0.1	108.8	2.0	126.2
Queue Length 95th (m)	10.6	49.6	10.5	0.8	181.0	5.7	208.8
Internal Link Dist (m)	53.1	355.9			273.6		78.6
Turn Bay Length (m)			20.0	15.0		40.0	
Base Capacity (vph)	234	219	294	257	1314	313	1367
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.59	0.16	0.01	0.74	0.12	0.78

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	4	1	119	5	46	2	861	68	35	1003	5
Future Volume (vph)	13	4	1	119	5	46	2	861	68	35	1003	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.97	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.99	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1831			1780	1560	1825	1722		1825	1794	
Flt Permitted		0.75			0.72	1.00	0.18	1.00		0.21	1.00	
Satd. Flow (perm)		1433			1344	1560	338	1722		410	1794	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	14	4	1	125	5	48	2	906	72	37	1056	5
RTOR Reduction (vph)	0	1	0	0	0	42	0	2	0	0	0	0
Lane Group Flow (vph)	0	18	0	0	130	6	2	976	0	37	1061	0
Confl. Peds. (#/hr)	1		2	2		1	2					2
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		15.9			15.9	15.9	91.0	91.0		91.0	91.0	
Effective Green, g (s)		15.9			15.9	15.9	91.0	91.0		91.0	91.0	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
Clearance Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		190			178	207	257	1312		312	1367	
v/s Ratio Prot								0.57			c0.59	
v/s Ratio Perm		0.01			c0.10	0.00	0.01			0.09		
v/c Ratio		0.10			0.73	0.03	0.01	0.74		0.12	0.78	
Uniform Delay, d1		45.4			49.7	45.0	3.4	7.8		3.7	8.3	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			14.3	0.1	0.1	3.9		0.8	4.4	
Delay (s)		45.7			64.0	45.1	3.5	11.7		4.5	12.6	
Level of Service		D			E	D	A	B		A	B	
Approach Delay (s)		45.7			58.9			11.6			12.4	
Approach LOS		D			E			B			B	

Intersection Summary			
HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	119.4	Sum of lost time (s)	12.5
Intersection Capacity Utilization	82.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	81	14	3	150	9	2
Future Volume (vph)	81	14	3	150	9	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.980				0.977	
Flt Protected				0.999	0.960	
Satd. Flow (prot)	1867	0	0	1882	1802	0
Flt Permitted				0.999	0.960	
Satd. Flow (perm)	1867	0	0	1882	1802	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Confl. Peds. (#/hr)		1	1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	2%	0%	0%
Adj. Flow (vph)	88	15	3	163	10	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	103	0	0	166	12	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 20.6%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	81	14	3	150	9	2
Future Volume (Veh/h)	81	14	3	150	9	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	88	15	3	163	10	2
Pedestrians				1	1	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			104		266	98
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			104		266	98
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1499		726	962

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	103	166	12
Volume Left	0	3	10
Volume Right	15	0	2
cSH	1700	1499	757
Volume to Capacity	0.06	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.1	9.8
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.8
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	1	0	0	10	16	1
Future Volume (vph)	1	0	0	10	16	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.992	
Flt Protected	0.950					
Satd. Flow (prot)	1825	0	0	1921	1906	0
Flt Permitted	0.950					
Satd. Flow (perm)	1825	0	0	1921	1906	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	145.0			95.3	69.0	
Travel Time (s)	10.9			7.1	5.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	1	0	0	10	16	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	0	10	17	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	0	0	10	16	1
Future Volume (Veh/h)	1	0	0	10	16	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	0	0	10	16	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	26	16	17			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	26	16	17			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	994	1068	1613			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	1	10	17
Volume Left	1	0	0
Volume Right	0	0	1
cSH	994	1613	1700
Volume to Capacity	0.00	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

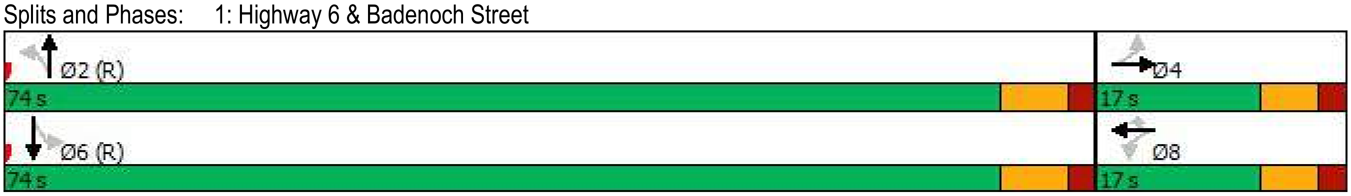
Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	6	2	85	3	45	0	942	58	20	914	2
Future Volume (vph)	32	6	2	85	3	45	0	942	58	20	914	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.98	0.98					1.00	
Frt		0.993				0.850		0.991				
Flt Protected		0.961			0.954					0.950		
Satd. Flow (prot)	0	1667	0	0	1764	1555	1921	1709	0	1426	1615	0
Flt Permitted		0.706			0.703					0.179		
Satd. Flow (perm)	0	1221	0	0	1281	1518	1921	1709	0	269	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				47		9				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		4	4		1	1					1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Adj. Flow (vph)	33	6	2	89	3	47	0	981	60	21	952	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	41	0	0	92	47	0	1041	0	21	954	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Minimum Split (s)	17.0	17.0		17.0	17.0	17.0	57.5	57.5		57.5	57.5	
Total Split (s)	17.0	17.0		17.0	17.0	17.0	74.0	74.0		74.0	74.0	
Total Split (%)	18.7%	18.7%		18.7%	18.7%	18.7%	81.3%	81.3%		81.3%	81.3%	
Maximum Green (s)	11.0	11.0		11.0	11.0	11.0	67.5	67.5		67.5	67.5	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0	6.0	6.5	6.5		6.5	6.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
v/c Ratio		0.28			0.60	0.21		0.82		0.11	0.80	
Control Delay		40.3			55.3	13.8		14.8		4.7	13.9	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		40.3			55.3	13.8		14.8		4.7	13.9	
LOS		D			E	B		B		A	B	
Approach Delay		40.3			41.3			14.8			13.7	
Approach LOS		D			D			B			B	

Intersection Summary	
Area Type: Other	
Cycle Length: 91	
Actuated Cycle Length: 91	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Pretimed	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 16.5	Intersection LOS: B
Intersection Capacity Utilization 86.8%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	41	92	47	1041	21	954
v/c Ratio	0.28	0.60	0.21	0.82	0.11	0.80
Control Delay	40.3	55.3	13.8	14.8	4.7	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.3	55.3	13.8	14.8	4.7	13.9
Queue Length 50th (m)	6.3	15.5	0.0	97.7	0.8	86.5
Queue Length 95th (m)	15.9	#34.8	9.6	164.6	2.9	146.6
Internal Link Dist (m)	53.1	355.9		273.6		78.6
Turn Bay Length (m)			20.0		40.0	
Base Capacity (vph)	149	154	224	1269	199	1197
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.60	0.21	0.82	0.11	0.80

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	6	2	85	3	45	0	942	58	20	914	2
Future Volume (vph)	32	6	2	85	3	45	0	942	58	20	914	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.98		1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.98	1.00		1.00		1.00	1.00	
Frt		0.99			1.00	0.85		0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1663			1738	1518		1709		1426	1614	
Flt Permitted		0.71			0.70	1.00		1.00		0.18	1.00	
Satd. Flow (perm)		1222			1280	1518		1709		269	1614	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	33	6	2	89	3	47	0	981	60	21	952	2
RTOR Reduction (vph)	0	2	0	0	0	41	0	2	0	0	0	0
Lane Group Flow (vph)	0	39	0	0	92	6	0	1039	0	21	954	0
Confl. Peds. (#/hr)	1		4	4		1	1					1
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Effective Green, g (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
Clearance Time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Grp Cap (vph)		147			154	183		1267		199	1197	
v/s Ratio Prot								c0.61			0.59	
v/s Ratio Perm		0.03			c0.07	0.00				0.08		
v/c Ratio		0.27			0.60	0.03		0.82		0.11	0.80	
Uniform Delay, d1		36.3			37.9	35.3		7.7		3.3	7.4	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		4.4			15.9	0.3		6.0		1.1	5.6	
Delay (s)		40.7			53.8	35.6		13.8		4.4	13.0	
Level of Service		D			D	D		B		A	B	
Approach Delay (s)		40.7			47.7			13.8			12.8	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	16.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	79	1	1	136	0	0
Future Volume (vph)	79	1	1	136	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999					
Flt Protected						
Satd. Flow (prot)	1745	0	0	1847	1921	0
Flt Permitted						
Satd. Flow (perm)	1745	0	0	1847	1921	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	10%	10%	10%	4%	0%	0%
Adj. Flow (vph)	91	1	1	156	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	92	0	0	157	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 11.3%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	79	1	1	136	0	0
Future Volume (Veh/h)	79	1	1	136	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	91	1	1	156	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			92		250	92
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			92		250	92
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1454		743	971

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	92	157	0
Volume Left	0	1	0
Volume Right	1	0	0
cSH	1700	1454	1700
Volume to Capacity	0.05	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.1	0.0
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	0.0
Approach LOS			A

