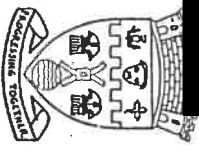


Township of Puslinch

7404 Wellington Rd. 34, R.R.3, Guelph, Ontario N1H 6H9
Telephone: (519) 763-1226 Fax (519) 763-5846



October 23rd, 2006

Dear Sir or Madam:

You will find enclosed for your information, a copy of Zoning By-law Amendment Application #P10/2006 as filed by Astrid J. Clos Planning Consultants on behalf of 1648253 Ontario Limited (Tom Kukovica) with respect to property located at Part Lots 7, 8 & 9, Concession 10.

The present zoning of this approximately 21-hectare property is 'AGRICULTURAL'. The applicant wishes to rezone this property to 'HAMLET RESIDENTIAL', which would allow him to establish a 38 lot residential plan of subdivision. The subject property is partially located within the Hamlet of Arkell. An expansion of the Hamlet Area would be required and the applicant has subsequently applied to the County of Wellington for an amendment to the Official Plan as well as an application for a Draft Plan of Subdivision.

Notice of this application has been sent to all property owners within a 1500' +/- radius of the lands, which are the subject of this application.

The Township of Puslinch Planning Advisory Committee welcomes any resident, property owner or agency to forward their comments in writing in favour of or in opposition to this application.

The Planning Advisory Committee will hold their initial review of this application at their meeting scheduled for:

Monday November 27th, 2006
Puslinch Municipal Office
8:00 p.m.

Please note that the November 27th, 2006 Planning Advisory Committee meeting will be an initial review of the application and the Township of Puslinch solicits and welcomes comments subsequent to this date should you not be able to do so by November 27th, 2006.

Should you have any questions in regard to this application, please do not hesitate to contact the Township Office.

Yours very truly,
TOWNSHIP OF PUSLINCH

[Redacted Signature]

COLLEEN SUTTON (Mrs.)
Secretary, Planning Advisory Committee

Encl.

The Corporation of the Township of Puslinch
Application for Zoning By-law Amendment

Application No P12/2006

A. THE AMENDMENT

1. TYPE OF AMENDMENT? Site Specific Other
2. WHAT IS THE PURPOSE OF AND REASONS FOR THE PROPOSED AMENDMENT(S)?

To rezone lands in order to permit the creation of residential lots within the Hamlet or Arkell.

B. GENERAL INFORMATION

3. APPLICANT INFORMATION

- a) Registered Owner's Name(s): Tom Kulsarica, 1648253 Ontario Limited
Address: RR # 1 Puslinch, Ontario, N0B 2J0
Phone: (519) 836-1072
Fax: (519) 836-3903
Email: tlak@look.ca

- b) Applicant's Name: Astrid Clos, Astrid J. Clos Planning Consultants
Address: 423 Woolwich Street, Suite 201, Guelph, Ontario, N1H 3X3
Phone: (519) 836-7526
Fax: (519) 836-9568
Email: astrid.clos@ajcplanning.ca

- c) Name, Address Phone of all persons having any mortgage charge or encumbrance on the property:
N/A
- d) Send Correspondence to? Owner Applicant Other
- e) When did the current owner acquire the subject land? September 2004

4. WHAT AREA DOES THE AMENDMENT COVER?

the "entire property" a "portion" of the property

5. PROVIDE A DESCRIPTION OF THE "ENTIRE" PROPERTY:

Municipal Address: Arkell Road/Wellington Road 37 and Watson Road
Legal Description: Part of Lots 7, 8 and 9, Concession 10, Township of Puslinch, County of Wellington
Area: 21.68 hectares
Depth: 878 m (irregular)
Frontage (width): 258 metres

6. PROVIDE A DESCRIPTION OF THE AREA TO BE AMENDED IF ONLY A "PORTION" OF THE PROPERTY: N/A
Area:
Depth:
Frontage (width):

7. WHAT IS THE CURRENT COUNTY OF WELLINGTON OFFICIAL PLAN DESIGNATION OF THE SUBJECT PROPERTY?

Hamlet Area (Arkell), Primary Agricultural, Secondary Agricultural

8. LIST LAND USES THAT ARE PERMITTED BY CURRENT OFFICIAL PLAN DESIGNATION:

Residential, Agricultural

9. WHAT IS THE CURRENT ZONING OF THE SUBJECT PROPERTY AND WHAT USES ARE PERMITTED?

Agriculture (A)

C. EXISTING AND PROPOSED LAND USES AND BUILDINGS

10. WHAT IS THE "EXISTING USE(S) OF THE SUBJECT LAND?"

Agricultural

11. HOW LONG HAS THE "EXISTING" USE(S) CONTINUED ON THE SUBJECT LAND?

Unknown.

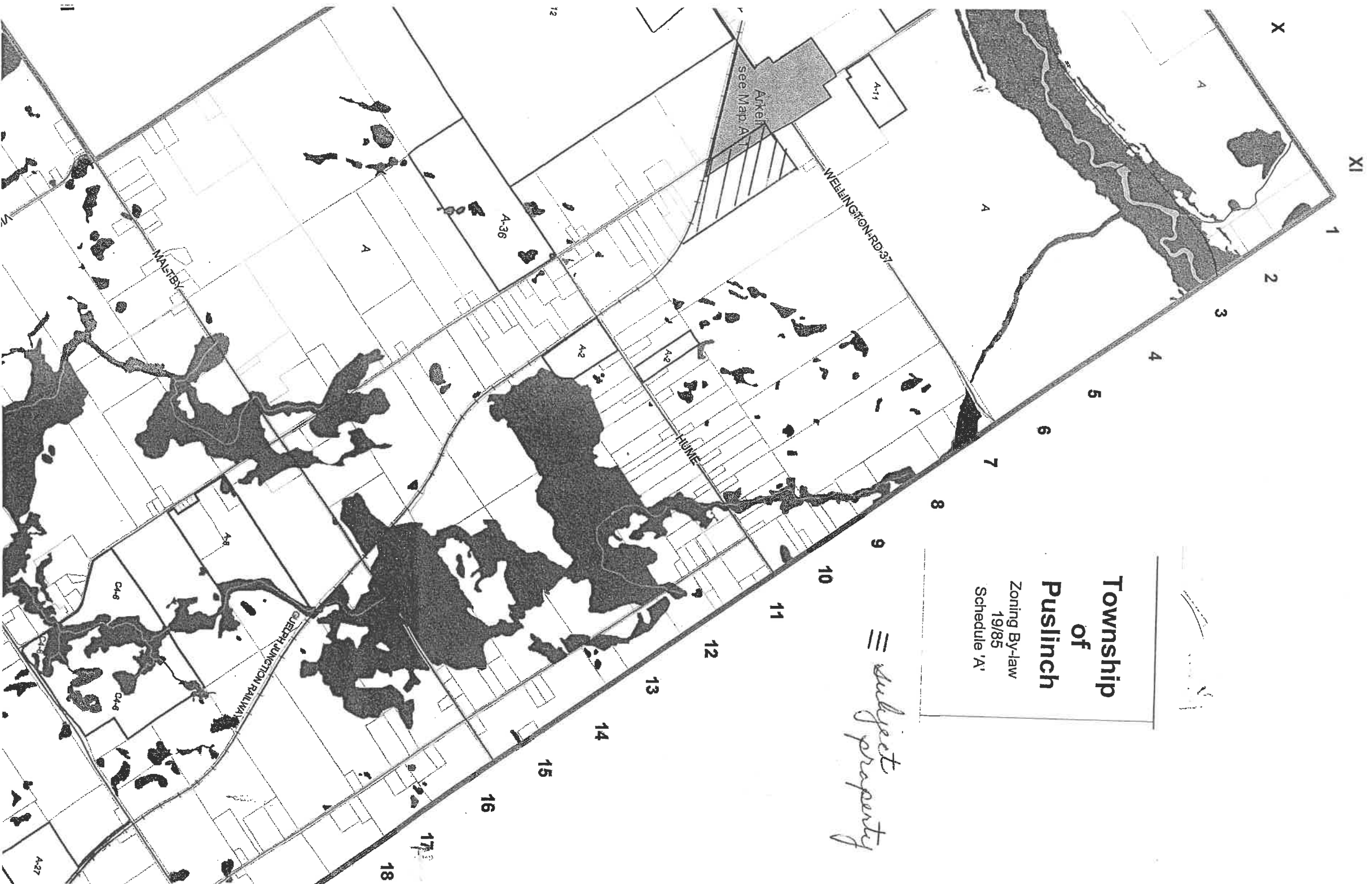
12. WHAT IS THE "PROPOSED" USE OF THE SUBJECT LAND?

Residential.

13. PROVIDE THE FOLLOWING DETAILS FOR ALL BUILDINGS OR STRUCTURES ON THE SUBJECT LAND:

Existing house and swimming pool shown on the Draft Plan of Subdivision.

	<u>Existing</u>	<u>Proposed</u>
a) Type of Building(s) or Structures		residential
b) Date of Construction		
c) Building Height		2 storeys
d) Number of Floors		2 floors
e) Total Floor Area		+3,000 sq. feet
f) Ground Floor Area (exclude basements)		+1,500 sq. feet
g) Distance from building/structure to the:		



**Township
of
Puslinch**
Zoning By-law
19/85
Schedule 'A'

≡ *subject property*

XI

X

1

2

3

4

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17

18

A-1

A-36

A-2

A-2

A-4

A-8

A-4

A-27

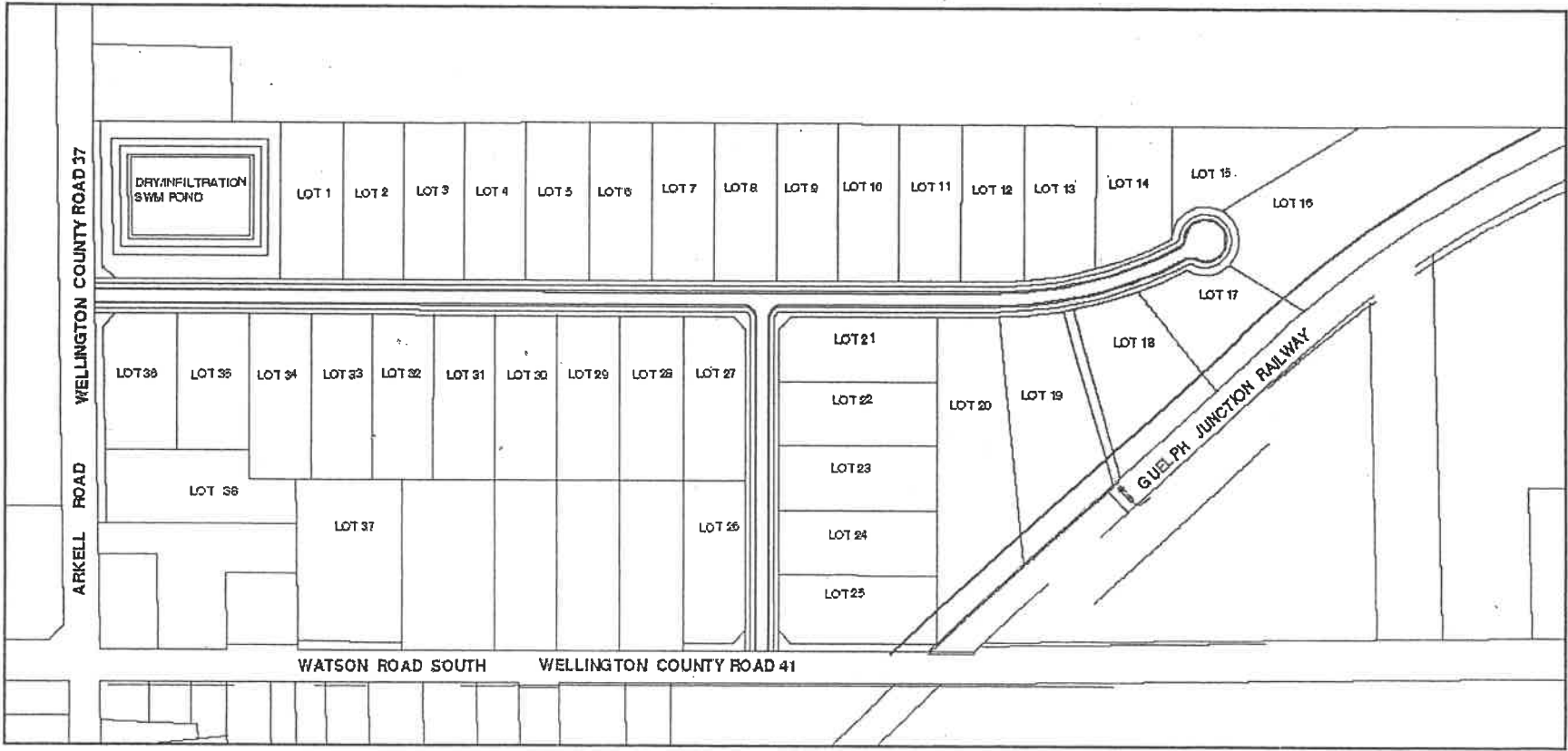
Arken
see Map A-1

WELLINGTON RD 37

HOME

MALTBY

QUEEN JUNCTION RAILWAY



PROPOSED PLAN OF SUB-DIVISION
 Part Lots 7, 8 & 9, Concession 10

	<u>Existing</u>	<u>Proposed</u>
front lot line		minimum 10 metres
side lot line		minimum 1 metre
side lot line		minimum 3 metres
rear lot line		minimum 7.5 metres

- h) % Lot Coverage
- i) # of Parking Spaces
- j) # of Loading Spaces

D. EXISTING AND PROPOSED SERVICES

14. WHAT IS THE ACCESS TO THE SUBJECT PROPERTY?

- Provincial Highway
- Continually maintained municipal road (Watson Road)
- Right-of-way
- County Road (Wellington Road 37)
- Seasonally maintained road
- Water access

15. WHAT IS THE NAME OF THE ROAD OR STREET THAT PROVIDES ACCESS TO THE SUBJECT PROPERTY?

Arkell Road/Wellington Road 37 and Watson Road

16. IF ACCESS IS BY WATER ONLY, PLEASE DESCRIBE THE PARKING AND DOCKING FACILITIES USED OR TO BE USED AND THE APPROXIMATE DISTANCE OF THESE FACILITIES FROM SUBJECT LAND TO THE NEAREST PUBLIC ROAD. (This information should be illustrated on the required drawing under item H of this application.)

N/A

17. INDICATE THE APPLICABLE WATER SUPPLY AND SEWAGE DISPOSAL:

	<u>Municipal Water</u>	<u>Communal Water</u>	<u>Private Well</u>	<u>Other Water Supply</u>	<u>Municipal Sewers</u>	<u>Communal Sewers</u>	<u>Private Septic</u>	<u>Other Sewage Disposal</u>
a) Existing	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b) Proposed	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

18. HOW IS STORM DRAINAGE PROVIDED?

Storm Sewers Ditches Swales Other means [explain below]

See the Stormwater Management Report submitted with this application.

E. OTHER RELATED PLANNING APPLICATIONS

19. HAS THE CURRENT OWNER (OR ANY PREVIOUS OWNER) MADE APPLICATION FOR ANY OF THE FOLLOWING, EITHER ON OR WITHIN 120 METRES OF THE SUBJECT LAND?

Official Plan Amendment	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Zoning By-law Amendment	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/> (The subject application)
Minor Variance	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Plan of Subdivision	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Consent (Severance)	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Site Plan Control	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

20. IF THE ANSWER TO QUESTION 19 IS YES, PLEASE PROVIDE THE FOLLOWING INFORMATION:

Official Plan Amendment

File No. and Date of Application: OP-2006-06 submitted August 16, 2006

Approval Authority: County of Wellington

Lands Subject to Application: Part of Lots 7, 8, and 9, Concession 10, Township of Puslinch
Purpose of Application: To re-designate lands from Prime Agricultural and Secondary Agricultural in the County of Wellington Official Plan to Hamlet which would expand the Arkell Hamlet and allow a 38 lot Draft Plan of Subdivision.