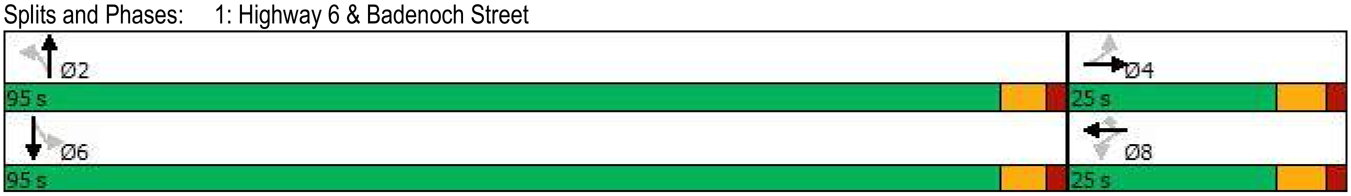
Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	11.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	4	1	127	5	47	2	951	67	31	1108	5
Future Volume (vph)	14	4	1	127	5	47	2	951	67	31	1108	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99	0.97					1.00	
Frt		0.993				0.850		0.990			0.999	
Flt Protected		0.964			0.954		0.950			0.950		
Satd. Flow (prot)	0	1836	0	0	1798	1601	1825	1723	0	1825	1794	0
Flt Permitted		0.744			0.719		0.124			0.170		
Satd. Flow (perm)	0	1413	0	0	1341	1560	238	1723	0	327	1794	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				45		8				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Adj. Flow (vph)	15	4	1	134	5	49	2	1001	71	33	1166	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	139	49	2	1072	0	33	1171	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	25.0	25.0		25.0	25.0	
Minimum Split (s)	17.5	17.5		17.5	17.5	17.5	57.5	57.5		57.5	57.5	
Total Split (s)	25.0	25.0		25.0	25.0	25.0	95.0	95.0		95.0	95.0	
Total Split (%)	20.8%	20.8%		20.8%	20.8%	20.8%	79.2%	79.2%		79.2%	79.2%	
Maximum Green (s)	18.5	18.5		18.5	18.5	18.5	89.0	89.0		89.0	89.0	
Yellow Time (s)	4.5	4.5		4.5	4.5	4.5	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		16.1			16.1	16.1	91.3	91.3		91.3	91.3	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
v/c Ratio		0.11			0.77	0.20	0.01	0.82		0.13	0.86	
Control Delay		43.8			77.0	16.4	4.5	16.3		5.8	18.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		43.8			77.0	16.4	4.5	16.3		5.8	18.9	
LOS		D			E	B	A	B		A	B	
Approach Delay		43.8			61.2			16.3			18.5	
Approach LOS		D			E			B			B	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 119.9	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 21.0	Intersection LOS: C
Intersection Capacity Utilization 86.7%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	20	139	49	2	1072	33	1171
v/c Ratio	0.11	0.77	0.20	0.01	0.82	0.13	0.86
Control Delay	43.8	77.0	16.4	4.5	16.3	5.8	18.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.8	77.0	16.4	4.5	16.3	5.8	18.9
Queue Length 50th (m)	3.9	31.3	0.8	0.1	145.1	1.9	174.2
Queue Length 95th (m)	11.1	#57.7	11.7	0.8	225.8	5.3	#273.1
Internal Link Dist (m)	53.1	355.9			273.6		78.6
Turn Bay Length (m)			20.0	15.0		40.0	
Base Capacity (vph)	218	206	278	181	1313	248	1365
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.67	0.18	0.01	0.82	0.13	0.86

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	4	1	127	5	47	2	951	67	31	1108	5
Future Volume (vph)	14	4	1	127	5	47	2	951	67	31	1108	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.97	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.99	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1831			1780	1560	1825	1723		1825	1795	
Flt Permitted		0.74			0.72	1.00	0.12	1.00		0.17	1.00	
Satd. Flow (perm)		1414			1342	1560	238	1723		327	1795	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	15	4	1	134	5	49	2	1001	71	33	1166	5
RTOR Reduction (vph)	0	1	0	0	0	39	0	2	0	0	0	0
Lane Group Flow (vph)	0	19	0	0	139	10	2	1070	0	33	1171	0
Confl. Peds. (#/hr)	1		2	2		1	2					2
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		16.1			16.1	16.1	91.3	91.3		91.3	91.3	
Effective Green, g (s)		16.1			16.1	16.1	91.3	91.3		91.3	91.3	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
Clearance Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		189			180	209	181	1312		249	1366	
v/s Ratio Prot								0.62			c0.65	
v/s Ratio Perm		0.01			c0.10	0.01	0.01			0.10		
v/c Ratio		0.10			0.77	0.05	0.01	0.82		0.13	0.86	
Uniform Delay, d1		45.6			50.1	45.2	3.4	9.0		3.8	9.8	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			18.3	0.1	0.1	5.7		1.1	7.1	
Delay (s)		45.8			68.5	45.3	3.6	14.7		4.9	16.9	
Level of Service		D			E	D	A	B		A	B	
Approach Delay (s)		45.8			62.4			14.7			16.6	
Approach LOS		D			E			B			B	

Intersection Summary			
HCM 2000 Control Delay	19.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	119.9	Sum of lost time (s)	12.5
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	90	0	1	166	1	1
Future Volume (vph)	90	0	1	166	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.932	
Flt Protected					0.976	
Satd. Flow (prot)	1902	0	0	1884	1748	0
Flt Permitted					0.976	
Satd. Flow (perm)	1902	0	0	1884	1748	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Confl. Peds. (#/hr)		1	1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	2%	0%	0%
Adj. Flow (vph)	98	0	1	180	1	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	98	0	0	181	2	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 19.9%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	90	0	1	166	1	1
Future Volume (Veh/h)	90	0	1	166	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	98	0	1	180	1	1
Pedestrians				1	1	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			99		281	100
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			99		281	100
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1505		712	959

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	98	181	2
Volume Left	0	1	1
Volume Right	0	0	1
cSH	1700	1505	818
Volume to Capacity	0.06	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.0	9.4
Lane LOS		A	A
Approach Delay (s)	0.0	0.0	9.4
Approach LOS			A

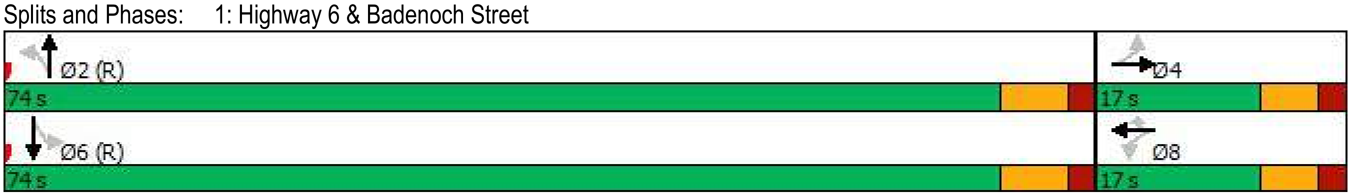
Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	19.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	6	2	92	3	52	0	942	60	22	914	2
Future Volume (vph)	32	6	2	92	3	52	0	942	60	22	914	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.98	0.98					1.00	
Frt		0.993				0.850		0.991				
Flt Protected		0.961			0.954					0.950		
Satd. Flow (prot)	0	1667	0	0	1764	1555	1921	1709	0	1426	1615	0
Flt Permitted		0.702			0.702					0.178		
Satd. Flow (perm)	0	1214	0	0	1279	1518	1921	1709	0	267	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				54		10				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		4	4		1	1					1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Adj. Flow (vph)	33	6	2	96	3	54	0	981	63	23	952	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	41	0	0	99	54	0	1044	0	23	954	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Minimum Split (s)	17.0	17.0		17.0	17.0	17.0	57.5	57.5		57.5	57.5	
Total Split (s)	17.0	17.0		17.0	17.0	17.0	74.0	74.0		74.0	74.0	
Total Split (%)	18.7%	18.7%		18.7%	18.7%	18.7%	81.3%	81.3%		81.3%	81.3%	
Maximum Green (s)	11.0	11.0		11.0	11.0	11.0	67.5	67.5		67.5	67.5	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0	6.0	6.5	6.5		6.5	6.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
v/c Ratio		0.28			0.64	0.23		0.82		0.12	0.80	
Control Delay		40.4			58.7	13.4		14.9		4.9	13.9	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		40.4			58.7	13.4		14.9		4.9	13.9	
LOS		D			E	B		B		A	B	
Approach Delay		40.4			42.7			14.9			13.7	
Approach LOS		D			D			B			B	

Intersection Summary	
Area Type:	Other
Cycle Length: 91	
Actuated Cycle Length: 91	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Pretimed	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 16.8	Intersection LOS: B
Intersection Capacity Utilization 87.0%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	41	99	54	1044	23	954
v/c Ratio	0.28	0.64	0.23	0.82	0.12	0.80
Control Delay	40.4	58.7	13.4	14.9	4.9	13.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	58.7	13.4	14.9	4.9	13.9
Queue Length 50th (m)	6.3	16.8	0.0	97.9	0.9	86.5
Queue Length 95th (m)	15.9	#38.5	10.3	165.6	3.3	146.6
Internal Link Dist (m)	53.1	355.9		273.6		78.6
Turn Bay Length (m)			20.0		40.0	
Base Capacity (vph)	148	154	230	1270	198	1197
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.64	0.23	0.82	0.12	0.80

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	6	2	92	3	52	0	942	60	22	914	2
Future Volume (vph)	32	6	2	92	3	52	0	942	60	22	914	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.98		1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.98	1.00		1.00		1.00	1.00	
Frt		0.99			1.00	0.85		0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1663			1737	1518		1709		1426	1614	
Flt Permitted		0.70			0.70	1.00		1.00		0.18	1.00	
Satd. Flow (perm)		1214			1279	1518		1709		267	1614	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	33	6	2	96	3	54	0	981	62	23	952	2
RTOR Reduction (vph)	0	2	0	0	0	47	0	3	0	0	0	0
Lane Group Flow (vph)	0	39	0	0	99	7	0	1041	0	23	954	0
Confl. Peds. (#/hr)	1		4	4		1	1					1
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Effective Green, g (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
Clearance Time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Grp Cap (vph)		146			154	183		1267		198	1197	
v/s Ratio Prot								c0.61			0.59	
v/s Ratio Perm		0.03			c0.08	0.00				0.09		
v/c Ratio		0.27			0.64	0.04		0.82		0.12	0.80	
Uniform Delay, d1		36.3			38.1	35.3		7.8		3.3	7.4	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		4.5			18.8	0.4		6.1		1.2	5.6	
Delay (s)		40.8			57.0	35.7		13.9		4.5	13.0	
Level of Service		D			E	D		B		A	B	
Approach Delay (s)		40.8			49.4			13.9			12.8	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM 2000 Control Delay	16.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	79	6	2	136	14	2
Future Volume (vph)	79	6	2	136	14	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.990				0.985	
Flt Protected				0.999	0.957	
Satd. Flow (prot)	1729	0	0	1844	1811	0
Flt Permitted				0.999	0.957	
Satd. Flow (perm)	1729	0	0	1844	1811	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	10%	10%	10%	4%	0%	0%
Adj. Flow (vph)	91	7	2	156	16	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	98	0	0	158	18	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 18.8%		ICU Level of Service A
Analysis Period (min) 15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	79	6	2	136	14	2
Future Volume (Veh/h)	79	6	2	136	14	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	91	7	2	156	16	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			98		254	94
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			98		254	94
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			100		98	100
cM capacity (veh/h)			1446		737	968

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	98	158	18
Volume Left	0	2	16
Volume Right	7	0	2
cSH	1700	1446	758
Volume to Capacity	0.06	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.6
Control Delay (s)	0.0	0.1	9.9
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	18.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	2	0	0	15	6	0
Future Volume (vph)	2	0	0	15	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1825	0	0	1921	1921	0
Flt Permitted	0.950					
Satd. Flow (perm)	1825	0	0	1921	1921	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	145.0			95.3	69.0	
Travel Time (s)	10.9			7.1	5.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	2	0	0	15	6	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	2	0	0	15	6	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	0	0	15	6	0
Future Volume (Veh/h)	2	0	0	15	6	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	0	0	15	6	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	21	6	6			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	21	6	6			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	1001	1083	1628			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	2	15	6
Volume Left	2	0	0
Volume Right	0	0	0
cSH	1001	1628	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

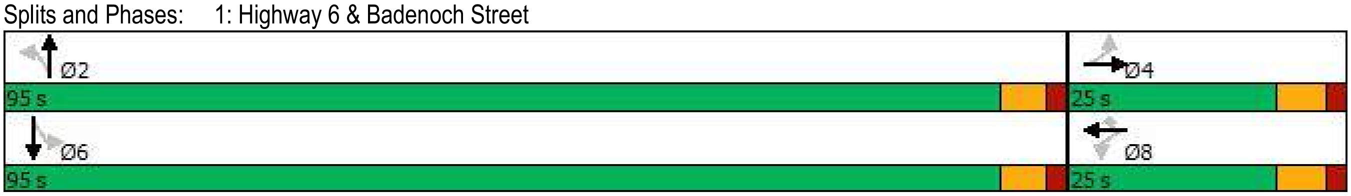
Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	4	1	131	5	51	2	951	74	38	1108	5
Future Volume (vph)	14	4	1	131	5	51	2	951	74	38	1108	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99	0.97					1.00	
Frt		0.993				0.850		0.989			0.999	
Flt Protected		0.964			0.954		0.950			0.950		
Satd. Flow (prot)	0	1836	0	0	1798	1601	1825	1722	0	1825	1794	0
Flt Permitted		0.744			0.719		0.122			0.165		
Satd. Flow (perm)	0	1413	0	0	1341	1560	234	1722	0	317	1794	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				49		9				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Adj. Flow (vph)	15	4	1	138	5	54	2	1001	78	40	1166	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	143	54	2	1079	0	40	1171	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	25.0	25.0		25.0	25.0	
Minimum Split (s)	17.5	17.5		17.5	17.5	17.5	57.5	57.5		57.5	57.5	
Total Split (s)	25.0	25.0		25.0	25.0	25.0	95.0	95.0		95.0	95.0	
Total Split (%)	20.8%	20.8%		20.8%	20.8%	20.8%	79.2%	79.2%		79.2%	79.2%	
Maximum Green (s)	18.5	18.5		18.5	18.5	18.5	89.0	89.0		89.0	89.0	
Yellow Time (s)	4.5	4.5		4.5	4.5	4.5	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		16.4			16.4	16.4	91.1	91.1		91.1	91.1	
Actuated g/C Ratio		0.14			0.14	0.14	0.76	0.76		0.76	0.76	
v/c Ratio		0.10			0.78	0.21	0.01	0.82		0.17	0.86	
Control Delay		43.7			77.8	16.3	4.5	16.8		6.4	19.1	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		43.7			77.8	16.3	4.5	16.8		6.4	19.1	
LOS		D			E	B	A	B		A	B	
Approach Delay		43.7			60.9			16.8			18.7	
Approach LOS		D			E			B			B	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 120	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 21.4	Intersection LOS: C
Intersection Capacity Utilization 87.1%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	20	143	54	2	1079	40	1171
v/c Ratio	0.10	0.78	0.21	0.01	0.82	0.17	0.86
Control Delay	43.7	77.8	16.3	4.5	16.8	6.4	19.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.7	77.8	16.3	4.5	16.8	6.4	19.1
Queue Length 50th (m)	3.9	32.3	1.0	0.1	150.6	2.4	177.6
Queue Length 95th (m)	11.1	#60.1	12.4	0.8	230.8	6.4	#273.1
Internal Link Dist (m)	53.1	355.9			273.6		78.6
Turn Bay Length (m)			20.0	15.0		40.0	
Base Capacity (vph)	218	206	281	177	1309	240	1362
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.69	0.19	0.01	0.82	0.17	0.86

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	4	1	131	5	51	2	951	74	38	1108	5
Future Volume (vph)	14	4	1	131	5	51	2	951	74	38	1108	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.97	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.99	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1831			1780	1560	1825	1722		1825	1795	
Flt Permitted		0.74			0.72	1.00	0.12	1.00		0.17	1.00	
Satd. Flow (perm)		1414			1341	1560	234	1722		317	1795	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	15	4	1	138	5	54	2	1001	78	40	1166	5
RTOR Reduction (vph)	0	1	0	0	0	42	0	2	0	0	0	0
Lane Group Flow (vph)	0	19	0	0	143	12	2	1077	0	40	1171	0
Confl. Peds. (#/hr)	1		2	2		1	2					2
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		16.4			16.4	16.4	91.1	91.1		91.1	91.1	
Effective Green, g (s)		16.4			16.4	16.4	91.1	91.1		91.1	91.1	
Actuated g/C Ratio		0.14			0.14	0.14	0.76	0.76		0.76	0.76	
Clearance Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		193			183	213	177	1307		240	1362	
v/s Ratio Prot								0.63			c0.65	
v/s Ratio Perm		0.01			c0.11	0.01	0.01			0.13		
v/c Ratio		0.10			0.78	0.05	0.01	0.82		0.17	0.86	
Uniform Delay, d1		45.3			50.1	45.1	3.5	9.3		4.0	10.0	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			19.2	0.1	0.1	6.0		1.5	7.3	
Delay (s)		45.6			69.3	45.2	3.6	15.3		5.5	17.3	
Level of Service		D			E	D	A	B		A	B	
Approach Delay (s)		45.6			62.7			15.3			16.9	
Approach LOS		D			E			B			B	

Intersection Summary			
HCM 2000 Control Delay	20.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	90	14	3	166	9	2
Future Volume (vph)	90	14	3	166	9	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.982				0.977	
Flt Protected				0.999	0.960	
Satd. Flow (prot)	1870	0	0	1882	1802	0
Flt Permitted				0.999	0.960	
Satd. Flow (perm)	1870	0	0	1882	1802	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Confl. Peds. (#/hr)		1	1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	2%	0%	0%
Adj. Flow (vph)	98	15	3	180	10	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	113	0	0	183	12	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 21.5%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	90	14	3	166	9	2
Future Volume (Veh/h)	90	14	3	166	9	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	98	15	3	180	10	2
Pedestrians				1	1	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			114		292	108
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			114		292	108
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1486		701	950

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	113	183	12
Volume Left	0	3	10
Volume Right	15	0	2
cSH	1700	1486	733
Volume to Capacity	0.07	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.1	10.0
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	10.0
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	21.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	1	0	0	10	16	1
Future Volume (vph)	1	0	0	10	16	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.992	
Flt Protected	0.950					
Satd. Flow (prot)	1825	0	0	1921	1906	0
Flt Permitted	0.950					
Satd. Flow (perm)	1825	0	0	1921	1906	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	145.0			95.3	69.0	
Travel Time (s)	10.9			7.1	5.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	1	0	0	10	16	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	0	10	17	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	0	0	10	16	1
Future Volume (Veh/h)	1	0	0	10	16	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	0	0	10	16	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	26	16	17			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	26	16	17			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	994	1068	1613			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	1	10	17
Volume Left	1	0	0
Volume Right	0	0	1
cSH	994	1613	1700
Volume to Capacity	0.00	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