Status of Application: under review

Effect on the Current Application for Amendment: required to implement the Zoning application.

Draft Plan of Subdivision

File No. and Date of Application: 23T-06003 submitted August 16, 2006

Approval Authority: County of Wellington

Lands Subject to Application: Part of Lots 7, 8, and 9, Concession 10, Township of Puslinch
Purpose of Application: To create 38 residential lots.

Status of Application: under review

Effect on the Current Application for Amendment: required to implement the Draft Plan of Subdivision.

Consent (severance)

File No. and Date of Application: B98/04 approved October 2004 and B31/05, B32/05, B33/05 approved March 2005.

Approval Authority: County of Wellington

Lands Subject to Application: Part of Lots 7, 8, and 9, Concession 10, Township of Puslinch

Purpose of Application: To create residential lots.

Status of Application: approved

Effect on the Current Application for Amendment: None.

F. OTHER SUPPORTING INFORMATION

21. PLEASE LIST THE TITLES OF ANY SUPPORTING DOCUMENTS: (e.g. *Environmental Impacts Study, Hydrogeological Report, Traffic Study, Market Area Study, Aggregate License Report, Stormwater Management Report, etc.*)

Preliminary Stormwater Management and Servicing Report, 2006, Richardson Foster Ltd.
Traffic Impact Study, 2006 Richardson Foster Ltd.
Hydrogeological Review and Predictive Nitrate Assessment, July 2006, Burnside
Rail Noise and Vibration Impact Assessment, July 2006, HGC Engineering

G. APPLICATION DRAWING

22. PLEASE PROVIDE AN ACCURATE DRAWING OF THE PROPOSAL, PREFERREABLY PREPARED BY A QUALIFIED PROFESSIONAL. IN SOME CASES IT MAY BE MORE APPROPRIATE TO SUBMIT ADDITIONAL DRAWINGS AT VARYING SCALES TO BETTER ILLUSTRATE THE PROPOSAL. THE DRAWING MUST INCLUDE THE FOLLOWING INFORMATION:

- owner's/applicant's name;
- legal description of the property;
- boundaries and dimensions of the subject property and its current land use;
- dimensions of area of amendment (if not the entire property)
- the size and use of all abutting land;
- all existing and proposed parking and loading areas, driveways and lanes;
- the nature of any easements or restrictive covenants on the property;
- the location of any municipal drains or award drains;
- woodlots, forested areas, ANSI's, ESA's, wetlands, floodplains, and all natural watercourses (rivers, stream banks, etc.);
- the dimensions of all existing and proposed buildings and structures on the subject land and their distance to all lot lines;
- the name, location and width of each abutting public or private road, unopened road allowance or right of way;
- if access is to the subject land is by water only, provide the location of parking and docking facilities to be used; and
- other features both on site or nearby that in the opinion of the applicant will have an effect on the application (such as bridges, railways, airports, wells, septic systems, springs, slopes, gravel pits)

THE DRAWING SHOULD ALSO INCLUDE THE SCALE, NORTH ARROW AND DATE WHEN THE DRAWING WAS PREPARED.

H. AUTHORIZATION FOR AGENT/SOLICITOR TO ACT FOR OWNER:

(If affidavit (J) is signed by an Agent/Solicitor on Owner's behalf, the Owner's written authorization below should be completed)

I, Tom Kukovica, 1648253 Ontario Limited of the Township of Puslinch in the County of Wellington do hereby authorize Astrid J. Clos Planning Consultants to act as my agent in this application.

[Redacted Signature]

July 28, 2006

Tom Kukovica, 1648253 Ontario Limited

I. AFFIDAVIT: (This affidavit must be signed in the presence of a Commissioner)

I, Astrid Clos, Astrid J. Clos Planning Consultants of the City of Guelph, solemnly declare that all statements contained in this application are true, and I make this solemn declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath and by virtue of the CANADA EVIDENCE ACT.

DECLARED before me at the City of Guelph this 28th day of July, 2006.

[Redacted Signature]

July 28, 2006

Astrid Clos
Astrid J. Clos Planning Consultants

[Redacted Signature]

Ronald Maurice Mak, a Commissioner,
etc., Province of Ontario, for Van Harten
Surveying Inc. Expires April 9, 2009

July 28, 2006

Signature of Commissioner

APPLICATION AND FEE OF \$ 2000.00

RECEIVED BY THE MUNICIPALITY:

[Redacted Signature]

Signature of Municipal Employee

Dec. 17/06
Date

ADDENDUM TRAFFIC IMPACT STUDY

**SECTION OF LOTS 7,8 AND 9, CONCESSION 10
TOWNSHIP OF PUSLINCH
COUNTY OF WELLINGTON**

PREPARED FOR:

**TIMBERWORX CUSTOM HOMES INC., SLOOT
CONSTRUCTION LTD., JOHN SLOOT
INVESTMENTS LTD.**

PREPARED BY:

**C.F. CROZIER & ASSOCIATES INC.
211 YONGE STREET, SUITE 600
TORONTO, ON M5B 1M4**

JANUARY 2026

CFCA FILE NO. 2433-6646

The material in this report reflects best judgment in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. C.F. Crozier & Associates Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.



Revision Number	Date	Comments
Rev.0	March 2024	Issued for 1 st Submission
Rev.1	August 2025	Issued for 2 nd Submission
Rev.2	January 2026	Issued for 3 rd Submission

EXECUTIVE SUMMARY

C.F. Crozier & Associates Inc. (Crozier) was retained by Timberworx Custom Homes Inc., Sloat Construction Ltd., John Sloat Investments Ltd. to undertake a Traffic Impact Study in support of the Zoning By-Law Amendment application for the property located on sections of Lots 7, 8 and 9 of Concession 10, in the Township of Puslinch, County of Wellington. The purpose of the study is to assess the impacts of the proposed development on the boundary road network and to recommend required mitigation measures, if warranted. This study has been completed in accordance with the County of Wellington's Traffic Impact Study Guidelines (2021).

A Traffic Impact Study and an Addendum Traffic Impact Study were previously prepared in March 2024 and August 2025, respectively. The addendum herein, addresses the Town staff comments on previous submission.

As illustrated on the conceptual site plan prepared by Stovel and Associates Inc. dated July 2025, the development proposal includes the following:

- Forty-four (44) Single detached residential properties.
- Associated internal roads.
- Proposed Site Accesses via Watson Road South and Arkell Road

The trip generation and traffic operations analysis summarized herein are based on an older site plan which had 50 residential properties. However, this was conservatively maintained as no material change in transportation operations or recommendations is expected.

Under 2023 existing traffic conditions, the study intersection of Arkell Road and Watson Road South is operating below capacity with minimal delay during both weekday a.m. and p.m. peak hours. The study intersections include Arkell Road and Watson Road South and the proposed access connection to Watson Road South.

The proposed development is expected to generate 40 and 52 two-way primary trips in the a.m. and p.m. peak hours, respectively.

Under the ultimate 2031 future total conditions,

- the all-way stop-controlled intersection of Arkell Road and Watson Road South is projected to operate below capacity at a LOS "A" and "B" during the weekday a.m. and p.m. peak hours, respectively. Average intersection control delays of 9.5 and 14.3 seconds in the a.m. and p.m. peak hours, respectively and maximum volume-to-capacity ratios of 0.27 (EB) and 0.54 (NB) are expected in the weekday a.m. and p.m. peak hours, respectively.
- The proposed site access connection at Watson Road South is forecast to operate at a LOS "A" and "B" during the a.m. and p.m. peak hours, respectively.
- The proposed site access connection at Arkell Road is forecast to operate at a LOS "A" during both a.m. and p.m. peak hours, respectively.
- Overall, the nearby road network is projected to operate adequately without any capacity constraints under the ultimate 2031 future total scenario. The nearby road network is expected to operate similarly or better under the 2026 horizon year.

- These operations are similar to the 2031 and 2026 Future Background traffic operations. Therefore, operations are expected to be similar with or without the proposed development.

The proposed access connections to Watson Road South and Arkell Road are satisfactory per the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR) with regards to sight distance, access spacing, corner clearance and Transport Canada's Grade Crossing Standards with regards to access spacing.

Based on the study findings, the development application can be supported from a traffic operations perspective as the nearby road network can accommodate the increase in traffic volumes attributable to the proposed development located on sections of Lots 7, 8 and 9 of Concession 10, in the Township of Puslinch, County of Wellington.

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Figure 2:	Boundary Road Network – Existing Conditions
Figure 3:	2023 Existing Traffic Volumes
Figure 4:	2026 Future Background Traffic Volumes
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Figure 6:	Trip Assignment
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LIST OF APPENDICES

Appendix A:	Correspondence
Appendix B:	Site Plan
Appendix C:	Traffic Data
Appendix D:	Level of Service Definitions
Appendix E:	Detailed Capacity Analysis Reports
Appendix F:	TTS Data

1.0 INTRODUCTION

C.F. Crozier & Associates Inc. (Crozier) was retained by Timberworx Custom Homes Inc., Sloat Construction Ltd., John Sloat Investments Ltd. to undertake a Traffic Impact Study in support of the Zoning By-Law Amendment application for the property located on sections of Lots 7,8 and 9 of Concession 10, in the Township of Puslinch, County of Wellington. The purpose of the study is to assess the impacts of the proposed development on the boundary road network and to recommend required mitigation measures, if warranted.

The Traffic Impact Study assesses the impacts of the proposed development on the boundary road network and recommends required mitigation measures as warranted. In accordance with the procedures set out in the County of Wellington's Traffic Impact Study Guidelines (2021), a Traffic Impact Study and an Addendum Traffic Impact Study were previously prepared in March 2024 and August 2025, respectively. The addendum herein, addresses the Town staff comments on previous submission. The terms of reference correspondence and Town staff comments on previous submission are included in **Appendix A**.

2.0 DEVELOPMENT PROPOSAL

As illustrated on the conceptual site plan prepared by Stovel and Associates Inc. dated July 2025, the development proposal includes the following:

- Forty-four (44) Single detached residential properties.
- Associated internal roads.
- Proposed Site Accesses via Watson Road South and Arkell Road

Refer to **Appendix B** for the Site Plan.

3.0 EXISTING CONDITIONS

This section outlines the current conditions of the transportation network in the vicinity of the subject site. Details of the study road network, including traffic controls, lane configurations, speed limits, active transportation infrastructure and other relevant transportation elements are identified.

3.1 Development Lands

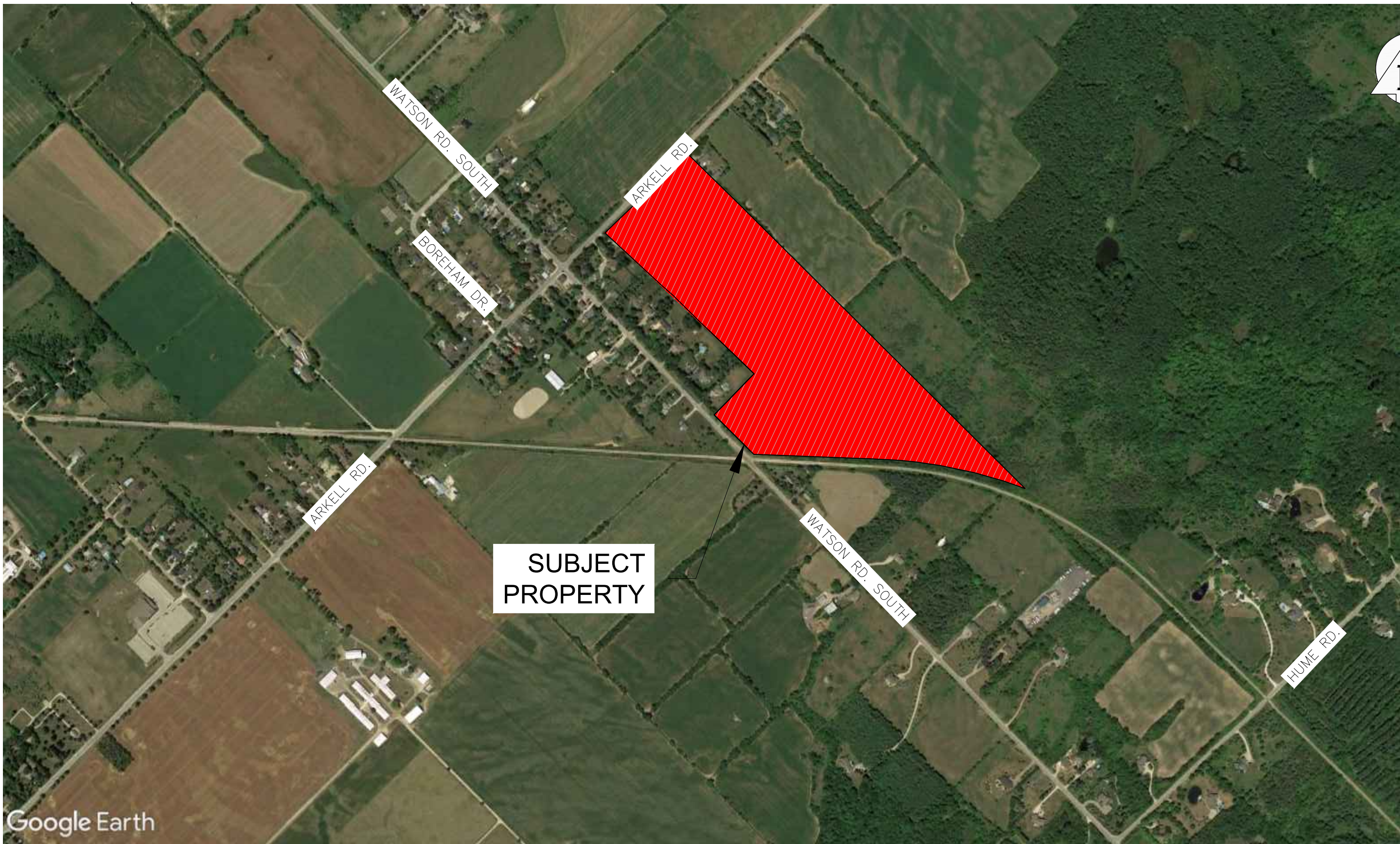
The subject lands cover an area of approximately 20.45 ha with 17.45 ha of it being developable and currently consists of agricultural/vegetated land. The property, located on the northeast corner of the intersection at Arkell Road and Watson Road South, is bounded by a residential property to the west, agricultural/vegetated lands to the north, the Guelph Junction Railway to the east, and Watson Road/residential properties to the south. The site location and surrounding area are illustrated in **Figure 1**.

3.2 Study Area

The Traffic Impact Study analyzes the following study intersections as confirmed with Town of Puslinch and County of Wellington staff (refer to **Appendix A**).

- Watson Road South and Arkell Road
- Proposed Site Accesses via Watson Road South and Arkell Road

Details of the boundary road network is provided in **Section 3.3**.



Google Earth

TIMBERWORX CUSTOM HOMES
 PARTS OF LOTS 7 & 8, CONCESSION 10
 TOWNSHIP OF PUSLINCH

SITE LOCATION

CROZIER
 CONSULTING ENGINEERS

211 YONGE STREET
 SUITE 600
 TORONTO, ON M5B 1M4
 416-477-3392 T
 WWW.CFCROZIER.CA

Drawn	R.L.	Design	Project No.	2433-6646
Date	08/05/2025	Check	Scale	N.T.S.
		M.I.	Dwg.	FIG. 1

3.3 Boundary Road Network

The boundary road network is described in **Table 1** below.

Table 1: Boundary Road Network

Feature	Roadway	
	Arkell Road	Watson Road South
Alignment	Two-Way (North-South)	Two-Way (East-West)
Classification ¹	Collector	Collector
Jurisdiction	County of Wellington	Town of Puslinch
Speed Limit	50 km/h	50 km/h
Pedestrian Facilities	Yes (Only available on the east side, north of Watson Road)	None
Cycling Facilities	None	None

Table 2 outlines the existing traffic control, configurations, at the study intersections on the boundary road network.

Table 2: Study Intersections

Intersection	Control	App. ¹	Major Street	Lane Configurations
Arkell Road and Watson Road South	All-Way Stop	4	Arkell Road	EBLTR; WBLTR; NBLTR; SBLTR

Note 1: App. - number of approaches for a given intersection.

Figure 2 illustrates the existing boundary road network, including lane configurations, lane storage lengths, and intersection control.

3.4 Existing Active Transportation Network

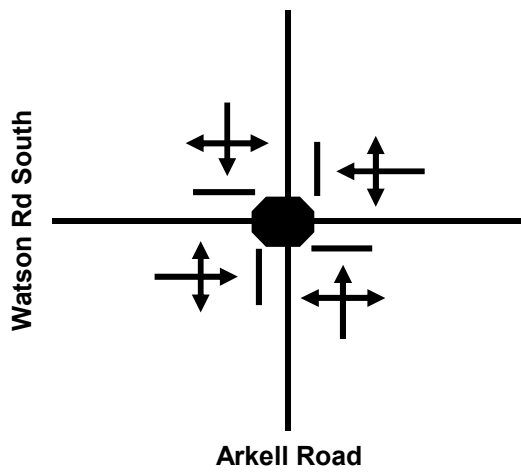
Sidewalks are available on the east side of Arkell Road, south of the intersection of Arkell Road and Watson Road, no cycling facilities exist on the boundary roads near the site.

3.5 Existing Transit Services

Given the rural nature and largely undeveloped surrounding lands, there are no transit services available within the study area currently.

3.6 Traffic Data

Turning movement counts (TMC) were collected at the study intersection from 7:00 a.m. to 7:00 p.m. on Thursday, July 28, 2022, by Wellington County. The traffic count data is summarized in **Appendix C**. 2023 existing traffic volumes were derived by applying annual growth rate of 2% to 2022 volumes. **Figure 3** illustrates the 2023 existing traffic volumes.



Legend

- xx A.M. Peak Hour Traffic Volumes
- {xx} P.M. Peak Hour Traffic Volumes
- {xx} Weekend Peak Hour Traffic Volumes

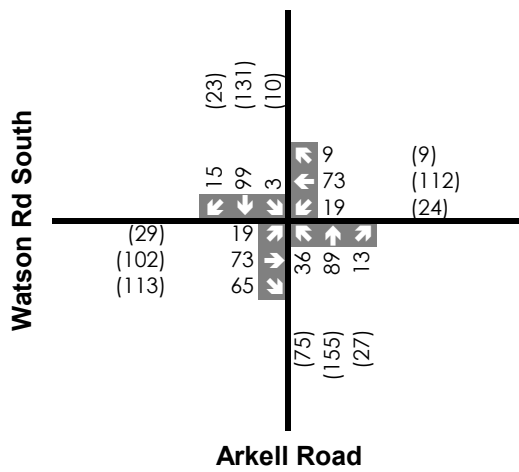
Arkell Developments

Boundary Road Network



Figure 2

Project No. 2433-6646
 Date. 45321
 Analyst. Parth Bhatt



Legend

- xx A.M. Peak Hour Traffic Volumes
- {xx} P.M. Peak Hour Traffic Volumes
- {xx} Weekend Peak Hour Traffic Volumes

Arkell Developments

Existing Traffic Volumes



Figure 3

Project No. 2433-6646
 Date. 45321
 Analyst. Parth Bhatt

3.7 Traffic Modeling

Synchro software (Version 11) was used for the intersection capacity and queueing analysis. Capacity Analysis per the general guidelines from the County and Town were used for the study intersections. All parameters for the intersection analysis were based on the Synchro default values.

The intersection assessment is based on the method outlined in the "Highway Capacity Manual, 2010" using Synchro modelling software. Intersections are assessed using a Level of Service metric, with ranges of delay assigned a letter from "A" to "F." For stop-controlled intersections, a Level of Service "A" or "B" would typically be measured during off-peak hours when lesser traffic volumes are on the roadways. Levels of Service "C" through "F" would typically be measured in the commuter peak hours when more significant vehicle volumes cause longer travel times. The Level of Service (LOS) definitions for signalized and stop control intersections are included in **Appendix D**.

3.8 Intersection Operations

The traffic operations at the study intersections were analyzed based on the 2023 existing traffic volumes illustrated in **Figure 3**. Detailed capacity analysis worksheets are included in **Appendix E. Table 4** outlines the 2023 existing traffic operations.

Table 4: 2023 Existing Traffic Operations Summary

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	v/c ratio ²	95 th Percentile Queue Length > Storage Length
Arkell Road and Watson Road South	All-Way Stop	A.M.	A	8.8s	0.21 (EB)	None
		P.M.	B	11.4s	0.42 (NB)	None

Note 1: Level of Service – The Level of Service (LOS) of a signalized intersection is based on the average control delay per vehicle. The LOS of unsignalized intersection is based on the critical control delay per approach.

Note 2: The critical v/c ratio is considered to be the maximum v/c ratio for movements at the intersection where the maximum v/c ratio does not exceed the critical thresholds.

As outlined in **Table 4**, under the 2023 existing conditions scenario, the all-way stop-controlled intersection of Arkell Road and Watson Road South is operating below capacity at a Level of Service (LOS) "A" and "B" during the weekday a.m. and p.m. peak hours, respectively. The average intersection control delay is 8.8s and 11.4s in the weekday a.m. and p.m. peak hours, respectively, and the maximum volume-to-capacity ratios are 0.21 (EB) and 0.42 (NB) in the weekday a.m. and p.m. peak hours, respectively.

4.0 FUTURE BACKGROUND CONDITIONS

This section summarizes the future background conditions of the study road network and provides details relating to growth rates, future transportation network improvements, and background developments within the study area.

4.1 Study Horizons

As confirmed through Terms of Reference correspondence, the full buildout year as well as five years beyond buildout is required, consistent with the County guidelines. Therefore, the 2026 horizon year (anticipated full buildout year) as well as 2031 were selected to assess future operations of the boundary road network.

4.2 Future Roadway Improvements

Currently, there are no planned improvements to roadway network within the study area. Therefore, the future background and future total analysis herein assumes the existing roadway configurations in the 2026 and 2031 horizon years.

4.3 Growth Rate

The Town recommended annual growth rate of 2%, compounded annually, was applied to all movements.

4.4 Background Developments

As confirmed by Town's staff, no background developments were identified in the vicinity of the site.

4.5 Intersection Operations

The traffic operations at the study intersections were analyzed based on the 2026 and 2031 future background traffic volumes illustrated in **Figures 4 and 5**. Detailed capacity analysis worksheets are included in **Appendix E. Tables 6 and 7** outline the 2026 and 2031 future background traffic operations.

Table 6: 2026 Future Background Traffic Operations

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	v/c ratio ²	95 th Percentile Queue Length > Storage Length
Arkell Road and Watson Road South	All-Way Stop	A.M.	A	9.0s	0.24(EB)	None
		P.M.	B	12.1s	0.46(NB)	None

Note 1: Level of Service – The Level of Service (LOS) of a signalized intersection is based on the average control delay per vehicle. The LOS of unsignalized intersection is based on the critical control delay per approach.

Note 2: The critical v/c ratio is considered to be the maximum v/c ratio for movements at the intersection where the maximum v/c ratio does not exceed the critical thresholds.

Table 7: 2031 Future Background Operations Summary

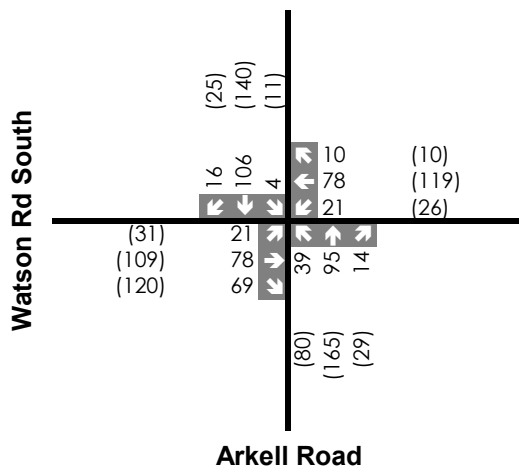
Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	v/c ratio ²	95 th Percentile Queue Length > Storage Length
Arkell Road and Watson Road South	All-Way Stop	A.M.	A	9.3s	0.27(EB)	None
		P.M.	B	13.7s	0.53(NB)	None

Note 1: Level of Service – The Level of Service (LOS) of a signalized intersection is based on the average control delay per vehicle. The LOS of unsignalized intersection is based on the critical control delay per approach.

Note 2: The critical v/c ratio is considered to be the maximum v/c ratio for movements at the intersection where the maximum v/c ratio does not exceed the critical thresholds.

As shown in **Table 7**, under 2031 future background conditions, the all-way stop-controlled intersection of Arkell Road and Watson Road South is projected to operate below capacity at a LOS "A" and "B" during the weekday a.m. and p.m. peak hours, respectively. Average intersection control delays of 9.3 and 13.7 seconds in the a.m. and p.m. peak hours, respectively and maximum volume-to-capacity ratios of 0.27 (EB) and 0.53 (NB) are expected in the weekday a.m. and p.m. peak hours, respectively. The intersection is forecast to operate efficiently with reserve capacity to accommodate future increases in traffic volumes.

The study intersection is forecast to operate similarly or better under the 2026 future background compared to the 2031 future background. No traffic operation issues are forecast on the boundary road network.



Legend

- xx A.M. Peak Hour Traffic Volumes
- (xx) P.M. Peak Hour Traffic Volumes
- {xx} Weekend Peak Hour Traffic Volumes

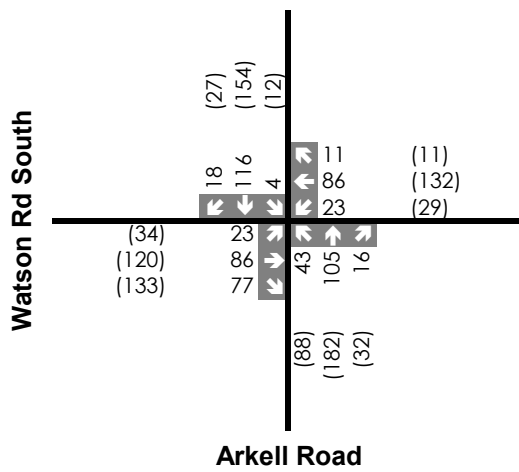
Arkell Developments

2026 Future Background Traffic Volumes



Figure 4

Project No. 2433-6646
 Date. 45321
 Analyst. Parth Bhatt



Legend

- xx A.M. Peak Hour Traffic Volumes
- {xx} P.M. Peak Hour Traffic Volumes
- {xx} Weekend Peak Hour Traffic Volumes

Arkell Developments

2031 Future Background Traffic Volumes



Figure 5

Project No. 2433-6646
 Date. 45321
 Analyst. Parth Bhatt

5.0 SITE GENERATED TRAFFIC

The proposed development will result in new traffic turning movements on the boundary road network that would otherwise not exist. This section presents the generated trips and trip assignment through the study intersections.

5.1 ITE Trip Generation

To forecast the trips generated by the development, the ITE Trip Generation Manual, 11th Edition was used. The ITE Trip Generation Manual is a compendium of industry collected trip generation data across North America for a variety of land uses and is used industry wide as a source for trip generation forecasts. Given the site location, the general urban/suburban setting was used; fitted curve estimates were used if available and deemed statistically valid per the ITE Trip Generation Manual (i.e., more than 20 data points and coefficient of determination $R^2 > 0.75$). The trips generated by the proposed development are presented in **Table 8**. It is noted that the trip generation is based on an older site plan which had 50 residential units. This was conservatively maintained as no material change in traffic operations or recommendations is expected.

Table 8: Total Site Generated Traffic

Land Use	Units	Peak Hour	Equation Used	Inbound	Outbound	Total
Single-Family Detached Housing (LUC 210)	50	A.M.	$\text{Ln}(T)=0.91*\text{Ln}(X)+0.12$	10 (25%)	30 (75%)	40
		P.M.	$\text{Ln}(T)=0.94*\text{Ln}(X)+0.27$	33 (63%)	19 (37%)	52

As shown in **Table 8**, the proposed residential development is expected to generate a total of 40 and 52 two-way trips in the a.m. and p.m. peak hours, respectively.

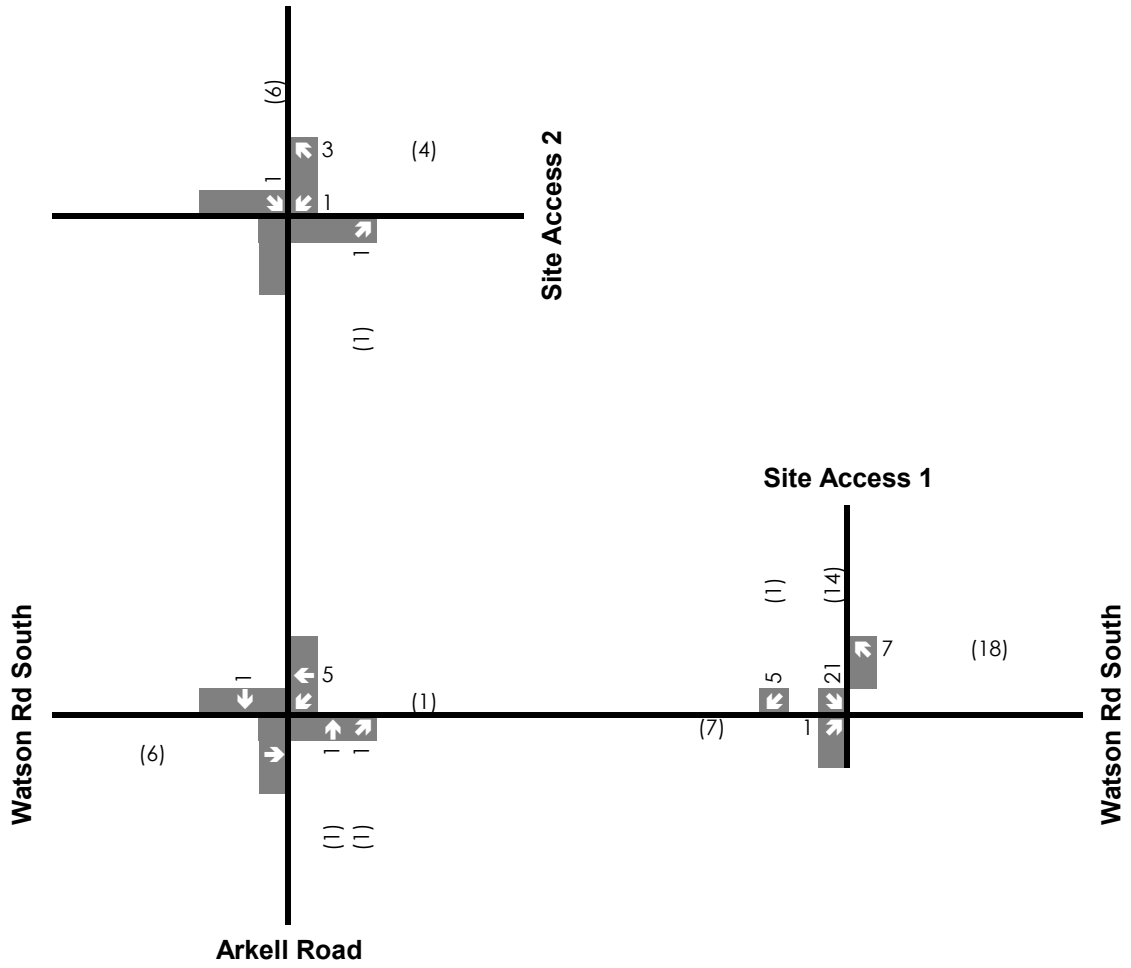
5.2 Trip Distribution and Assignment

The Transportation Tomorrow Survey (TTS) is a comprehensive travel data survey conducted in the Greater Toronto and Hamilton Area. Data from the 2016 TTS was used to determine the peak hour trip distribution at the site for the residential land use proposed at the site.