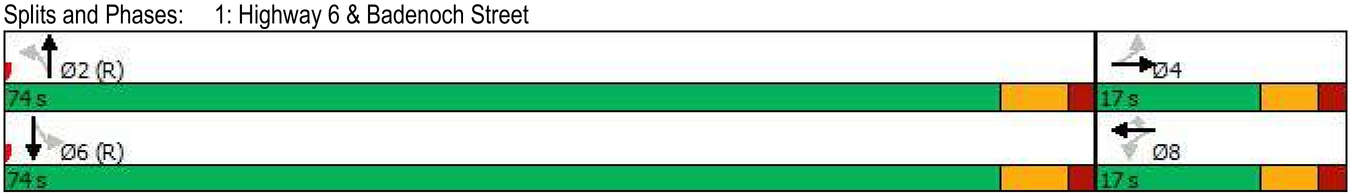
Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	7	2	94	3	49	0	1040	64	22	1009	2
Future Volume (vph)	36	7	2	94	3	49	0	1040	64	22	1009	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.98	0.98					1.00	
Frt		0.994				0.850		0.991				
Flt Protected		0.961			0.954					0.950		
Satd. Flow (prot)	0	1678	0	0	1764	1555	1921	1709	0	1426	1615	0
Flt Permitted		0.699			0.698					0.126		
Satd. Flow (perm)	0	1217	0	0	1271	1518	1921	1709	0	189	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				51		9				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		4	4		1	1					1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Adj. Flow (vph)	38	7	2	98	3	51	0	1083	67	23	1051	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	47	0	0	101	51	0	1150	0	23	1053	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Minimum Split (s)	17.0	17.0		17.0	17.0	17.0	57.5	57.5		57.5	57.5	
Total Split (s)	17.0	17.0		17.0	17.0	17.0	74.0	74.0		74.0	74.0	
Total Split (%)	18.7%	18.7%		18.7%	18.7%	18.7%	81.3%	81.3%		81.3%	81.3%	
Maximum Green (s)	11.0	11.0		11.0	11.0	11.0	67.5	67.5		67.5	67.5	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0	6.0	6.5	6.5		6.5	6.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
v/c Ratio		0.32			0.66	0.22		0.91		0.16	0.88	
Control Delay		41.7			60.2	13.6		21.7		6.5	19.7	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		41.7			60.2	13.6		21.7		6.5	19.7	
LOS		D			E	B		C		A	B	
Approach Delay		41.7			44.6			21.7			19.4	
Approach LOS		D			D			C			B	

Intersection Summary	
Area Type:	Other
Cycle Length: 91	
Actuated Cycle Length: 91	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 90	
Control Type: Pretimed	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay: 22.5	Intersection LOS: C
Intersection Capacity Utilization 92.4%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	47	101	51	1150	23	1053
v/c Ratio	0.32	0.66	0.22	0.91	0.16	0.88
Control Delay	41.7	60.2	13.6	21.7	6.5	19.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	60.2	13.6	21.7	6.5	19.7
Queue Length 50th (m)	7.3	17.2	0.0	128.8	1.0	112.4
Queue Length 95th (m)	17.8	#39.8	10.1	#263.4	3.8	#239.3
Internal Link Dist (m)	53.1	355.9		273.6		78.6
Turn Bay Length (m)			20.0		40.0	
Base Capacity (vph)	148	153	228	1269	140	1197
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.66	0.22	0.91	0.16	0.88

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	7	2	94	3	49	0	1040	64	22	1009	2
Future Volume (vph)	36	7	2	94	3	49	0	1040	64	22	1009	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.98		1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.98	1.00		1.00		1.00	1.00	
Frt		0.99			1.00	0.85		0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1674			1737	1518		1709		1426	1614	
Flt Permitted		0.70			0.70	1.00		1.00		0.13	1.00	
Satd. Flow (perm)		1218			1271	1518		1709		188	1614	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	38	7	2	98	3	51	0	1083	67	23	1051	2
RTOR Reduction (vph)	0	2	0	0	0	45	0	2	0	0	0	0
Lane Group Flow (vph)	0	45	0	0	101	6	0	1148	0	23	1053	0
Confl. Peds. (#/hr)	1		4	4		1	1					1
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Effective Green, g (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
Clearance Time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Grp Cap (vph)		147			153	183		1267		139	1197	
v/s Ratio Prot								c0.67			0.65	
v/s Ratio Perm		0.04			c0.08	0.00				0.12		
v/c Ratio		0.31			0.66	0.03		0.91		0.17	0.88	
Uniform Delay, d1		36.5			38.2	35.3		9.2		3.5	8.7	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		5.4			20.2	0.3		10.9		2.6	9.4	
Delay (s)		41.9			58.4	35.7		20.1		6.0	18.1	
Level of Service		D			E	D		C		A	B	
Approach Delay (s)		41.9			50.8			20.1			17.8	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	92.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	88	1	1	150	0	0
Future Volume (vph)	88	1	1	150	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999					
Flt Protected						
Satd. Flow (prot)	1745	0	0	1847	1921	0
Flt Permitted						
Satd. Flow (perm)	1745	0	0	1847	1921	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	10%	10%	10%	4%	0%	0%
Adj. Flow (vph)	101	1	1	172	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	102	0	0	173	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type: Other	
Control Type: Unsignalized	
Intersection Capacity Utilization 12.0%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	88	1	1	150	0	0
Future Volume (Veh/h)	88	1	1	150	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	101	1	1	172	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			102		276	102
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			102		276	102
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1441		718	959

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	102	173	0
Volume Left	0	1	0
Volume Right	1	0	0
cSH	1700	1441	1700
Volume to Capacity	0.06	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS		A	A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	12.0%	ICU Level of Service	A
Analysis Period (min)	15		

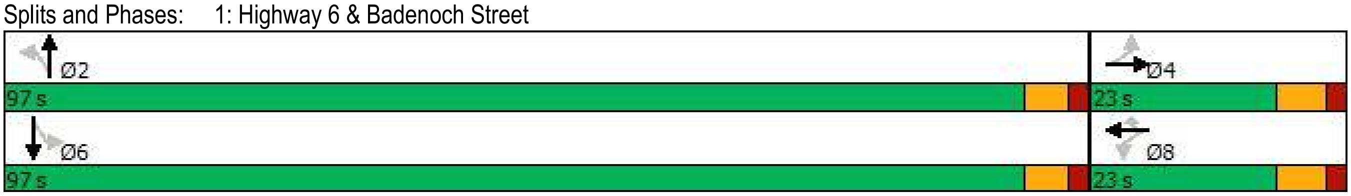
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	4	1	140	6	52	2	1050	74	34	1223	6
Future Volume (vph)	16	4	1	140	6	52	2	1050	74	34	1223	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99	0.97					1.00	
Frt		0.994				0.850		0.990			0.999	
Flt Protected		0.963			0.954		0.950			0.950		
Satd. Flow (prot)	0	1836	0	0	1798	1601	1825	1723	0	1825	1794	0
Flt Permitted		0.677			0.718		0.064			0.120		
Satd. Flow (perm)	0	1287	0	0	1340	1560	123	1723	0	231	1794	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				45		9			1	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Adj. Flow (vph)	17	4	1	147	6	55	2	1105	78	36	1287	6
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	22	0	0	153	55	2	1183	0	36	1293	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	25.0	25.0		25.0	25.0	
Minimum Split (s)	17.5	17.5		17.5	17.5	17.5	57.5	57.5		57.5	57.5	
Total Split (s)	23.0	23.0		23.0	23.0	23.0	97.0	97.0		97.0	97.0	
Total Split (%)	19.2%	19.2%		19.2%	19.2%	19.2%	80.8%	80.8%		80.8%	80.8%	
Maximum Green (s)	16.5	16.5		16.5	16.5	16.5	91.0	91.0		91.0	91.0	
Yellow Time (s)	4.5	4.5		4.5	4.5	4.5	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		15.8			15.8	15.8	91.7	91.7		91.7	91.7	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
v/c Ratio		0.13			0.87	0.23	0.02	0.90		0.20	0.94	
Control Delay		46.1			91.7	19.4	4.0	22.0		7.3	27.7	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		46.1			91.7	19.4	4.0	22.0		7.3	27.7	
LOS		D			F	B	A	C		A	C	
Approach Delay		46.1			72.6			22.0			27.1	
Approach LOS		D			E			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 28.5 Intersection LOS: C
Intersection Capacity Utilization 92.3% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	22	153	55	2	1183	36	1293
v/c Ratio	0.13	0.87	0.23	0.02	0.90	0.20	0.94
Control Delay	46.1	91.7	19.4	4.0	22.0	7.3	27.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	91.7	19.4	4.0	22.0	7.3	27.7
Queue Length 50th (m)	4.4	35.5	2.1	0.1	181.9	2.1	224.7
Queue Length 95th (m)	12.3	#71.5	14.0	0.8	#337.7	6.1	#380.3
Internal Link Dist (m)	53.1	355.9			273.6		78.6
Turn Bay Length (m)			20.0	15.0		40.0	
Base Capacity (vph)	177	184	253	94	1318	176	1370
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.83	0.22	0.02	0.90	0.20	0.94