The inbound and outbound trip distributions were derived by filtering TTS data with a trip purpose of "Home", destined to and originating from the subject GTA Zone 8303. The A.M. and P.M. distributions were determined by filtering for trips starting during the periods of 6:30 A.M. – 9:30 A.M. and 3:30 P.M. – 6:30 P.M., respectively. **Appendix F** provides the TTS query used to determine the site trip distribution. **Table 9** summarizes the trip distribution at the site. **Figure 6** illustrates the trip assignment for the proposed development.

Table 9: Trip Distribution

Direction	A.M. Inbound	A.M. Outbound	P.M. Inbound	P.M. Outbound
Northwest	24%	18%	32%	40%
North	0%	0%	0%	0%
Northeast	0%	0%	7%	0%
East	0%	18%	15%	0%
Southeast	0%	0%	0%	0%
South	0%	0%	0%	0%
Southwest	38%	7%	12%	13%
West	38%	58%	35%	47%
Total	100%	100%	100%	100%



Legend

xx A.M. Peak Hour Traffic Volumes
 (xx) P.M. Peak Hour Traffic Volumes

Arkell Developments

Trip Assignment



Figure 6

Project No. 2433-6646

6.0 TOTAL TRAFFIC CONDITIONS

This section discusses the traffic operations of the study intersections with the addition of the new site generated trips. It's noted the future total analysis outlined herein is based on the trips generated for an older site plan with 50 residential units. This was conservatively maintained as no material change in traffic operations or recommendations is expected.

6.1 Intersection Operations

Traffic operations at the study intersections were assessed with the addition of the new site generated trips to the future background traffic volumes. The 2026 and 2031 future total traffic volumes are illustrated in **Figures 7 and 8**. **Tables 10 and 11** outline the future total traffic operations for the 2026 and 2031 horizon years, respectively. Detailed capacity analysis worksheets are included in **Appendix E**.

Table 10: 2026 Future Total Traffic Operations Summary

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	v/c ratio ²	95 th Percentile Queue Length > Storage Length
Arkell Road and Watson Road South	All-Way Stop	A.M.	A	9.0s	0.24(EB)	None
		P.M.	B	12.3s	0.47(NB)	None
Site Access via Watson Road South	Stop (Minor Street)	A.M.	A(SB)	9.6s	0.07(WB)	None
		P.M.	B(SB)	10.3s	0.10(WB)	None
Site Access via Arkell Road	Stop (Minor Street)	A.M.	A (WB)	9.2s	0.08 (NB)	None
		P.M.	A (WB)	9.4s	0.12 (NB)	None

Note 1: Level of Service – The Level of Service (LOS) of a signalized intersection is based on the average control delay per vehicle. The LOS of unsignalized intersection is based on the critical control delay per approach.

Note 2: The critical v/c ratio is considered to be the maximum v/c ratio for movements at the intersection where the maximum v/c ratio does not exceed the critical thresholds.

Table 11: 2031 Future Total Operations Summary

Intersection	Control	Peak Hour	Level of Service ¹	Control Delay	v/c ratio ²	95 th Percentile Queue Length > Storage Length
Arkell Road and Watson Road South	All-Way Stop	A.M.	A	9.4s	0.27(EB)	None
		P.M.	B	14.1s	0.54(NB)	None
Site Access via Watson Road South	Stop (Minor Street)	A.M.	A(SB)	9.6s	0.07(WB)	None
		P.M.	B(SB)	10.5s	0.10(WB)	None
Site Access via Arkell Road	Stop (Minor Street)	A.M.	A (WB)	9.2s	0.08 (NB)	None
		P.M.	A (WB)	9.4s	0.12 (NB)	None

Note 1: Level of Service – The Level of Service (LOS) of a signalized intersection is based on the average control delay per vehicle. The LOS of unsignalized intersection is based on the critical control delay per approach.

Note 2: The critical v/c ratio is considered to be the maximum v/c ratio for movements at the intersection where the maximum v/c ratio does not exceed the critical thresholds.

Under the ultimate 2031 future total conditions, the study intersections are projected to operate similarly compared to the corresponding 2031 future background scenario, with minor additional delays attributable to the proposed development traffic.

As shown in **Table 11**, under 2031 future total conditions, the all-way stop-controlled intersection of Arkell Road and Watson Road South is projected to operate below capacity at a LOS “A” and “B”

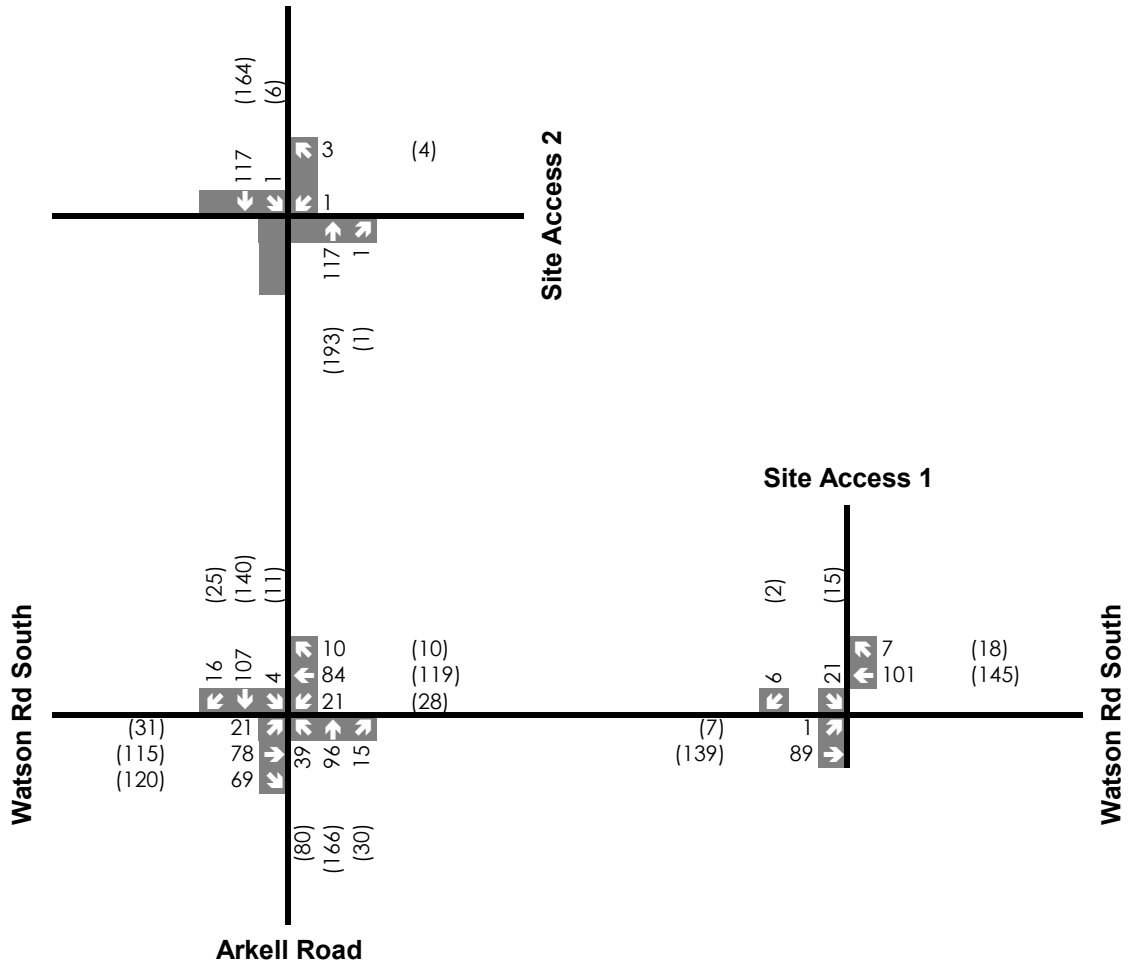
during the weekday a.m. and p.m. peak hours, respectively. Average intersection control delays of 9.5 and 14.3 seconds in the a.m. and p.m. peak hours, respectively and maximum volume-to-capacity ratios of 0.27 (EB) and 0.54 (NB) are expected in the weekday a.m. and p.m. peak hours, respectively.

The proposed Access Connection at Watson Road South is forecast to operate below capacity at a LOS "A" and LOS "B" during the a.m. and p.m. peak hours respectively.

The proposed Access Connection at Arkell is forecast to operate below capacity at a LOS "A" during both a.m. and p.m. peak hours respectively.

Overall, the boundary road network is projected to operate adequately without any capacity constraints under the ultimate 2031 future total scenario. The boundary road network is expected to operate similarly or better under the 2026 horizon year.

Based on the analysis herein, the proposed development is not expected to significantly alter the traffic operations of the study intersections. The proposed development can be supported from a traffic operations perspective.



Legend

xx A.M. Peak Hour Traffic Volumes
 (xx) P.M. Peak Hour Traffic Volumes

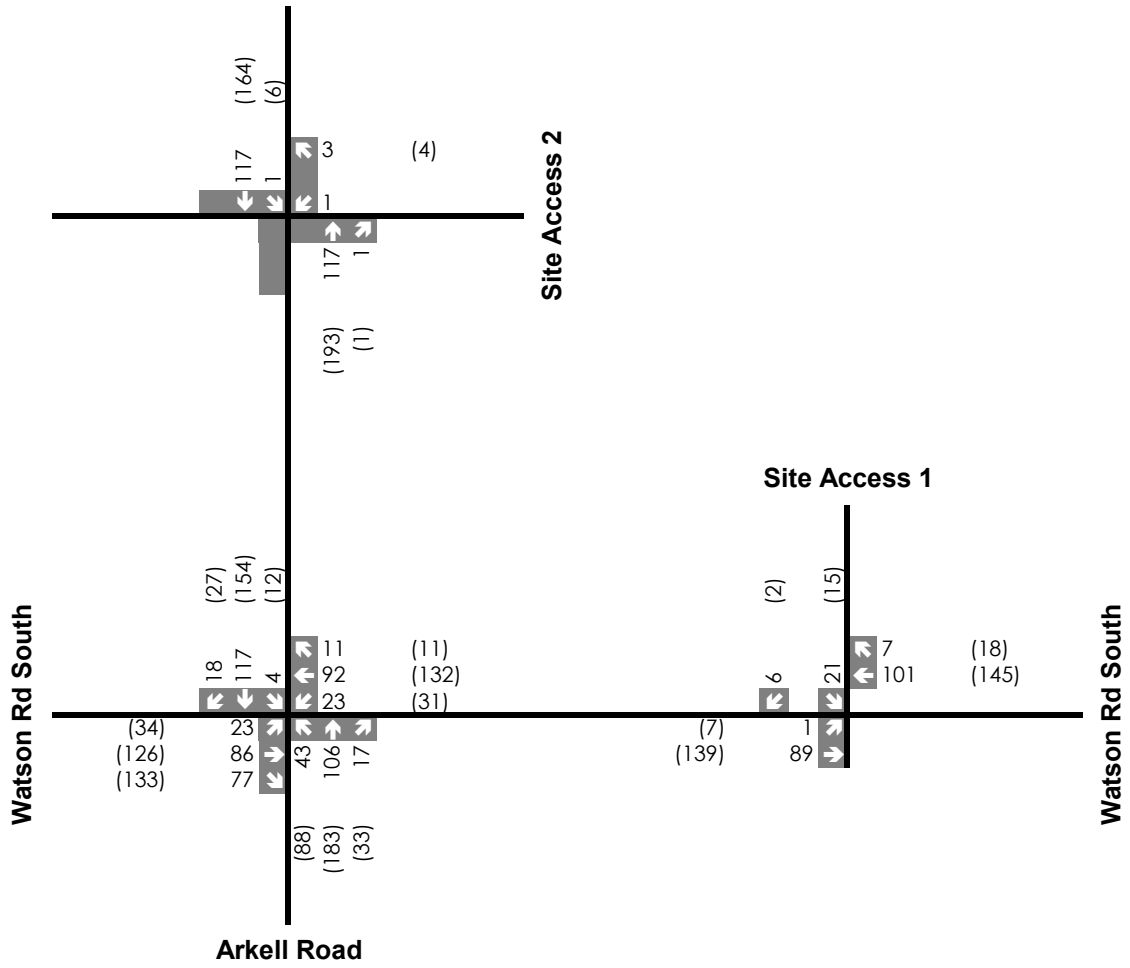
Arkell Developments

2026 Future Total Traffic Volumes



Figure 7

Project No. 2433-6646



Legend

xx A.M. Peak Hour Traffic Volumes
 (xx) P.M. Peak Hour Traffic Volumes

Arkell Developments

2031 Future Total Traffic Volumes



Figure 8

Project No. 2433-6646

7.0 SITE ACCESS SAFETY REVIEW

In the following section, the geometrics of the proposed site accesses were reviewed against the guidelines provided in the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR).

7.1 Sight Distance Assessment

The available sightlines at the site access connections to Watson Road South and Arkell Road were measured and compared to the standards set out in the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR). Sight distance was measured from the proposed site accesses using the following assumptions:

- A standard driver eye height of 1.08 metres for a passenger car, and
- A 4.4 metre setback from the approximate extension of the outer curb to represent a vehicle waiting to exit the site.

Intersection sight distance is calculated using equation 9.9.1 from the GDGCR as outlined below:

$$ISD = 0.278 * V_{major} * tg$$

Where;

ISD = Intersection Sight Distance

V major = design speed of roadway (km/h)

tg = assumed time gap for vehicles to turn from stop onto roadway (s)

The design speed of a Collector Road in a suburban environment is typically 10-20 km/h greater than posted speed limit. The posted speed limit on Watson Road South and Arkell Road at the site frontages are both 50 km/h. Therefore, design speed of 60 km/h was assumed for both. **Table 12** outlines the sight distance analysis for the proposed site accesses.