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	4	1	140	6	52	2	1050	74	34	1223	6
Future Volume (vph)	16	4	1	140	6	52	2	1050	74	34	1223	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.97	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.99	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1830			1780	1560	1825	1723		1825	1794	
Flt Permitted		0.68			0.72	1.00	0.06	1.00		0.12	1.00	
Satd. Flow (perm)		1288			1340	1560	122	1723		231	1794	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	4	1	147	6	55	2	1105	78	36	1287	6
RTOR Reduction (vph)	0	1	0	0	0	39	0	2	0	0	0	0
Lane Group Flow (vph)	0	21	0	0	153	16	2	1181	0	36	1293	0
Confl. Peds. (#/hr)	1		2	2		1	2					2
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		15.8			15.8	15.8	91.7	91.7		91.7	91.7	
Effective Green, g (s)		15.8			15.8	15.8	91.7	91.7		91.7	91.7	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
Clearance Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		169			176	205	93	1316		176	1370	
v/s Ratio Prot								0.69			c0.72	
v/s Ratio Perm		0.02			c0.11	0.01	0.02			0.16		
v/c Ratio		0.13			0.87	0.08	0.02	0.90		0.20	0.94	
Uniform Delay, d1		46.0			51.1	45.7	3.4	10.6		4.0	12.0	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			33.6	0.2	0.4	9.9		2.6	14.1	
Delay (s)		46.3			84.7	45.9	3.8	20.5		6.6	26.1	
Level of Service		D			F	D	A	C		A	C	
Approach Delay (s)		46.3			74.4			20.4			25.6	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	27.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	99	0	1	184	1	1
Future Volume (vph)	99	0	1	184	1	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt					0.932	
Flt Protected					0.976	
Satd. Flow (prot)	1902	0	0	1884	1748	0
Flt Permitted					0.976	
Satd. Flow (perm)	1902	0	0	1884	1748	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Confl. Peds. (#/hr)		1	1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	2%	0%	0%
Adj. Flow (vph)	108	0	1	200	1	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	108	0	0	201	2	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary		
Area Type:	Other	
Control Type: Unsignalized		
Intersection Capacity Utilization 20.8%		ICU Level of Service A
Analysis Period (min) 15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	99	0	1	184	1	1
Future Volume (Veh/h)	99	0	1	184	1	1
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	108	0	1	200	1	1
Pedestrians				1	1	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			109		311	110
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			109		311	110
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1493		685	947

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	108	201	2
Volume Left	0	1	1
Volume Right	0	0	1
cSH	1700	1493	795
Volume to Capacity	0.06	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.1
Control Delay (s)	0.0	0.0	9.5
Lane LOS		A	A
Approach Delay (s)	0.0	0.0	9.5
Approach LOS			A

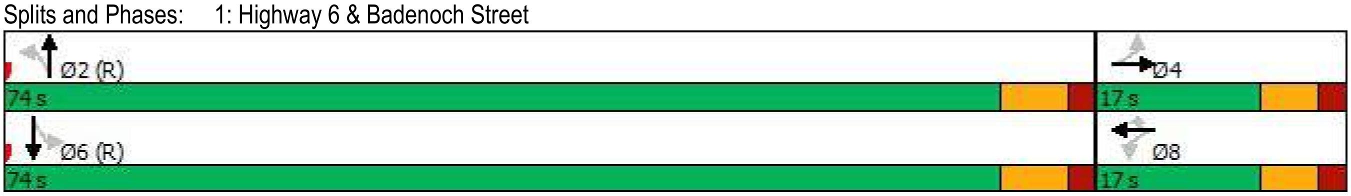
Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	20.8%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	7	2	101	3	56	0	1040	66	24	1009	2
Future Volume (vph)	36	7	2	101	3	56	0	1040	66	24	1009	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.98	0.98					1.00	
Frt		0.994				0.850		0.991				
Flt Protected		0.961			0.954					0.950		
Satd. Flow (prot)	0	1678	0	0	1764	1555	1921	1709	0	1426	1615	0
Flt Permitted		0.695			0.697					0.125		
Satd. Flow (perm)	0	1210	0	0	1269	1518	1921	1709	0	188	1615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2				58		10				
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		4	4		1	1					1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Adj. Flow (vph)	38	7	2	105	3	58	0	1083	69	25	1051	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	47	0	0	108	58	0	1152	0	25	1053	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Minimum Split (s)	17.0	17.0		17.0	17.0	17.0	57.5	57.5		57.5	57.5	
Total Split (s)	17.0	17.0		17.0	17.0	17.0	74.0	74.0		74.0	74.0	
Total Split (%)	18.7%	18.7%		18.7%	18.7%	18.7%	81.3%	81.3%		81.3%	81.3%	
Maximum Green (s)	11.0	11.0		11.0	11.0	11.0	67.5	67.5		67.5	67.5	
Yellow Time (s)	4.0	4.0		4.0	4.0	4.0	4.5	4.5		4.5	4.5	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.0			6.0	6.0	6.5	6.5		6.5	6.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Act Effct Green (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
v/c Ratio		0.32			0.71	0.25		0.91		0.18	0.88	
Control Delay		41.8			64.4	13.2		21.8		7.0	19.7	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		41.8			64.4	13.2		21.8		7.0	19.7	
LOS		D			E	B		C		A	B	
Approach Delay		41.8			46.5			21.8			19.4	
Approach LOS		D			D			C			B	

Intersection Summary	
Area Type:	Other
Cycle Length: 91	
Actuated Cycle Length: 91	
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green	
Natural Cycle: 90	
Control Type: Pretimed	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay: 22.8	Intersection LOS: C
Intersection Capacity Utilization 92.5%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBT	SBL	SBT
Lane Group Flow (vph)	47	108	58	1152	25	1053
v/c Ratio	0.32	0.71	0.25	0.91	0.18	0.88
Control Delay	41.8	64.4	13.2	21.8	7.0	19.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.8	64.4	13.2	21.8	7.0	19.7
Queue Length 50th (m)	7.3	18.5	0.0	129.3	1.1	112.4
Queue Length 95th (m)	17.8	#43.1	10.6	#264.1	4.0	#239.3
Internal Link Dist (m)	53.1	355.9		273.6		78.6
Turn Bay Length (m)			20.0		40.0	
Base Capacity (vph)	148	153	234	1270	139	1197
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.71	0.25	0.91	0.18	0.88

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	7	2	101	3	56	0	1040	66	24	1009	2
Future Volume (vph)	36	7	2	101	3	56	0	1040	66	24	1009	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.98		1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.98	1.00		1.00		1.00	1.00	
Frt		0.99			1.00	0.85		0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00		1.00		0.95	1.00	
Satd. Flow (prot)		1674			1737	1518		1709		1426	1614	
Flt Permitted		0.70			0.70	1.00		1.00		0.12	1.00	
Satd. Flow (perm)		1210			1270	1518		1709		187	1614	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	38	7	2	105	3	58	0	1083	69	25	1051	2
RTOR Reduction (vph)	0	2	0	0	0	51	0	3	0	0	0	0
Lane Group Flow (vph)	0	45	0	0	108	7	0	1149	0	25	1053	0
Confl. Peds. (#/hr)	1		4	4		1	1					1
Heavy Vehicles (%)	3%	17%	100%	4%	0%	5%	0%	12%	2%	28%	19%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Effective Green, g (s)		11.0			11.0	11.0		67.5		67.5	67.5	
Actuated g/C Ratio		0.12			0.12	0.12		0.74		0.74	0.74	
Clearance Time (s)		6.0			6.0	6.0		6.5		6.5	6.5	
Lane Grp Cap (vph)		146			153	183		1267		138	1197	
v/s Ratio Prot								c0.67			0.65	
v/s Ratio Perm		0.04			c0.09	0.00				0.13		
v/c Ratio		0.31			0.71	0.04		0.91		0.18	0.88	
Uniform Delay, d1		36.5			38.4	35.3		9.3		3.5	8.7	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		5.4			23.9	0.4		11.0		2.9	9.4	
Delay (s)		42.0			62.4	35.7		20.3		6.4	18.1	
Level of Service		D			E	D		C		A	B	
Approach Delay (s)		42.0			53.1			20.3			17.8	
Approach LOS		D			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	21.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	91.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	88	6	2	150	14	2
Future Volume (vph)	88	6	2	150	14	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.991				0.985	
Flt Protected				0.999	0.957	
Satd. Flow (prot)	1731	0	0	1844	1811	0
Flt Permitted				0.999	0.957	
Satd. Flow (perm)	1731	0	0	1844	1811	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	10%	10%	10%	4%	0%	0%
Adj. Flow (vph)	101	7	2	172	16	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	108	0	0	174	18	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 19.5%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	88	6	2	150	14	2
Future Volume (Veh/h)	88	6	2	150	14	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Hourly flow rate (vph)	101	7	2	172	16	2
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			108		280	104
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			108		280	104
tC, single (s)			4.2		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.3		3.5	3.3
p0 queue free %			100		98	100
cM capacity (veh/h)			1434		713	956

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	108	174	18
Volume Left	0	2	16
Volume Right	7	0	2
cSH	1700	1434	733
Volume to Capacity	0.06	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.6
Control Delay (s)	0.0	0.1	10.0
Lane LOS		A	B
Approach Delay (s)	0.0	0.1	10.0
Approach LOS			B