Table 12: Sight Distance Analysis

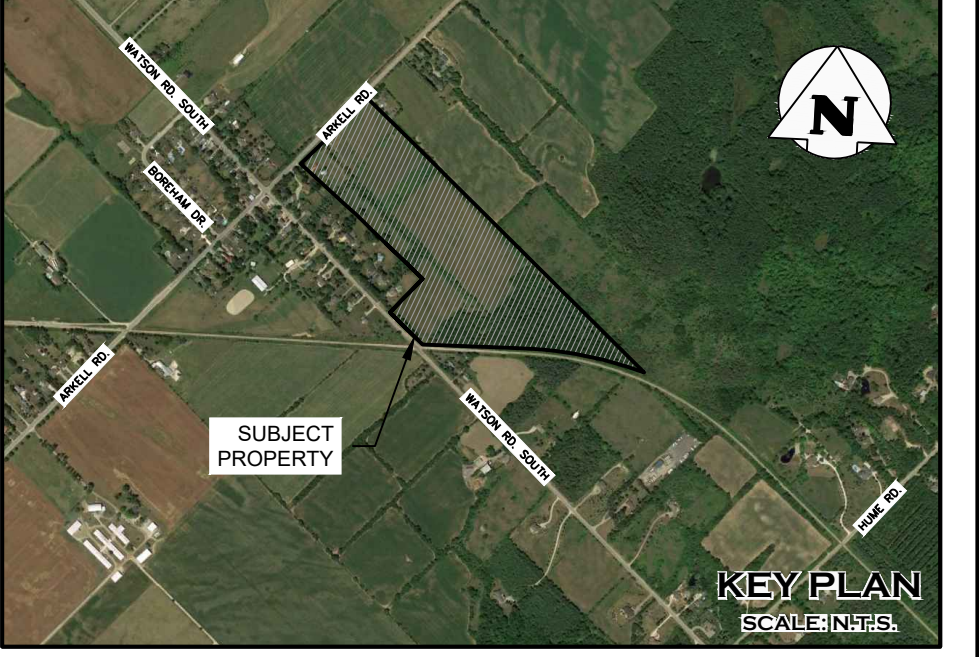
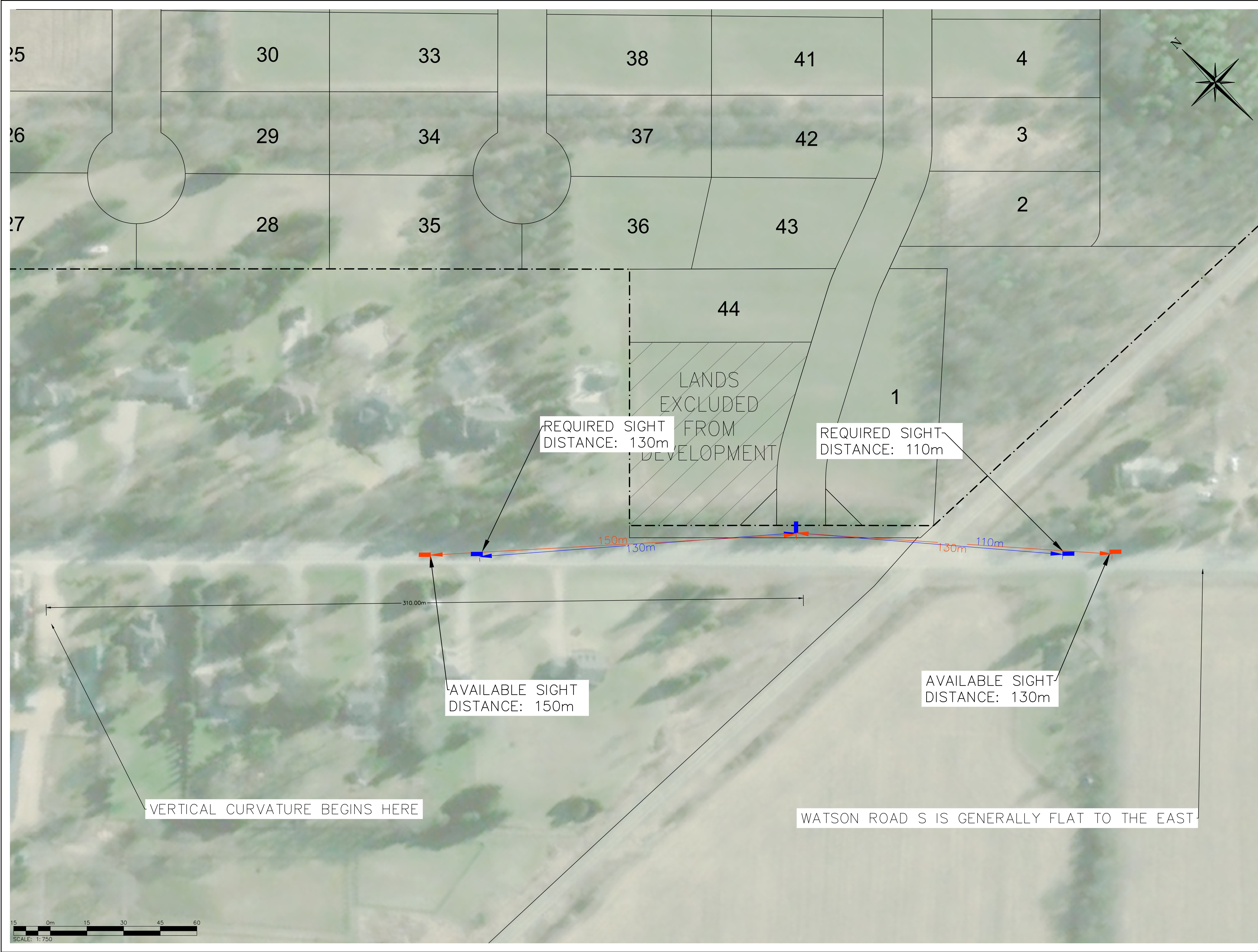
Feature	Site Access at Watson Road South	Site Access at Arkell Road
Access Type	Full moves	Full moves
Intersection Control	Stop Control on Minor Road	Stop Control on Minor Road
Speed Limit of Roadway	50 km/h	50 km/h
Assumed Design Speed	60 km/h	60 km/h
Design Vehicle	Passenger Car	Passenger Car
Base Time Gap	6.5 s (for right-turn) ¹ 7.5 s (for left turn) ²	6.5 s (for right-turn) ¹ 7.5 s (for left turn) ²
Vertical Alignment of Roadway	Fairly flat	Fairly flat
Grade of Roadway	Less than 3%	Less than 3%
Horizontal Alignment of Roadway	Straight	Straight
Sight Distance Required ³	110 m (right turn) 130 m (left turn)	110 m (right turn) 130 m (left turn)
Measured Sight Distance	> 130 m (looking right) > 110 m (looking left)	> 130 m (looking right) > 110 m (looking left)
Minimum Sight Distance Satisfied?	Yes	Yes

Note 1: Time gap for right-turning passenger cars from a stop onto a two-lane highway with no median and with a grade less than 3%. Value from Table 9.9.5 in the GDGCR.

Note 2: Time gap for left-turning passenger cars from a stop onto a two-lane highway with no median and with a grade less than 3%. Value from Table 9.9.3 in the GDGCR.

Note 3: Sight distance value calculated from Intersection Sight Distance equation 9.9.1 in the GDGCR.

As outlined in **Table 12**, minimum sight distance requirements are satisfied at the location of the access connections to Watson Road South and Arkell Road. **Figures 9 and 10** contains Sight Distance Assessment Drawings.



No.	ISSUE	DATE: MM/DD/YYYY
1	ISSUED FOR 1st SUBMISSION	03/08/2024
2	ISSUED FOR 2nd SUBMISSION	08/05/2025
3	ISSUED FOR 3rd SUBMISSION	10/29/2025

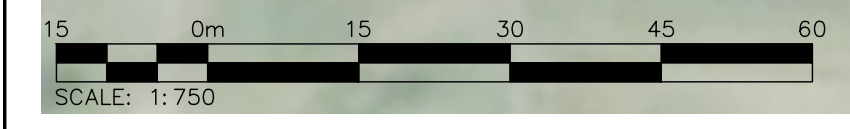
Project: **TIMBERWORX CUSTOM HOMES
PARTS OF LOTS 7 & 8, CONCESSION 10
TOWNSHIP OF PUSLINCH**

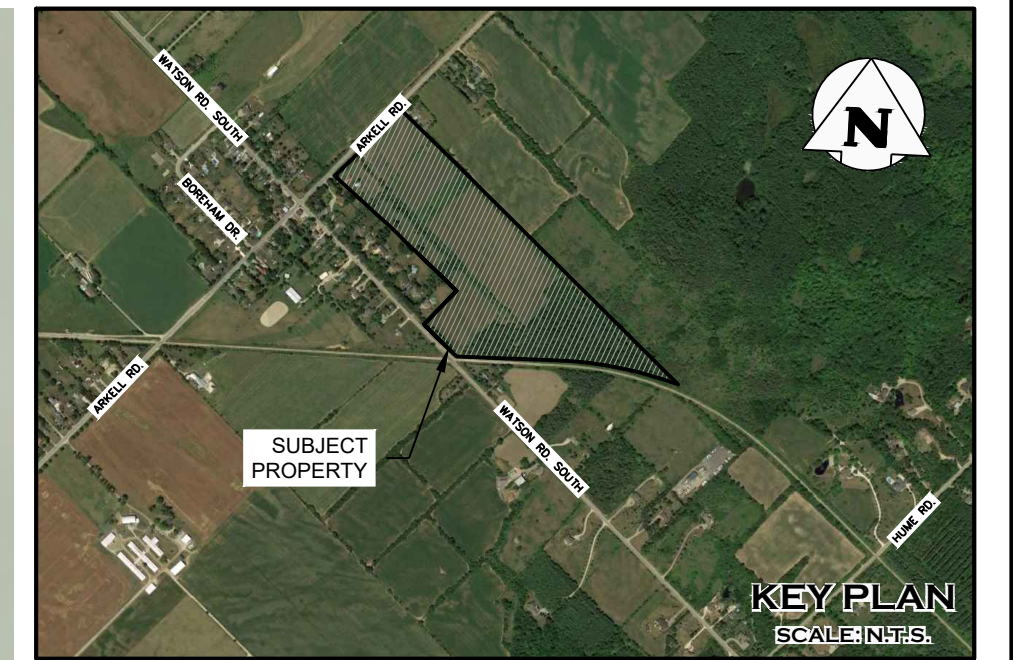
Drawing: **SIGHT DISTANCE ASSESSMENT
ACCESS TO WATSON RD. S**

CROZIER
CONSULTING ENGINEERS

211 YONGE STREET
SUITE 600
TORONTO, ON, M5B 1M4
416-477-3392 T
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	R.L.	Design By	Project	2433-6646
Check By	M.I.	Check By	Scale	1:500 Drawing FIG. 9B





REQUIRED SIGHT DISTANCE: 130m

AVAILABLE SIGHT DISTANCE: 150m

REQUIRED SIGHT DISTANCE: 110m

AVAILABLE SIGHT DISTANCE: 130m

LANDS EXCLUDED FROM DEVELOPMENT

No.	ISSUE	DATE: MM/DD/YYYY
1	ISSUED FOR 1st SUBMISSION	03/08/2024
2	ISSUED FOR 2nd SUBMISSION	08/05/2025
3	ISSUED FOR 3rd SUBMISSION	10/29/2025

Project: **TIMBERWORX CUSTOM HOMES PARTS OF LOTS 7 & 8, CONCESSION 10 TOWNSHIP OF PUSLINCH**

Drawing: **SIGHT DISTANCE ASSESSMENT ACCESS TO ARKELL RD.**

CROZIER CONSULTING ENGINEERS
 211 YONGE STREET SUITE 600 TORONTO, ON, M5B 1M4
 416-477-3392 T WWW.CFCROZIER.CA INFO@CFCROZIER.CA

Drawn By: R.L. Design By: R.L. Project: **2433-6646**
 Check By: M.I. Check By: M.I. Scale: 1:750 Drawing: **FIG. 10**



7.2 Access Location and Spacing Review

The Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR) and Transport Canada's Grade Crossing Standards were used to review access spacing and corner clearance for the proposed site access connections to Watson Road South and Arkell Road. The site access spacing requirements and proposed spacings are presented in **Table 13**.

Table 13: Access Spacing Review

Site Access	Available Spacing	Minimum Spacing Requirements	Evaluation	Source
Private Access connection to Watson Road South	Approximately 500 m (to Arkell Road and Watson Road South Intersection)	Minimum 60m spacing between adjacent intersections along a collector road	Satisfied	TAC-GDGCR Section 9.4.2.2
Private Access connection to Arkell Road	Approximately 250 m (to Arkell Road and Watson Road South Intersection)	Minimum 60m spacing between adjacent intersections along a collector road	Satisfied	TAC-GDGCR Section 9.4.2.2

The site corner clearance requirements, Transport Canada's Grade Crossing requirements and proposed clearances are presented in **Table 14**.

Table 14: Corner Clearance and distance from Grade Crossing Review

Site Access	Available Corner Clearance	Minimum Corner Clearance Requirements	Evaluation	Source
Private Access connection to Watson Road South	Approximately 500 m (to Arkell Road and Watson Road South Intersection)	Minimum 25m corner clearance from stop-controlled intersection	Satisfied	TAC-GDGCR Figure 8.8.2
	Approximately 50 m (to Grade Crossing)	Minimum 30m distance from Grade Crossing	Satisfied	Transport Canada's Grade Crossing Standards
Private Access connection to Arkell Road	Approximately 250 m (to Arkell Road and Watson Road South Intersection)	Minimum 25m corner clearance from stop-controlled intersection	Satisfied	TAC-GDGCR Figure 8.8.2

As presented in **Tables 13 and 14**, the proposed accesses are satisfactory compared to the minimum spacing and corner clearance requirements of the TAC-GDGCR and Transport Canada's Grade Crossing Standards.

8.0 PARKING REVIEW

The Township of Puslinch's Zoning By-Law No. 023-18, section 5.2.2 identifies a requirement of 2 parking spaces per unit for the proposed development. As part of the subdivision plan, the parking supply identified in the By-Law will be provided along with potential on-street visitor parking as applicable.

9.0 CONCLUSIONS AND RECOMMENDATIONS

This study has assessed the transportation impacts of the proposed residential development located on sections of Lots 7, 8 and 9 of Concession 10, in the Township of Puslinch, County of Wellington. It is noted that the trip generation and traffic operations analysis were based on an older site plan which had 50 residential units. This was conservatively maintained as no material change in traffic operations or recommendations is expected. The detailed analysis contained within this report has resulted in the following key findings:


- Under 2023 existing traffic conditions, the study intersection of Arkell Road and Watson Road South is operating below capacity with minimal delay during both weekday a.m. and p.m. peak hours.
- The proposed development is expected to generate 40 and 52 two-way primary trips in the a.m. and p.m. peak hours, respectively.
- Under the ultimate 2031 future total conditions:
 - The all-way stop-controlled intersection of Arkell Road and Watson Road South is projected to operate below capacity at a LOS "A" and "B" during the weekday a.m. and p.m. peak hours, respectively. Average intersection control delays of 9.4 and 14.1 seconds in the a.m. and p.m. peak hours, respectively and maximum volume-to-capacity ratios of 0.27 (EB) and 0.54 (NB) are expected in the weekday a.m. and p.m. peak hours, respectively.
 - The proposed site access connection at Watson Road South is forecast to operate at a LOS "A" and "B" during the a.m. and p.m. peak hours respectively.
 - The proposed site access connection at Arkell Road is forecast to operate at a LOS "A" during both a.m. and p.m. peak hours respectively.
 - Overall, the nearby road network is projected to operate adequately without any capacity constraints under the ultimate 2031 future total scenario. The nearby road network is expected to operate similarly or better under the 2026 horizon year.
 - These operations are similar to the 2031 and 2026 Future Background traffic operations. Therefore, operations are expected to be similar with or without the proposed development.
- The proposed access connections to Watson Road South and Arkell Road are satisfactory per the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR) with regards to sight distance, access spacing, corner clearance and Transport Canada's Grade Crossing Standards with regards to access spacing.

Based on the study findings, the development application can be supported from a traffic operations perspective as the boundary road network can accommodate the increase in traffic volumes attributable to the proposed development located on sections of Lots 7, 8 and 9 of Concession 10, in the Township of Puslinch, County of Wellington. Further, the proposed accesses are forecast to be functionally adequate with immaterial impacts to the study intersections.

Prepared by,

C.F. CROZIER & ASSOCIATES INC.

C.F. CROZIER & ASSOCIATES INC.



Masoud Imaniboossejini
Engineering Intern

Brandon Bradt, M.Eng. CEM, P.Eng.
Manager, Transportation Planning

J:\2400\2433 - Timberworx Custom Homes\6646 - Arkell Developments\Reports\Traffic\2024.01.30_Arkell Developments TIS (DRAFT)-MI - Copy.Docx

APPENDIX A

Correspondence

Township of Puslinch	C.F. Crozier & Associates Inc. Comment Responses
Traffic	
<p>- The TIS continues to say that the proposed road connection to Arkell Road is for emergency purposes, but the site concept plan that was included with the application appears to include a fully open public road connection. As Arkell Road is a Wellington County Road, I will defer to the County to comment on the proposed road connection. The addition of a second road connection for the subdivision would result in more routing options for traffic and less traffic at the Watson Road South connection near the railway and reduced impacts on any one traffic movement at the Watson/Arkell intersection.</p>	<p>Noted. The Addendum TIS has assessed the impact of the proposed development on the boundary road network under the assumption that the site will be served by two access connections, one to Watson Road South and the other to Arkell Road.</p>
<p>- The study maintains analysis for 50 units when 44 are now proposed. A reduction in the number of units would result in fewer trips on the road network so the current analysis is conservative.</p>	<p>Noted. The addendum TIS maintains the trip generation based on an older site plan which had 50 residential properties. It's noted that this was conservatively maintained as no material change in transportation operations or recommendations is expected.</p>
<p>- The TIS indicates that the sight distance assessment was based on a review of base mapping and aerial mapping. The aerial mapping in the TIS illustrates the available sight distance in plan view, but does not confirm that there are no vertical curves in the road. Were vertical road plans reviewed to confirm the sight distance or did the consultant do a field visit to confirm? How was the available sight distance confirmed?</p>	<p>Noted. Sight distance assessments were calculated based on a review of base mapping and aerial images.</p> <p>As shown in the sight distance assessment illustrated in Figure 9 of the Addendum TIS, although Watson Road has vertical curvature to the west of the property, it begins at about 300 m west of the proposed site access and no physical obstructions are expected, and adequate sight distance is available. Also, Watson Road is generally flat to the east of the site access and adequate sight distance is available. To sum up, no safety issues are expected at the proposed site access along Watson Road.</p>
<p>- Guelph Junction Railway provided comments indicating that additional signals may be required for the new</p>	<p>Noted.</p>

<p>driveway entrance. The consultant team has indicated that traffic signals will not be required at the new road connection to Watson Road, but it's possible that GJR was referring to railway signals or other technical requirements at the rail/road crossing. I would like to receive a copy of any further comments provided by GJR when and if they become available to understand if they are in agreement with the new road location.</p>	
<p>- The changes in the plan to include a new road connection and fewer units would impact how much traffic access the road network and how. Additionally, my previous comment about the routing of traffic applies to this study since the analysis is the same. It is still my opinion that updating the analysis to reflect an additional road connection, fewer units, and a modified assignment of traffic would not materially change the capacity analyses and would not change the recommendations in the report. The two study area intersections are forecast to operate at good levels of service and the traffic volumes generated by the proposal are low.</p>	<p>Noted.</p>
<p>-The County and their consultant may have additional comments based on their review of the proposed road connection to Arkell Road and the Watson/Arkell intersection.</p>	<p>Noted.</p>
<p>In response to the Township's request, I offer the following feedback:</p> <ol style="list-style-type: none"> 1. The Zoning By-law Amendment application can be deemed complete from a transportation perspective and I am in support of the application. 2. Conditions of approval should include: <ol style="list-style-type: none"> a. confirmation of how the sight distance was measured on Watson Road South, and 	<ol style="list-style-type: none"> 1. Noted. 2. <ol style="list-style-type: none"> a: Sight distance assessments were calculated based on a review of base mapping and aerial images. <p>As shown in the sight distance assessment illustrated in Figure 9 of the Addendum TIS, although Waston Road has vertical curvature to the west of the property, it begins at about 300 m west of the proposed site access and no physical obstructions are expected, and adequate sight distance is available. Also, Watson Road is</p>

<p>b.confirmation from Guelph Junction Railway that they will support the location of the new road connection to Watson Road South adjacent to the at-grade railway crossing.</p> <p>3. n/a</p> <p>4. Technical requirements are described in point 2 above.</p> <p>5. No additional requirements beyond those identified in point 2 above.</p>	<p>generally flat to the east of the site access and adequate sight distance is available. To sum up, no safety issues are expected at the proposed site access along Watson Road.</p> <p>b: According to Transport Canada's Grade Crossing Standards a Minimum 30m distance from Grade Crossing is required. Given the proposed site access along Watson Road South is about 50m from the at grade railway crossing, the proposed access is satisfactory compared to Transport Canada's Grade Crossing Standards.</p> <p>3. Noted.</p> <p>4. Noted.</p> <p>5. Noted.</p>
<p>Guelph Junction Railway (GJR)</p>	
<p>-Possibility of additional signals required for new driveway entrance to the development.</p>	<p>Noted. Given the traffic volumes generated by the proposed development are low and as detailed in Section 6.1 of the Addendum Traffic Impact Study, the proposed Access Connection at Watson Road South is forecast to operate below capacity at a LOS "A" and LOS "B" during the a.m. and p.m. peak hours respectively. Accordingly, signals are not warranted at this intersection and therefore not recommended.</p>

Archived: September 19, 2023 1:46:22 PM

From: julia@salviniconsulting.com

Sent: Mon, 18 Sep 2023 14:41:57 +0000Received: from YT3PR01CA0145.CANPRD01.PROD.OUTLOOK.COM (2603:10b6:b01:83::14) by MN2PR03MB4992.namprd03.prod.outlook.com (2603:10b6:208:1aa::15) with Microsoft SMTP Server (version=TLS1_2, cipher=TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384) id 15.20.6792.26; Mon, 18 Sep 2023 14:41:54

+0000Received: from YT3CAN01FT019.eop

To: 'Lynne Banks'; Parth Bhatt

Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Importance: Normal

Hi Parth,

Generally I'm okay with the Terms of Reference you've proposed. We will also be circulating to the rail authority to get their comments – I'll be curious to see how the new road connection works relative to the rail crossing.

There are no active developments in the area for you to include specifically so we are okay with the background growth rates recommended by the County.

I look forward to reviewing your study and feel free to reach out with any other questions.

Julia

Julia Salvini (she, her), PEng, FITE

President

julia@salviniconsulting.com

519-591-0426

From: Lynne Banks <lbanks@puslinch.ca>

Sent: Monday, September 18, 2023 10:33 AM

To: Parth Bhatt <pbhatt@cfcrozier.ca>

Cc: julia@salviniconsulting.com

Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Parth –

I can confirm that Julia Salvini of Salvini Consulting will be reaching out to you directly regarding the TOR.

Thanks –

Lynne



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

From: Parth Bhatt <pbhatt@cfcrozier.ca>

Sent: Thursday, September 7, 2023 9:42 AM

To: Lynne Banks <lbanks@puslinch.ca>; Mike Fowler <mfowler@puslinch.ca>

Cc: Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>

Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Lynne,

Hope you are doing well. I am following up for the background development information. Did you hear anything? Let us know

Thanks

Parth

Parth Bhatt, M.Eng., P.Eng.

Project Engineer, Transportation

Office: 416.477.3392

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From: Lynne Banks <lbanks@puslinch.ca>

Sent: Tuesday, August 29, 2023 2:09 PM

To: Parth Bhatt <pbhatt@cfcrozier.ca>; Mike Fowler <mfowler@puslinch.ca>

Cc: Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>

Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Parth –

Our consultant was on vacation for 2 weeks, but is reviewing your proposal now that she is back. I will forward comments to you once I receive them.

Regards –

Lynne



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

From: Parth Bhatt <pbhatt@cfcrozier.ca>

Sent: Thursday, August 24, 2023 10:04 AM

To: Lynne Banks <lbanks@puslinch.ca>; Mike Fowler <mfowler@puslinch.ca>

Cc: Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>

Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Lynne,

Hope you are doing well. I am following up with this email for my request on background development information. Did you hear anything? Let us know.

Thanks

Parth

Parth Bhatt, M.Eng., P.Eng.
Project Engineer, Transportation
Office: 416.477.3392
Collingwood | Milton | Toronto | Bradford | Guelph

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From: Parth Bhatt

Sent: Friday, August 18, 2023 4:24 PM

To: Lynne Banks <lbanks@puslinch.ca>; Mike Fowler <mfowler@puslinch.ca>

Cc: Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>

Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Lynne,

Please find the draft plan of subdivision attached. Thanks

Parth

From: Lynne Banks <lbanks@puslinch.ca>

Sent: Friday, August 18, 2023 3:54 PM

To: Parth Bhatt <pbhatt@cfcrozier.ca>; Mike Fowler <mfowler@puslinch.ca>

Cc: Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>

Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Parth –

Can you please provide me with a copy of the draft plan of subdivision and I will forward it, and the information below, to the Township's traffic consultant for review and comments regarding anything else that should be considered.

Thanks –

Lynne



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

From: Parth Bhatt <pbhatt@cfcrozier.ca>
Sent: Friday, August 18, 2023 3:19 PM
To: Mike Fowler <mfowler@puslinch.ca>; Lynne Banks <lbanks@puslinch.ca>
Cc: Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>
Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Mike and Lynne,
Can you please advise if any background developments should be accounted for in our analysis based on email chain below and also let us know if there are any comments on our Terms of Reference ? Thanks
Parth

Parth Bhatt, M.Eng., P.Eng.
Project Engineer, Transportation
Office: 416.477.3392
Collingwood | Milton | Toronto | Bradford | Guelph

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From: Pasquale Costanzo <pasqualec@wellington.ca>
Sent: Friday, August 18, 2023 1:49 PM
To: Parth Bhatt <pbhatt@cfcrozier.ca>; Kooistra, Tim <tkooistra@dillon.ca>
Cc: mfowler@puslinch.ca; Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>; Meagan Ferris <meaganf@wellington.ca>; Lynne Banks <lbanks@puslinch.ca>
Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Parth,

The Township would be your contact to provide you background developments for your study.

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: Parth Bhatt <pbhatt@cfcrozier.ca>
Sent: Friday, August 18, 2023 12:24 PM
To: Kooistra, Tim <tkooistra@dillon.ca>
Cc: mfowler@puslinch.ca; Pasquale Costanzo <pasqualec@wellington.ca>; Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>
Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

CAUTION: This email originated from outside the organization. Do not click links or open attachments unless you know the contents to be safe.

Hi Tim,

Hope you are doing well. I am following up regarding my email below for the background developments. Let us know if you have the information. Thanks

Parth

Parth Bhatt, M.Eng., P.Eng.
Project Engineer, Transportation
Office: 416.477.3392
Collingwood | Milton | Toronto | Bradford | Guelph

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From: Parth Bhatt
Sent: Tuesday, August 15, 2023 11:21 AM
To: Kooistra, Tim <tkooistra@dillon.ca>
Cc: mfowler@puslinch.ca; pasqualec@wellington.ca; Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>
Subject: RE: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Hi Tim,

Thanks for your feedback and TMC, can you please let us know the background developments that needs to be accounted and provide us with the respective traffic impact studies.

Parth

From: Kooistra, Tim <tkooistra@dillon.ca>
Sent: Tuesday, August 15, 2023 10:47 AM
To: Parth Bhatt <pbhatt@cfcrozier.ca>

Cc: mfwolder@puslinch.ca; pasqualec@wellington.ca; Brandon Bradt <bbradt@cfcrozier.ca>; Masoud Imaniboossejin <mimaniboossejin@cfcrozier.ca>
Subject: Re: Terms of Reference for residential development on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington

Good morning Parth,

Thank you for reaching out regarding the planned Transportation Impact Assessment you are looking to prepare for a proposed residential subdivision found within the community of Arkell in the Township of Puslinch. As you are aware, Dillon Consulting Limited has been retained by the County of Wellington to review the proposed scope of work for various traffic impact studies that may impact the County road network and associated intersections. As a result, this response is being provided on behalf of the County of Wellington for your consideration.

The scope you have identified is generally acceptable from the County's perspective, noting that the following needs to be considered in the study:

- Rather than having to collect a new turning movement count (TMC) at the Wellington Road 37 and Wellington Road 41 intersection in Arkell, you may be pleased to know that a TMC was completed at this intersection in 2022. This TMC is attached for your reference.
- A 2.0% per annum growth rate is required within the study area.
- The Township of Puslinch will need to identify any other background developments and/or associated traffic impact studies that have been previously submitted that may impact the future traffic volumes that need to be considered in the study.

Thank you,

Tim

Tim Kooistra, C.E.T.
Dillon Consulting Limited
130 Dufferin Avenue Suite 1400
London, Ontario, N6A 5R2
T - 519.438.1288 ext. 1330
F - 519.672.8209
M - 519.851.5403
TKooistra@dillon.ca
www.dillon.ca

On Fri, Aug 11, 2023 at 12:32\u00a0PM Parth Bhatt <pbhatt@cfcrozier.ca> wrote:

Good Evening Mike, Tim and Pasquale,

C.F. Crozier has been retained to complete a Traffic Impact Study (TIS) for a proposed residential development located on sections of Lots 7 and 8 of Concession 10, in the Township of Puslinch, County of Wellington. The subject lands cover an area of approximately 17 ha and currently consist of agricultural/vegetated land. The property, located on the southeast corner of the intersection at Arkell Road and Watson Road South, is bounded by a residential property to the north, agricultural/vegetated lands to the east, the Guelph Junction Railway to the south, and Watson Road/residential properties to the west.

The elements envisioned for this development include:

- Forty (40) Single detached residential properties (each lot will be 0.2 ha or larger).
- Associated internal public road network.
- Proposed Site Accesses via Watson Road South

For additional detail please refer to the preliminary Draft Plan of Subdivision attached here but note that it is subject to change prior to the submission.

Below are the proposed terms of reference for this development's Traffic Impact Study (TIS). The TIS will be completed as per the County of Wellington's Traffic Impact Study Guidelines with the following assumptions:

Please provide feedback at the earliest possible. Should you have any questions or concerns, please feel free to contact us, we would be happy to discuss.

Thanks,

Parth

Based on the preliminary ITE Trip Generation estimates, approximately 32 and 42 new two-way a.m. and p.m. peak hour trips, respectively, are generated by the development. The TIS will evaluate the potential impacts of traffic generated by the proposed development during the weekday a.m. and p.m. peak hours. The study will consider the existing 2023, full build-out year (2026 assumed) as well as five years (2031) beyond full build-out in accordance with the County of Wellington's Traffic Impact Study Guidelines. The following intersections will be analyzed.

- Watson Road South and Arkell Road
- Proposed Site Accesses via Watson Road South
- Existing, future background and future total traffic operations will be analyzed using Synchro 11. Standard traffic operations metrics for signalized and unsignalized intersections including delays, volume-to-capacity ratios, and 95th percentile queue length will be analyzed and reported on.
- Existing counts will be undertaken to establish the 2023 existing traffic volumes.
- Based on AADT data; otherwise please advise the appropriate growth rates for the roadways listed above.
- Please advise if any background developments should be accounted for in our analysis.
- Trip distribution will be derived from a combination of 2016 Transportation Tomorrow Survey (TTS) data and existing travel patterns.
- Future total traffic operations will be compared to future background traffic operations under the future study horizon(s) to determine what mitigation measures are required on the boundary road network to accommodate the development. These mitigation measures may include auxiliary turn lanes, signalization, etc. as warranted.
- The proposed site accesses will be reviewed from a safety perspective with regards to design vehicle maneuverability (ie. waste vehicles and fire trucks), driver sight lines, intersection spacing and access configuration. The safety assessment will be based on the standards set out by the Transportation Associates of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR) and the Transport Canada Grade Crossing Standards.
- The minimum vehicle parking requirements will be reviewed per the Township of Puslinch Zoning By-law 023-18 and compare with the proposed supply.
- The study findings regarding traffic operations, recommendations and conclusions will all be compiled for review.

Confirmation regarding traffic counts survey

We would like to confirm regarding traffic counts survey, as we are currently in month of August, does Township of Puslinch / County of Wellington permit traffic counts done in August as schools are currently closed and usually opens in September ?