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	19.5%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	2	0	0	15	6	0
Future Volume (vph)	2	0	0	15	6	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1825	0	0	1921	1921	0
Flt Permitted	0.950					
Satd. Flow (perm)	1825	0	0	1921	1921	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	145.0			95.3	69.0	
Travel Time (s)	10.9			7.1	5.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%
Adj. Flow (vph)	2	0	0	15	6	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	2	0	0	15	6	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	0	0	15	6	0
Future Volume (Veh/h)	2	0	0	15	6	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	0	0	15	6	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	21	6	6			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	21	6	6			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	1001	1083	1628			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	2	15	6
Volume Left	2	0	0
Volume Right	0	0	0
cSH	1001	1628	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

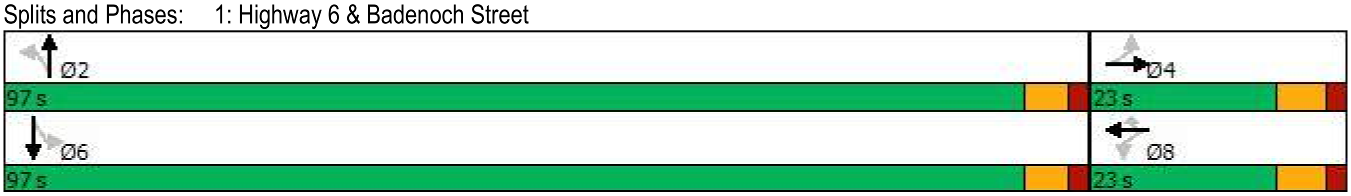
Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	4	1	144	6	56	2	1050	81	41	1223	6
Future Volume (vph)	16	4	1	144	6	56	2	1050	81	41	1223	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		0.0	0.0		20.0	15.0		0.0	40.0		0.0
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			0.99	0.97					1.00	
Frt		0.994				0.850		0.989			0.999	
Flt Protected		0.963			0.954		0.950			0.950		
Satd. Flow (prot)	0	1836	0	0	1798	1601	1825	1722	0	1825	1794	0
Flt Permitted		0.664			0.718		0.063			0.116		
Satd. Flow (perm)	0	1263	0	0	1340	1560	121	1722	0	223	1794	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1				47		10			1	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		77.1			379.9			297.6			102.6	
Travel Time (s)		5.8			28.5			22.3			7.7	
Confl. Peds. (#/hr)	1		2	2		1	2					2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Adj. Flow (vph)	17	4	1	152	6	59	2	1105	85	43	1287	6
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	22	0	0	158	59	2	1190	0	43	1293	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
Two way Left Turn Lane												
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	25.0	25.0		25.0	25.0	
Minimum Split (s)	17.5	17.5		17.5	17.5	17.5	57.5	57.5		57.5	57.5	
Total Split (s)	23.0	23.0		23.0	23.0	23.0	97.0	97.0		97.0	97.0	
Total Split (%)	19.2%	19.2%		19.2%	19.2%	19.2%	80.8%	80.8%		80.8%	80.8%	
Maximum Green (s)	16.5	16.5		16.5	16.5	16.5	91.0	91.0		91.0	91.0	
Yellow Time (s)	4.5	4.5		4.5	4.5	4.5	4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	6.0	6.0		6.0	6.0	6.0	6.0	6.0		6.0	6.0	
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0		0	0	
Act Effct Green (s)		15.9			15.9	15.9	91.6	91.6		91.6	91.6	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
v/c Ratio		0.13			0.89	0.24	0.02	0.90		0.25	0.95	
Control Delay		46.1			95.2	19.8	4.0	22.8		8.6	28.0	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		46.1			95.2	19.8	4.0	22.8		8.6	28.0	
LOS		D			F	B	A	C		A	C	
Approach Delay		46.1			74.7			22.7			27.3	
Approach LOS		D			E			C			C	

Intersection Summary	
Area Type: Other	
Cycle Length: 120	
Actuated Cycle Length: 120	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 29.2	Intersection LOS: C
Intersection Capacity Utilization 92.8%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Highway 6 & Badenoch Street



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	22	158	59	2	1190	43	1293
v/c Ratio	0.13	0.89	0.24	0.02	0.90	0.25	0.95
Control Delay	46.1	95.2	19.8	4.0	22.8	8.6	28.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	95.2	19.8	4.0	22.8	8.6	28.0
Queue Length 50th (m)	4.4	36.9	2.5	0.1	185.7	2.6	224.7
Queue Length 95th (m)	12.3	#74.4	14.7	0.8	#341.2	7.6	#380.3
Internal Link Dist (m)	53.1	355.9			273.6		78.6
Turn Bay Length (m)			20.0	15.0		40.0	
Base Capacity (vph)	174	184	255	92	1316	170	1368
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.86	0.23	0.02	0.90	0.25	0.95

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	4	1	144	6	56	2	1050	81	41	1223	6
Future Volume (vph)	16	4	1	144	6	56	2	1050	81	41	1223	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00			1.00	0.97	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			0.99	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected		0.96			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1831			1780	1560	1825	1722		1825	1794	
Flt Permitted		0.66			0.72	1.00	0.06	1.00		0.12	1.00	
Satd. Flow (perm)		1263			1340	1560	120	1722		223	1794	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	4	1	152	6	59	2	1105	85	43	1287	6
RTOR Reduction (vph)	0	1	0	0	0	41	0	2	0	0	0	0
Lane Group Flow (vph)	0	21	0	0	158	18	2	1188	0	43	1293	0
Confl. Peds. (#/hr)	1		2	2		1	2					2
Heavy Vehicles (%)	0%	0%	0%	2%	0%	2%	0%	11%	2%	0%	7%	0%
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		15.9			15.9	15.9	91.6	91.6		91.6	91.6	
Effective Green, g (s)		15.9			15.9	15.9	91.6	91.6		91.6	91.6	
Actuated g/C Ratio		0.13			0.13	0.13	0.76	0.76		0.76	0.76	
Clearance Time (s)		6.5			6.5	6.5	6.0	6.0		6.0	6.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		167			177	206	91	1314		170	1369	
v/s Ratio Prot								0.69			c0.72	
v/s Ratio Perm		0.02			c0.12	0.01	0.02			0.19		
v/c Ratio		0.13			0.89	0.09	0.02	0.90		0.25	0.94	
Uniform Delay, d1		45.9			51.2	45.7	3.4	10.8		4.2	12.0	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			38.7	0.2	0.4	10.4		3.5	14.2	
Delay (s)		46.3			89.9	45.9	3.9	21.2		7.7	26.3	
Level of Service		D			F	D	A	C		A	C	
Approach Delay (s)		46.3			77.9			21.2			25.7	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM 2000 Control Delay	28.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	99	14	3	184	9	2
Future Volume (vph)	99	14	3	184	9	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.984				0.977	
Flt Protected				0.999	0.960	
Satd. Flow (prot)	1874	0	0	1882	1802	0
Flt Permitted				0.999	0.960	
Satd. Flow (perm)	1874	0	0	1882	1802	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	379.9			142.3	69.0	
Travel Time (s)	28.5			10.7	5.2	
Confl. Peds. (#/hr)		1	1			1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	0%	0%	2%	0%	0%
Adj. Flow (vph)	108	15	3	200	10	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	123	0	0	203	12	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	0.0			0.0	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 22.4%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	99	14	3	184	9	2
Future Volume (Veh/h)	99	14	3	184	9	2
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	108	15	3	200	10	2
Pedestrians				1	1	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.2	1.2	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	380					
pX, platoon unblocked						
vC, conflicting volume			124		322	118
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			124		322	118
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1474		673	938

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	123	203	12
Volume Left	0	3	10
Volume Right	15	0	2
cSH	1700	1474	707
Volume to Capacity	0.07	0.00	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.1	10.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.1	10.2
Approach LOS			B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	22.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	1	0	0	10	16	1
Future Volume (vph)	1	0	0	10	16	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.992	
Flt Protected	0.950					
Satd. Flow (prot)	1825	0	0	1921	1906	0
Flt Permitted	0.950					
Satd. Flow (perm)	1825	0	0	1921	1906	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	145.0			95.3	69.0	
Travel Time (s)	10.9			7.1	5.2	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Adj. Flow (vph)	1	0	0	10	16	1
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1	0	0	10	17	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary	
Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 13.3%	ICU Level of Service A
Analysis Period (min) 15	

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	0	0	10	16	1
Future Volume (Veh/h)	1	0	0	10	16	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	0	0	10	16	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	26	16	17			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	26	16	17			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	994	1068	1613			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	1	10	17
Volume Left	1	0	0
Volume Right	0	0	1
cSH	994	1613	1700
Volume to Capacity	0.00	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	8.6	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.6	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 1: Highway 6 & Badenoch Street

Movement	EB	WB	WB	NB	SB	SB
Directions Served	LTR	LT	R	TR	L	TR
Maximum Queue (m)	30.6	56.5	22.5	249.2	36.8	110.5
Average Queue (m)	9.4	21.3	10.8	105.8	7.9	74.0
95th Queue (m)	21.5	43.7	24.5	213.1	24.5	125.9
Link Distance (m)	69.4	365.0		291.6		93.9
Upstream Blk Time (%)				0		6
Queuing Penalty (veh)				0		0
Storage Bay Dist (m)			20.0		40.0	
Storage Blk Time (%)		14	2	21	0	12
Queuing Penalty (veh)		7	2	0	0	3

Intersection: 1: Highway 6 & Badenoch Street

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (m)	16.1	82.3	22.6	6.8	246.7	36.3	111.0
Average Queue (m)	4.9	36.4	12.9	0.4	124.1	10.9	92.4
95th Queue (m)	13.5	66.3	27.5	3.4	241.9	27.0	125.4
Link Distance (m)	69.4	365.0			291.6		93.9
Upstream Blk Time (%)					2		18
Queuing Penalty (veh)					0		0
Storage Bay Dist (m)			20.0	15.0		40.0	
Storage Blk Time (%)		36	2		20	0	18
Queuing Penalty (veh)		19	4		0	1	6

Intersection: 1: Highway 6 & Badenoch Street

Movement	EB	WB	WB	NB	SB	SB
Directions Served	LTR	LT	R	TR	L	TR
Maximum Queue (m)	37.2	51.7	22.5	241.1	31.4	110.4
Average Queue (m)	11.3	23.4	12.7	117.0	10.2	74.2
95th Queue (m)	26.8	45.7	25.8	231.0	27.5	122.2
Link Distance (m)	69.4	365.0		291.6		93.9
Upstream Blk Time (%)				2		6
Queuing Penalty (veh)				0		0
Storage Bay Dist (m)			20.0		40.0	
Storage Blk Time (%)		13	6	22	0	12
Queuing Penalty (veh)		7	6	0	1	3

Intersection: 1: Highway 6 & Badenoch Street

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (m)	19.9	87.8	22.5	6.8	303.3	42.2	112.5
Average Queue (m)	5.0	36.6	12.9	0.3	141.1	17.0	96.0
95th Queue (m)	14.2	67.7	27.2	3.0	275.6	40.1	120.4
Link Distance (m)	69.4	365.0			291.6		93.9
Upstream Blk Time (%)					2		22
Queuing Penalty (veh)					0		0
Storage Bay Dist (m)			20.0	15.0		40.0	
Storage Blk Time (%)		37	3		20	6	19
Queuing Penalty (veh)		21	4		0	73	8

Appendix C

Transportation Tomorrow Survey 2016

AM Inbound

Mon Feb 13 2023 08:43:58 GMT-0500 (Eastern Standard Time) -

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of origin - pd_orig
Column: 2006 GTA zone of destination - gta06_dest

RowG:
ColG:(8307,8315)
TblG:

Filters:
Start time of trip - start_time In 600-900
and
Trip purpose of destination - purp_dest In H,

Trip 2016
Table:

,1	
Kitchener	20

AM Outbound

Mon Feb 13 2023 08:42:08 GMT-0500 (Eastern Standard Time) - Run Time: 2835ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of destination - pd_dest
Column: 2006 GTA zone of origin - gta06_orig

RowG:
ColG:(8307,8315)
TblG:

Filters:
Start time of trip - start_time In 600-900
and
Trip purpose of origin - purp_orig In H,

Trip 2016
Table:

,1		N	S	E	N Trips	S Trips	E Trips
PD 3 of Torontc	9	1			9	0	0
Scugog	113	1			113	0	0
Milton	44	1			44	0	0
Burlington	44	0.5	0.5		22	22	0
Kitchener	97	1			97	0	0
City of Guelph	175	0.5		0.5	87.5	0	87.5
Puslinch	175		1		0	175	0
Brantford	113	0.5	0.5		56.5	56.5	0
Sum	**770**				**429**	**253.5**	**87.5**
					56%	33%	11%

PM Inbound

Mon Feb 13 2023 08:43:44 GMT-0500 (Eastern Standard Time) - Run Time: 2605ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of origin - pd_orig
Column: 2006 GTA zone of destination - gta06_dest

RowG:
ColG:(8307,8315)
TblG:

Filters:
Start time of trip - start_time In 1600-1900
and
Trip purpose of destination - purp_dest In H,

Trip 2016
Table:

,1		N	S	E	W	N Trips	S Trips	E Trips	W Trips	
PD 3 of Torontc	9	0.5	0.5			4.5	4.5	0	0	
Milton	156	1				156	0	0	0	
Burlington	44		1			0	44	0	0	
Flamborough	45		0.5		0.5	0	22.5	0	22.5	
Kitchener	78	1				78	0	0	0	
City of Guelph	131	0.5		0.5		65.5	0	65.5	0	
Puslinch	64		1			0	64	0	0	
Sum	**527**					**304**	**135**	**65.5**	**22.5**	**527**
						58%	26%	12%	4%	

PM Outbound

Mon Feb 13 2023 08:43:17 GMT-0500 (Eastern Standard Time) - Run Time: 2476ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of destination - pd_dest
Column: 2006 GTA zone of origin - gta06_orig

RowG:
ColG:(8307,8315)
TblG:

Filters:
Start time of trip - start_time In 1600-1900
and
Trip purpose of origin - purp_orig In H,

Trip 2016
Table:

,1	
Milton	89
Puslinch	20

TOTAL - TTS

		N	S	E	W	
AM	Inbound					0%
	Outbound	56%	33%	11%	N/A	100%
PM	Inbound	58%	26%	12%	4%	100%
	Outbound					0%

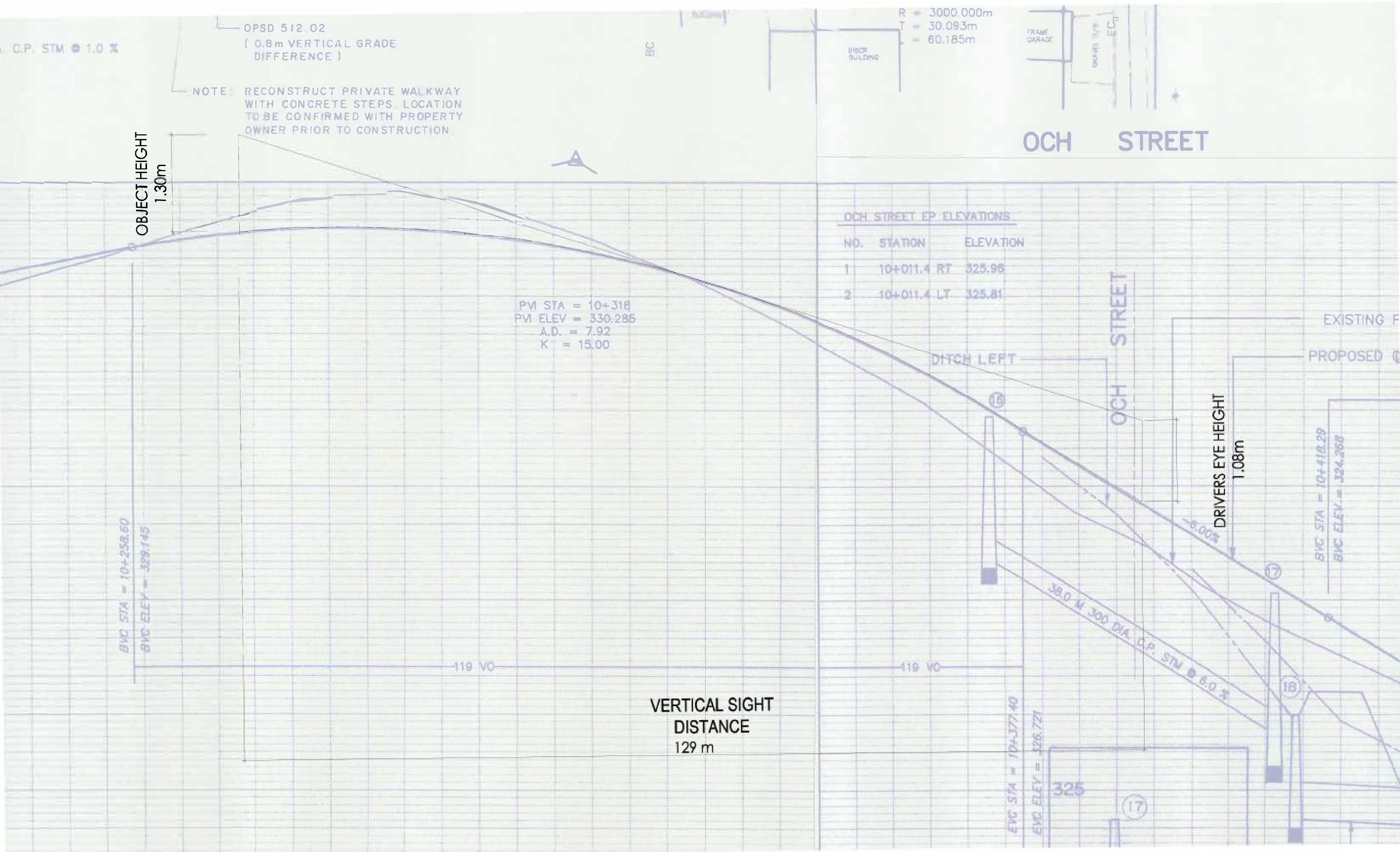
TOTAL - Adjusted

		N	S	E	W	
AM	Inbound	45%	45%	10%	0%	100%
	Outbound	45%	45%	10%	0%	100%
PM	Inbound	45%	45%	10%	0%	100%
	Outbound	45%	45%	10%	0%	100%