Parth Bhatt, M.Eng., P.Eng.
Project Engineer, Transportation
Office: 416.477.3392
Collingwood | Milton | Toronto | Bradford | Guelph

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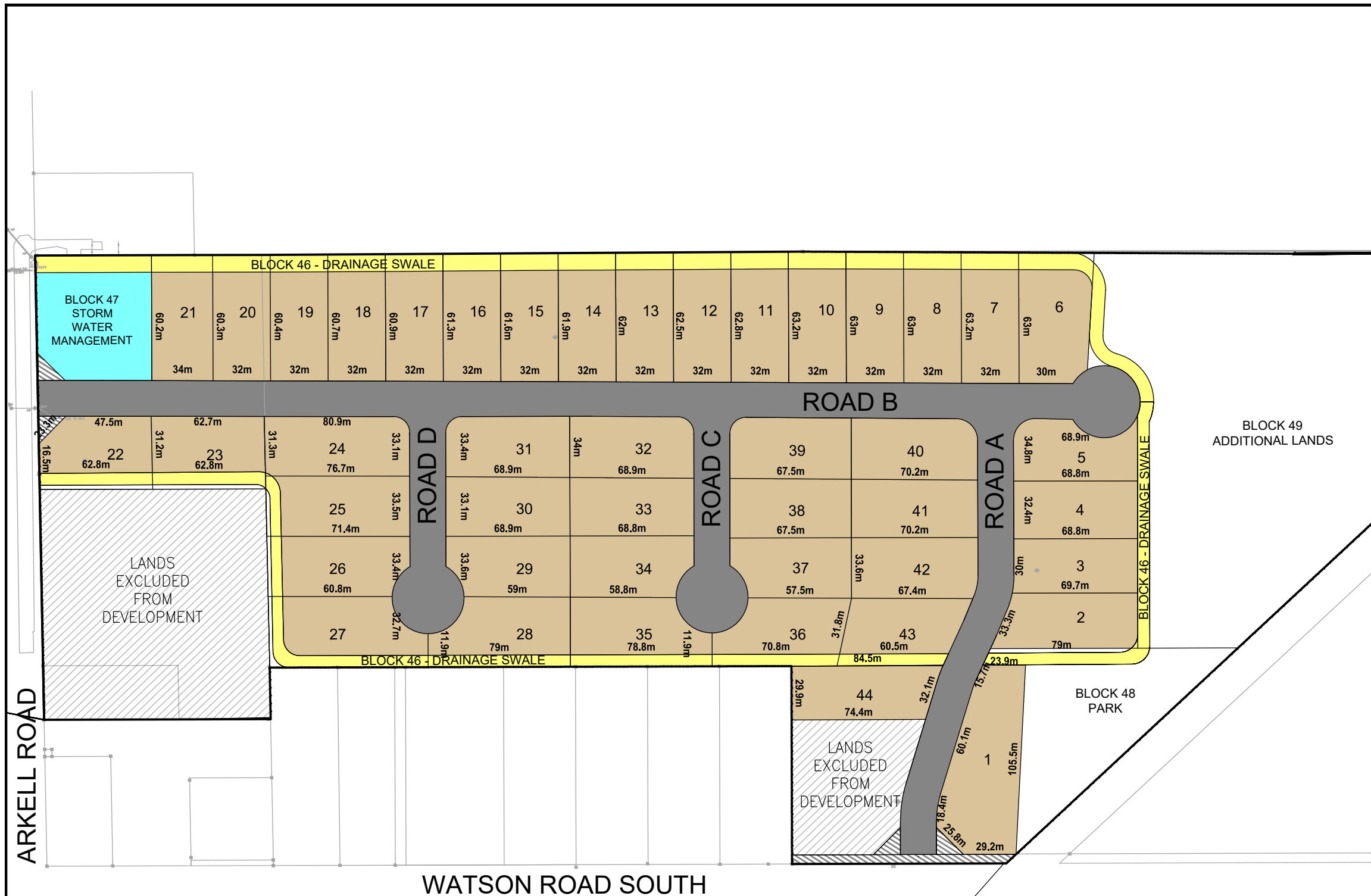
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APPENDIX B

Site Plan

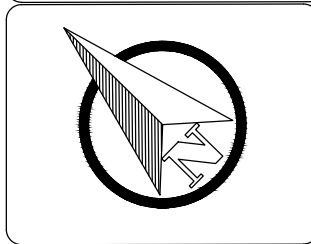
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1	94.2	44	0.39
2	33.3	79	0.23
3	30	69.7	0.21
4	32.4	68.8	0.21
5	34.8	68.8	0.21
6	37.9	63	0.24
7-20	32	63.2-60.3	0.2
21	34	60.2	0.21
22	47.5	31.2	0.19
23	62.7	31.2	0.19
24	33.1	76.7	0.26
25	33.5	71.4	0.24
26	33.4	60.8	0.23
27	32.7	60.8	0.23
28	32.5	79	0.22
29	33.6	59	0.22
30	33.1	68.9	0.23
31	33.4	68.9	0.23
32	34	68.9	0.22
33	32.5	68.8	0.22
34	33.9	58.8	0.22
35	32.5	78.8	0.22
36	32.5	70.8	0.2
37	33.6	57.5	0.22
38	32.5	67.5	0.22
39	34	67.5	0.23
40	34	70.2	0.24
41	32.5	70.2	0.23
42	33.6	67.4	0.24
43	33.5	60.5	0.2
44	32.1	74.4	0.24



Conceptual Plan
44 Lots
 PART OF LOTS 7, 8, & 9, CONCESSION 10
 ASSESSMENT ROLL NUMBER 2301000008034800000
 ARKELL, ONTARIO

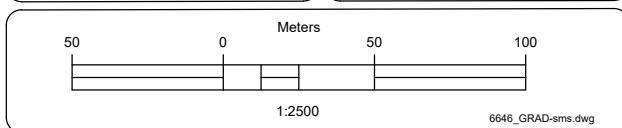
1. This is Not a Plan Of Survey.
2. Locations of Natural Features Have Been Extracted From The Government of Ontario: Land Information Ontario Open Data.
3. Distances Shown on This Plan Are Adjusted Ground Distances and Can Be Converted To Grid Distances by Multiplying by An Averaged Combined Scale Factor of 0.999636.
4. Coordinates on This Plan Are UTM, ZONE 17, NAD83 (CSRS-2010) Adjustment and Are Based on GPS Observations From a Network of Permanent GPS Reference Stations.

SAI Stovel and Associates Inc.
 651 Orangeville Road,
 Fergus ON
 N1M 1T9
 P: 519-766-8042
 E: stovel.associates@outlook.com
 PLANNING. AGROLOGY. ENVIRONMENTAL.

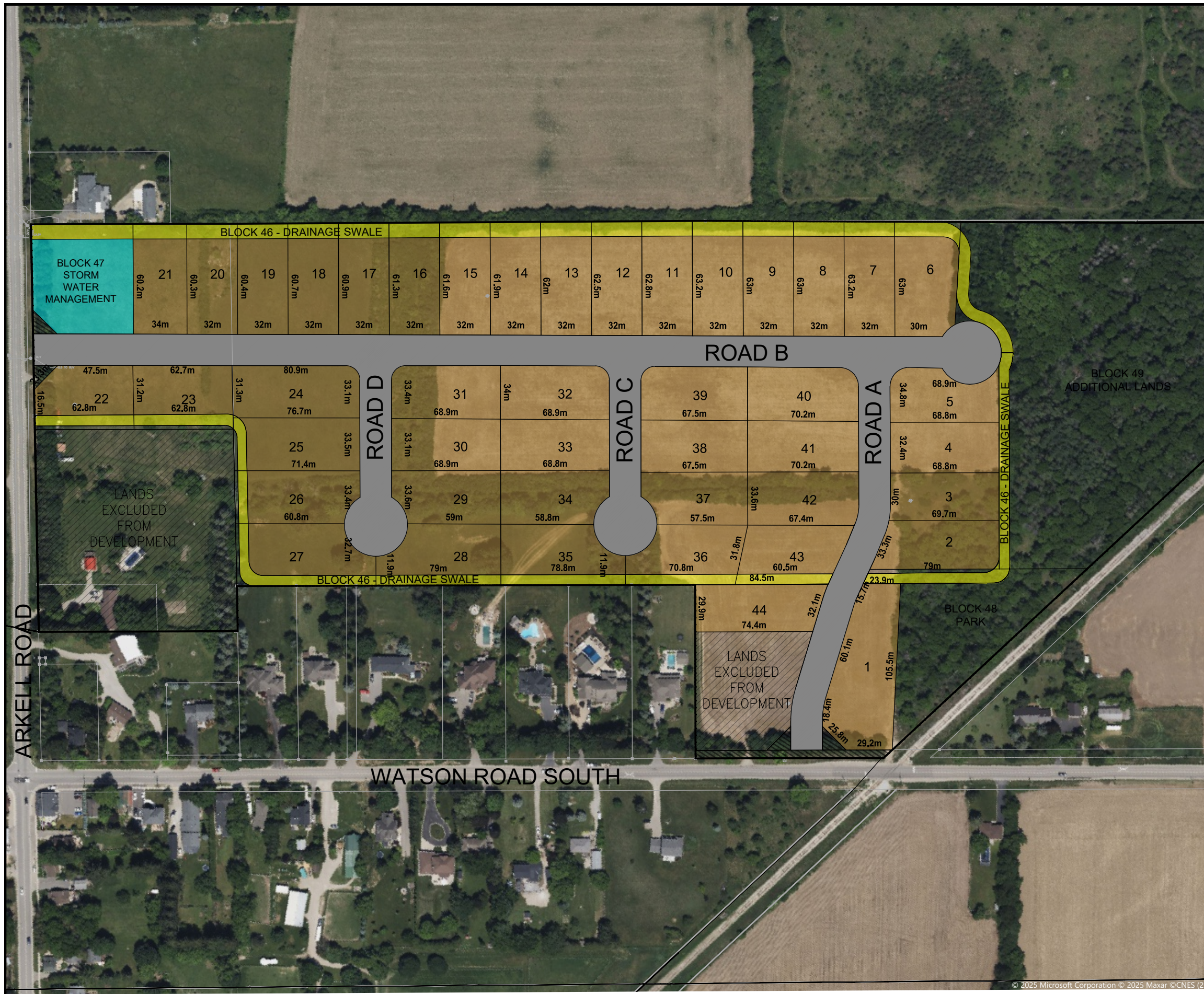


DRAFT

July 29, 2025



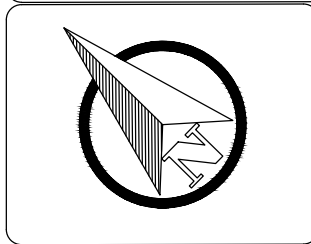
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4	32.4	68.8	0.21
5	34.8	68.8	0.21
6	37.9	63	0.24
7-20	32	63.2-60.3	0.2
21	34	60.2	0.21
22	47.5	31.2	0.19
23	62.7	31.2	0.19
24	33.1	76.7	0.26
25	33.5	71.4	0.24
26	33.4	60.8	0.23
27	32.7	60.8	0.23
28	32.5	79	0.22
29	33.6	59	0.22
30	33.1	68.9	0.23
31	33.4	68.9	0.23
32	34	68.9	0.22
33	32.5	68.8	0.22
34	33.9	58.8	0.22
35	32.5	78.8	0.22
36	32.5	70.8	0.2
37	33.6	57.5	0.22
38	32.5	67.5	0.22
39	34	67.5	0.23
40	34	70.2	0.24
41	32.5	70.2	0.23
42	33.6	67.4	0.24
43	33.5	60.5	0.2
44	32.1	74.4	0.24



Conceptual Plan
44 Lots
 PART OF LOTS 7, 8, & 9, CONCESSION 10
 ASSESSMENT ROLL NUMBER 230100008034800000
 ARKELL, ONTARIO

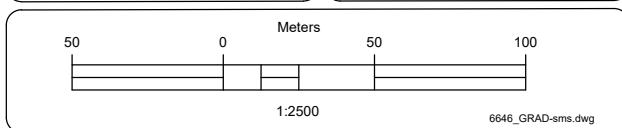
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SAI Stovel and Associates Inc.
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 P: 519-766-8042
 E: stovel.associates@outlook.com
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DRAFT

July 29, 2025



APPENDIX C

Traffic Data

WELLINGTON COUNTY TRAFFIC COUNT SUMMARY

Intersection: WR 37 at WR 41 (Puslinch)
Site code: 00004137
Count date: 07/28/2022
Counted by: Shayna - student

North approach: WR 37 (major)					N/S totals	South approach: WR 37 (major)				
Hour	Right	Thru	Left	Peds		Hour	Right	Thru	Left	Peds
7:00	10	72	6	8	207	7:00	11	81	27	0
8:00	15	97	3	1	250	8:00	13	87	35	1
9:00	0	0	0	0	0	9:00	0	0	0	0
10:00	0	0	0	0	0	10:00	0	0	0	0
11:00	9	62	4	2	207	11:00	22	75	35	1
12:00	21	74	7	1	251	12:00	33	75	41	2
13:00	18	76	4	0	244	13:00	25	88	33	1
14:00	0	0	0	0	0	14:00	0	0	0	0
15:00	0	0	0	0	0	15:00	0	0	0	0
16:00	23	128	10	2	413	16:00	26	152	74	2
17:00	14	122	12	6	352	17:00	22	136	46	3
18:00	18	100	6	1	303	18:00	28	89	62	3
Totals	128	731	52	21		Totals	180	783	353	13

East approach: WR 41 (minor)					E/W totals	West approach: WR 41 (minor)				
Hour	Right	Thru	Left	Peds		Hour	Right	Thru	Left	Peds
7:00	3	43	9	3	176	7:00	42	65	14	1
8:00	9	72	19	2	255	8:00	64	72	19	1
9:00	0	0	0	0	0	9:00	0	0	0	0
10:00	0	0	0	0	0	10:00	0	0	0	0
11:00	11	49	25	5	182	11:00	39	41	17	4
12:00	7	60	25	3	199	12:00	41	44	22	1
13:00	13	70	21	0	209	13:00	40	47	18	2
14:00	0	0	0	0	0	14:00	0	0	0	0
15:00	0	0	0	0	0	15:00	0	0	0	0
16:00	9	110	24	0	382	16:00	111	100	28	1
17:00	9	87	27	0	300	17:00	66	83	28	6
18:00	8	79	29	4	219	18:00	41	47	15	26
Totals	69	570	179	17		Totals	444	499	161	42

Calculated values for traffic crossing major street

Hour:	7:00	8:00	11:00	12:00	13:00	16:00	17:00	18:00
Value:	186	222	176	197	201	364	316	257

WR 37 at WR 41 (Puslinch)

Count date: 07/28/2022
 Intersection: WR 37 at WR 41
 Major road: WR 37
 Major road runs: north/south (one lane each way)
 Speed of major road: 80 km/h
 Operating conditions: Free flow

WARRANT #1 MINIMUM VEHICULAR VOLUMES

SATISFIED

A. All approaches

No. of lanes	Minimum requirements					Hours								Percentage warrant
	1 lane each way		2 lanes each way		3+ lanes	7:00	8:00	11:00	12:00	13:00	16:00	17:00	18:00	
Flow cond'n	f. flow (code 1)	r. flow (code 2)	f. flow (code 3)	r. flow (code 4)	r. flow (code 5)									
100%	480	720	600	900	1125	383	505	389	450	453	795	652	522	100%
80%	385	575	480	720	900									NO
All approaches	100% fulfilled					0	100	0	0	0	100	100	100	400
	80% fulfilled					0	0	80	80	80	0	0	0	240
	Actual % if below 80%					80	0	0	0	0	0	0	0	80
													Total:	720
													Actual average (total/8):	90

B. Minor street both approaches

100%	120	170	120	170	170	176	255	182	199	209	382	300	219	100%
80%	95	135	95	135	135									YES
Both approaches	100% fulfilled					100	100	100	100	100	100	100	100	800
	80% fulfilled					0	0	0	0	0	0	0	0	0
	Actual % if below 80%					0	0	0	0	0	0	0	0	0
													Total:	800
													Actual average (total/8):	100

WR 37 at WR 41 (Puslinch)

Count date: 07/28/2022
 Intersection: WR 37 at WR 41
 Major road: WR 37
 Major road runs: north/south (one lane each way)
 Speed of major road: 80 km/h
 Operating conditions: Free flow

WARRANT #2 DELAY TO CROSS TRAFFIC

NOT SATISFIED

A. Major street both approaches

No. of lanes	Minimum requirements					Hours								Percentage warrant
	1 lane each way		2 lanes each way		3+ lanes	7:00	8:00	11:00	12:00	13:00	16:00	17:00	18:00	
Flow cond'n	f. flow (code 1)	r. flow (code 2)	f. flow (code 3)	r. flow (code 4)	r. flow (code 5)									
100%	480	720	600	900	1125	207	250	207	251	244	413	352	303	100%
80%	385	575	480	720	900									NO
All approaches	100% fulfilled					0	0	0	0	0	0	0	0	0
	80% fulfilled					0	0	0	0	0	80	0	0	80
	Actual % if below 80%					43	52	43	52	51	0	73	63	378
													Total:	458
													Actual average (total/8):	57

B. Traffic crossing major street

100%	50	75	50	75	75	186	222	176	197	201	364	316	257	100%
80%	40	60	40	60	60									YES
All approaches	100% fulfilled					100	100	100	100	100	100	100	100	800
	80% fulfilled					0	0	0	0	0	0	0	0	0
	Actual % if below 80%					0	0	0	0	0	0	0	0	0
													Total:	800
													Actual average (total/8):	100

WR 37 at WR 41 (Puslinch)	
Count date:	07/28/2022
Intersection:	WR 37 at WR 41
Major road:	WR 37
Major road runs:	north/south (one lane each way)
Speed of major road:	80 km/h
Operating conditions:	Free flow

WARRANT #3 ACCIDENT EXPERIENCE

A. Reportable accidents within a 12 month period averaged over 36 consecutive months susceptible to correction by a traffic signal			
Minimum requirements per year	Actual number of accidents in 36 months	Average number of accidents per year	Fulfilled
5	2	0.67	13%
B. Adequate trial of less restrictive remedies has failed to reduce accident frequency			No
C. Either Warrant 1 or Warrant 2 satisfied 80% or more			Yes

WARRANT #4 COMBINATION WARRANT (used if no warrant satisfied 100%)

Minimum requirements	Warrant satisfied 80% or more	Fulfilled
At least two warrants satisfied 80%	Warrant 1 (Minimum Vehicular Volume)	Yes
	Warrant 2 (Delay to Cross Traffic)	No
	Warrant 3 (Accident Experience)	No

CONCLUSION

Traffic signal is not warranted

APPENDIX D

Level of Service Definitions

Level of Service Definitions

Two-Way Stop Controlled Intersections

Level of Service	Control Delay per Vehicle (seconds)	Interpretation
A	≤ 10	EXCELLENT. Large and frequent gaps in traffic on the main roadway. Queuing on the minor street is rare.
B	> 10 and ≤ 15	VERY GOOD. Many gaps exist in traffic on the main roadway. Queuing on the minor street is minimal.
C	> 15 and ≤ 25	GOOD. Fewer gaps exist in traffic on the main roadway. Delay on minor approach becomes more noticeable.
D	> 25 and ≤ 35	FAIR. Infrequent and shorter gaps in traffic on the main roadway. Queue lengths develop on the minor street.
E	> 35 and ≤ 50	POOR. Very infrequent gaps in traffic on the main roadway. Queue lengths become noticeable.
F	> 50	UNSATISFACTORY. Very few gaps in traffic on the main roadway. Excessive delay with significant queue lengths on the minor street.