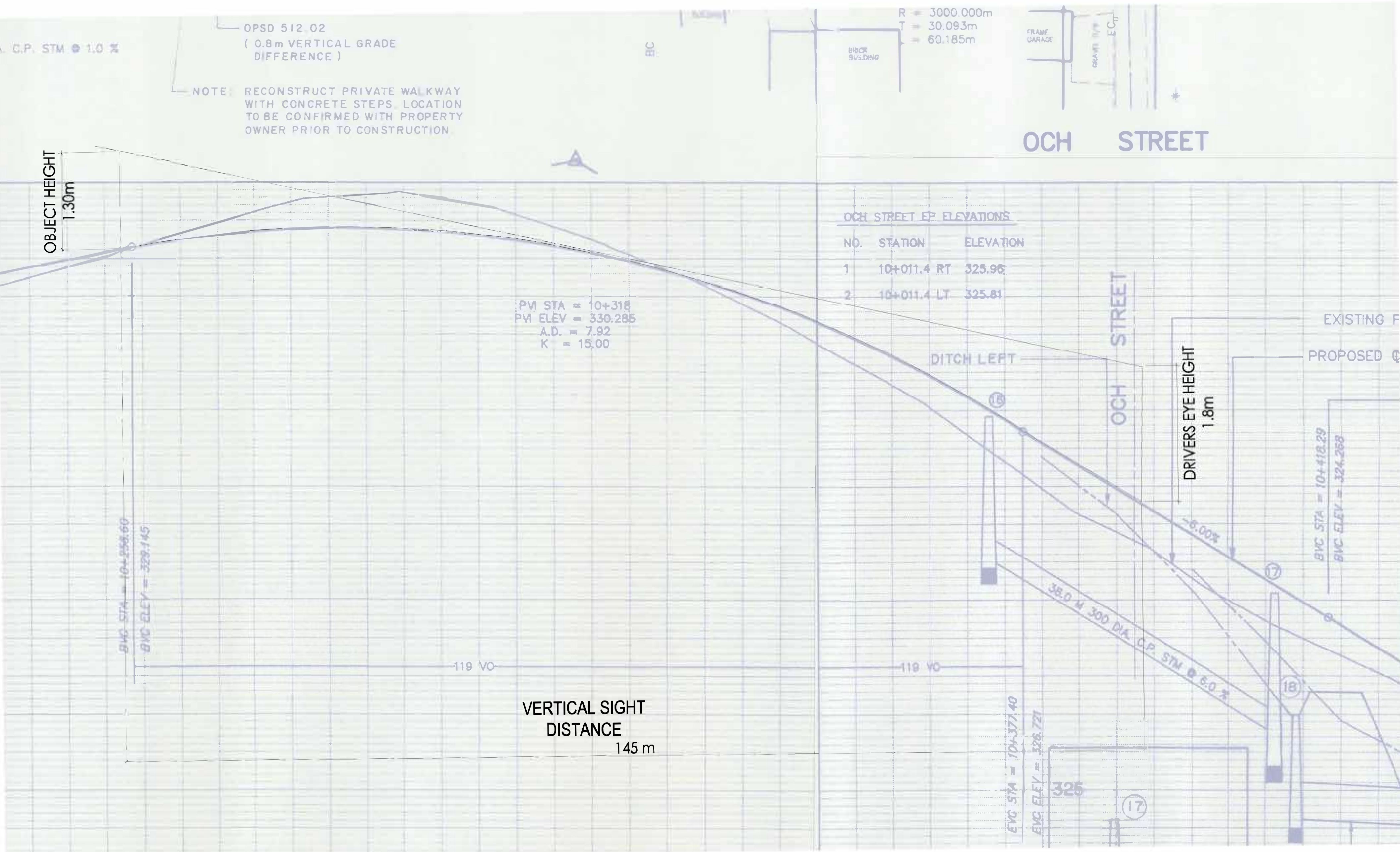
in	out
45%	45%
45%	45%
10%	10%
45%	45%
45%	45%
10%	10%

Appendix D

Sightline Assessment



Vertical Sightline – Passenger Vehicle



Vertical Sightline – Single Unit Truck

Appendix E

Response to MTO Comments

GHD Limited is pleased to submit the following updated Traffic Impact Study in support of the proposed residential development located on part of lots 7 & 8 North of Queen Street and Part of lot 31 Concession 8, located generally southeast of the intersection of Highway 6 and Badenoch Street in the Township of Puslinch.

The updated TIS report, dated December 2023, is in response to comments provided by the MTO, County of Wellington, and the Township of Puslinch from their review of the first submission, dated February 2023. This letter presents the MTO's comments and GHD's respective responses. The County and Township expressed concerns with having the site's access on Ochs Street due to potential sightline concerns at the intersection of Badenoch Street and Ochs Street. The TIS has also been updated to address the concern related to the sightline issues at the existing intersection.

Response to MTO Comments

<u>Comment #1</u>

MTO: The intersection capacity analysis at Highway 6 and Badenoch Street must be analysed using PHF = 0.92 using Synchro. MTO require justification of what value is being used for saturation flow in Synchro.
GHD Response: The intersection of Highway 6 and Badenoch Street currently operates with a high volume of traffic in the north/south direction during both peak hours resulting in a PHF of 0.96 during the a.m. peak hour and 0.95 during the p.m. peak hour. Reducing the peak hour factor from the existing to 0.92 would further increase the delays at an already busy intersection. Additionally, the MTO's TIS guidelines do not specifically state that a PHF of 0.92 must be used so it is unclear why a PHF of 0.92 is being requested.

<u>Comment #2</u>

MTO: (P11) trip distribution says that TTS is not used because the neighbouring zones have sample sizes that are too low. How were trip distributions assumed? Were they assumed from TMCs?
GHD Response: The TIS was revised to state that the existing travel patterns were derived from the TMCs.

<u>Comment #3</u>

MTO: (P17) future background 2034 v/c > 0.85, future background + development 2034 v/c > 0.85. MTO Protocol for critical threshold v/c is 0.85 for intersections. MTO protocol says that if v/c is > 0.85, SP must provide traffic engineering solutions to correct the problem. However, since background for 2034 is already > 0.85, SP will need to determine the impact of the development only on the intersection. MTO and developer to enter into a legal agreement and cost sharing agreement for the required improvements.
GHD Response: Based on the review of the capacity analysis under the 2034 horizon year, the subject site is expected to negligibly impact the operation of the intersection, some examples from movements in which site traffic has been assigned to include:

1. The overall v/c ratio increasing by 0.01 during both peak hours (0.87 to 0.88 during the a.m. peak hour and 0.93 to 0.94 during the p.m. peak hour).
2. The overall delay remaining at 22 seconds during the a.m. peak hour and increasing by 1 second from 27 seconds to 28 seconds during the p.m. peak hour.

3. The delay for the westbound shared through/left movement increasing by four seconds (58 to 62 seconds) during the a.m. peak hour and increasing by five seconds during the p.m. peak hour (85 to 90 seconds)
4. The delay in the southbound left-turn movement remaining unchanged at 6 seconds during the a.m. peak hour and increasing by one second from 7 to 8 seconds during the p.m. peak hour.
5. The delay in the northbound shared through/right remaining at 20 seconds during the a.m. peak hour and increasing by a second from 20 to 21 seconds during the p.m. peak hour.

As a result, the site generated traffic will have a marginal impact on the operation of the intersection and no geometric improvements have been recommended as a result of the subject site.

In addition, due to the unique geometry and lane alignment as well as limited right-of-way, there is no opportunity to revise the lane configuration to provide intersection improvements that can mitigate the capacity issues which are predominately a result of the assumed corridor growth rate increasing volumes to the 2034 horizon year. The existing volumes in the north/south direction along Highway 6 with the addition of 2% per annum growth rate for 11 years up to the 2034 horizon year primarily causes the higher delays under the future horizon years and the Morriston Bypass is the geometric solution to reduce the high v/c ratios and delays experienced at this intersection.

Comment #4

MTO: SP indicates v/c will be reduced because of Morriston Bypass. MTO have no timeline for when the Morriston Bypass will be constructed. MTO will require that trip assignment analysis be completed for future years without consideration of the Morriston bypass.
GHD Response: The distribution was not completed based on the assumption that the Morriston Bypass will be built, it was noted that the distribution would not significantly change as a result of the Bypass.

Comment #5

MTO: MTO require that the SP complete queue/storage analysis at approach lanes at intersections, using MTO Protocol below if they are impacted MTO facilities. If non-MTO facilities, Synchro analysis will be sufficient.
GHD Response: GHD calculated the recommended left-turn storage length for the southbound left-turn lane at the intersection of Highway 6 and Badenoch Street. Based on the MTO's Protocol, a storage length of 30 metres would be required to accommodate the southbound left-turn volume during the peak hours. The southbound left-turn lane provides a storage length of approximately 40 metres, satisfying the calculated recommended storage length.
GHD reviewed the MTO's Geometric Design Standards for Ontario Highways Chapter B to find a corresponding calculation for right-turn lanes, but was unable to find one. As a result, a SimTraffic analysis was completed for the westbound right-turn lane using a 15-minute seed time, 60-minute run time, and took an average of the 5 runs. Under the future total 2034 scenario, the greatest 95th percentile queue length was reported at 27 metres during the p.m. peak hour. The existing right-turn lane has a storage length of approximately 30 metres and would be able to accommodate the reported 95th percentile queue length.