Adapted from Highway Capacity Manual 2000, Transportation Research Board

Signalized Intersections

Level of Service	Control Delay per Vehicle (seconds)	Interpretation
A	≤ 10	EXCELLENT. Extremely favourable progression with most vehicles arriving during the green phase. Most vehicles do not stop and short cycle lengths may contribute to low delay.
B	> 10 and ≤ 20	VERY GOOD. Very good progression and/or short cycle lengths with slightly more vehicles stopping than LOS "A" causing slightly higher levels of average delay.
C	> 20 and ≤ 35	GOOD. Fair progression and longer cycle lengths lead to a greater number of vehicles stopping than LOS "B".
D	> 35 and ≤ 55	FAIR. Congestion becomes noticeable with higher average delays resulting from a combination of long cycle lengths, high volume-to-capacity ratios and unfavourable progression.
E	> 55 and ≤ 80	POOR. Lengthy delays values are indicative of poor progression, long cycle lengths and high volume-to-capacity ratios. Individual cycle failures are common with individual movement failures also common.
F	> 80	UNSATISFACTORY. Indicative of oversaturated conditions with vehicular demand greater than the capacity of the intersection.

















Adapted from Highway Capacity Manual 2000, Transportation Research Board

APPENDIX E

Detailed Capacity Analysis Reports

Lanes, Volumes, Timings
1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2023 Existing AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	19	73	65	19	73	9	36	89	13	3	99	15
Future Volume (vph)	19	73	65	19	73	9	36	89	13	3	99	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.944			0.988			0.987			0.983	
Flt Protected		0.994			0.991			0.987			0.999	
Satd. Flow (prot)	0	1748	0	0	1824	0	0	1815	0	0	1829	0
Flt Permitted		0.994			0.991			0.987			0.999	
Satd. Flow (perm)	0	1748	0	0	1824	0	0	1815	0	0	1829	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			515.6			455.7			424.1	
Travel Time (s)		29.9			37.1			32.8			30.5	
Confl. Peds. (#/hr)	2		1	1		2	1		1	1		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	79	71	21	79	10	39	97	14	3	108	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	171	0	0	110	0	0	150	0	0	127	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	31.6%
Analysis Period (min)	15
	ICU Level of Service A

Intersection	
Intersection Delay, s/veh	8.8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	19	73	65	19	73	9	36	89	13	3	99	15
Future Vol, veh/h	19	73	65	19	73	9	36	89	13	3	99	15
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	21	79	71	21	79	10	39	97	14	3	108	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.8	8.6	9	8.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	26%	12%	19%	3%
Vol Thru, %	64%	46%	72%	85%
Vol Right, %	9%	41%	9%	13%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	138	157	101	117
LT Vol	36	19	19	3
Through Vol	89	73	73	99
RT Vol	13	65	9	15
Lane Flow Rate	150	171	110	127
Geometry Grp	1	1	1	1
Degree of Util (X)	0.197	0.214	0.146	0.166
Departure Headway (Hd)	4.738	4.506	4.781	4.7
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	755	795	748	760
Service Time	2.783	2.546	2.826	2.747
HCM Lane V/C Ratio	0.199	0.215	0.147	0.167
HCM Control Delay	9	8.8	8.6	8.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.7	0.8	0.5	0.6

Lanes, Volumes, Timings
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2023 Existing PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	29	102	113	24	112	9	75	155	27	10	131	23
Future Volume (vph)	29	102	113	24	112	9	75	155	27	10	131	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.938			0.991			0.986			0.981	
Flt Protected		0.994			0.992			0.986			0.997	
Satd. Flow (prot)	0	1737	0	0	1831	0	0	1811	0	0	1822	0
Flt Permitted		0.994			0.992			0.986			0.997	
Satd. Flow (perm)	0	1737	0	0	1831	0	0	1811	0	0	1822	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			513.9			455.7			424.1	
Travel Time (s)		29.9			37.0			32.8			30.5	
Confl. Peds. (#/hr)			1	1			2		2	2		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	32	111	123	26	122	10	82	168	29	11	142	25
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	266	0	0	158	0	0	279	0	0	178	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	50.2%
ICU Level of Service	A
Analysis Period (min)	15

Intersection	
Intersection Delay, s/veh	11.4
Intersection LOS	B

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	29	102	113	24	112	9	75	155	27	10	131	23
Future Vol, veh/h	29	102	113	24	112	9	75	155	27	10	131	23
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	32	111	123	26	122	10	82	168	29	11	142	25
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	11.5	10.5	12.3	10.6
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	12%	17%	6%
Vol Thru, %	60%	42%	77%	80%
Vol Right, %	11%	46%	6%	14%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	257	244	145	164
LT Vol	75	29	24	10
Through Vol	155	102	112	131
RT Vol	27	113	9	23
Lane Flow Rate	279	265	158	178
Geometry Grp	1	1	1	1
Degree of Util (X)	0.418	0.384	0.247	0.272
Departure Headway (Hd)	5.383	5.211	5.631	5.484
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	668	690	635	652
Service Time	3.427	3.258	3.682	3.534
HCM Lane V/C Ratio	0.418	0.384	0.249	0.273
HCM Control Delay	12.3	11.5	10.5	10.6
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2.1	1.8	1	1.1

Lanes, Volumes, Timings
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2026 Future Background AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	78	69	21	78	10	39	95	14	4	106	16
Future Volume (vph)	21	78	69	21	78	10	39	95	14	4	106	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.945			0.988			0.987			0.983	
Flt Protected		0.994			0.990			0.987			0.999	
Satd. Flow (prot)	0	1750	0	0	1822	0	0	1815	0	0	1829	0
Flt Permitted		0.994			0.990			0.987			0.999	
Satd. Flow (perm)	0	1750	0	0	1822	0	0	1815	0	0	1829	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			515.6			455.7			424.1	
Travel Time (s)		29.9			37.1			32.8			30.5	
Confl. Peds. (#/hr)	2		1	1		2	1		1	1		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	85	75	23	85	11	42	103	15	4	115	17
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	183	0	0	119	0	0	160	0	0	136	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	36.7%
Analysis Period (min)	15
	ICU Level of Service A

Intersection	
Intersection Delay, s/veh	9
Intersection LOS	A

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	21	78	69	21	78	10	39	95	14	4	106	16
Future Vol, veh/h	21	78	69	21	78	10	39	95	14	4	106	16
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	23	85	75	23	85	11	42	103	15	4	115	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9	8.8	9.2	8.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	26%	12%	19%	3%
Vol Thru, %	64%	46%	72%	84%
Vol Right, %	9%	41%	9%	13%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	148	168	109	126
LT Vol	39	21	21	4
Through Vol	95	78	78	106
RT Vol	14	69	10	16
Lane Flow Rate	161	183	118	137
Geometry Grp	1	1	1	1
Degree of Util (X)	0.215	0.232	0.16	0.182
Departure Headway (Hd)	4.809	4.579	4.856	4.775
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	743	780	735	748
Service Time	2.862	2.629	2.911	2.83
HCM Lane V/C Ratio	0.217	0.235	0.161	0.183
HCM Control Delay	9.2	9	8.8	8.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.8	0.9	0.6	0.7

Lanes, Volumes, Timings
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2026 Future Background PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	109	120	26	119	10	80	165	29	11	140	25
Future Volume (vph)	31	109	120	26	119	10	80	165	29	11	140	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.938			0.991			0.986			0.981	
Flt Protected		0.994			0.992			0.986			0.997	
Satd. Flow (prot)	0	1737	0	0	1831	0	0	1811	0	0	1822	0
Flt Permitted		0.994			0.992			0.986			0.997	
Satd. Flow (perm)	0	1737	0	0	1831	0	0	1811	0	0	1822	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			513.9			455.7			424.1	
Travel Time (s)		29.9			37.0			32.8			30.5	
Confl. Peds. (#/hr)			1	1			2		2	2		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	118	130	28	129	11	87	179	32	12	152	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	282	0	0	168	0	0	298	0	0	191	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	52.8%
Analysis Period (min)	15
	ICU Level of Service A

Intersection	
Intersection Delay, s/veh	12.1
Intersection LOS	B

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	31	109	120	26	119	10	80	165	29	11	140	25
Future Vol, veh/h	31	109	120	26	119	10	80	165	29	11	140	25
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	34	118	130	28	129	11	87	179	32	12	152	27
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	12.3	11	13.2	11.1
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	12%	17%	6%
Vol Thru, %	60%	42%	77%	80%
Vol Right, %	11%	46%	6%	14%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	274	260	155	176
LT Vol	80	31	26	11
Through Vol	165	109	119	140
RT Vol	29	120	10	25
Lane Flow Rate	298	283	168	191
Geometry Grp	1	1	1	1
Degree of Util (X)	0.457	0.421	0.271	0.3
Departure Headway (Hd)	5.525	5.36	5.798	5.644
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	649	670	617	633
Service Time	3.58	3.417	3.863	3.707
HCM Lane V/C Ratio	0.459	0.422	0.272	0.302
HCM Control Delay	13.2	12.3	11	11.1
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	2.4	2.1	1.1	1.3

Lanes, Volumes, Timings
1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2031 Future Background AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	86	77	23	86	11	43	105	16	4	116	18
Future Volume (vph)	23	86	77	23	86	11	43	105	16	4	116	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.944			0.988			0.987			0.982	
Flt Protected		0.994			0.990			0.987			0.999	
Satd. Flow (prot)	0	1748	0	0	1822	0	0	1815	0	0	1827	0
Flt Permitted		0.994			0.990			0.987			0.999	
Satd. Flow (perm)	0	1748	0	0	1822	0	0	1815	0	0	1827	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			515.6			455.7			424.1	
Travel Time (s)		29.9			37.1			32.8			30.5	
Confl. Peds. (#/hr)	2		1	1		2	1		1	1		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	93	84	25	93	12	47	114	17	4	126	20
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	202	0	0	130	0	0	178	0	0	150	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	39.3%					ICU Level of Service A						
Analysis Period (min)	15											

Intersection	
Intersection Delay, s/veh	9.3
Intersection LOS	A

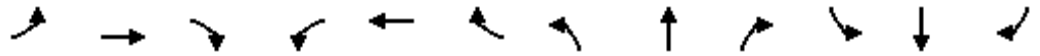
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	23	86	77	23	86	11	43	105	16	4	116	18
Future Vol, veh/h	23	86	77	23	86	11	43	105	16	4	116	18
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	25	93	84	25	93	12	47	114	17	4	126	20
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.4	9.1	9.6	9.2
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	26%	12%	19%	3%
Vol Thru, %	64%	46%	72%	84%
Vol Right, %	10%	41%	9%	13%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	164	186	120	138
LT Vol	43	23	23	4
Through Vol	105	86	86	116
RT Vol	16	77	11	18
Lane Flow Rate	178	202	130	150
Geometry Grp	1	1	1	1
Degree of Util (X)	0.243	0.263	0.18	0.204
Departure Headway (Hd)	4.912	4.679	4.971	4.885
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	726	762	716	729
Service Time	2.982	2.744	3.042	2.957
HCM Lane V/C Ratio	0.245	0.265	0.182	0.206
HCM Control Delay	9.6	9.4	9.1	9.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.9	1.1	0.7	0.8

Lanes, Volumes, Timings
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2031 Future Background PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (vph)	34	120	133	29	132	11	88	182	32	12	154	27
Future Volume (vph)	34	120	133	29	132	11	88	182	32	12	154	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.937			0.991			0.986			0.981	
Flt Protected		0.994			0.992			0.986			0.997	
Satd. Flow (prot)	0	1735	0	0	1831	0	0	1811	0	0	1822	0
Flt Permitted		0.994			0.992			0.986			0.997	
Satd. Flow (perm)	0	1735	0	0	1831	0	0	1811	0	0	1822	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			513.9			455.7			424.1	
Travel Time (s)		29.9			37.0			32.8			30.5	
Confl. Peds. (#/hr)			1	1			2		2	2		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	130	145	32	143	12	96	198	35	13	167	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	312	0	0	187	0	0	329	0	0	209	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	57.0%
ICU Level of Service	B
Analysis Period (min)	15

Intersection	
Intersection Delay, s/veh	13.7
Intersection LOS	B

















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	34	120	133	29	132	11	88	182	32	12	154	27
Future Vol, veh/h	34	120	133	29	132	11	88	182	32	12	154	27
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	37	130	145	32	143	12	96	198	35	13	167	29
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	14	12	15.2	12.2
HCM LOS	B	B	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	12%	17%	6%
Vol Thru, %	60%	42%	77%	80%
Vol Right, %	11%	46%	6%	14%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	302	287	172	193
LT Vol	88	34	29	12
Through Vol	182	120	132	154
RT Vol	32	133	11	27
Lane Flow Rate	328	312	187	210
Geometry Grp	1	1	1	1
Degree of Util (X)	0.526	0.486	0.316	0.346
Departure Headway (Hd)	5.772	5.612	6.089	5.933
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	620	636	585	600
Service Time	3.855	3.697	4.188	4.027
HCM Lane V/C Ratio	0.529	0.491	0.32	0.35
HCM Control Delay	15.2	14	12	12.2
HCM Lane LOS	C	B	B	B
HCM 95th-tile Q	3.1	2.7	1.3	1.5

Lanes, Volumes, Timings
1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2026 Future Total AM

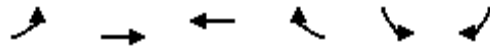
												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	78	69	21	84	10	39	96	15	4	107	16
Future Volume (vph)	21	78	69	21	84	10	39	96	15	4	107	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	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												
Frt		0.945			0.988			0.987			0.983	
Flt Protected		0.994			0.991			0.987			0.999	
Satd. Flow (prot)	0	1750	0	0	1824	0	0	1815	0	0	1829	0
Flt Permitted		0.994			0.991			0.987			0.999	
Satd. Flow (perm)	0	1750	0	0	1824	0	0	1815	0	0	1829	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			515.6			455.7			275.0	
Travel Time (s)		29.9			37.1			32.8			19.8	
Confl. Peds. (#/hr)	2		1	1		2	1		1	1		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	23	85	75	23	91	11	42	104	16	4	116	17
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	183	0	0	125	0	0	162	0	0	137	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	37.0%
Analysis Period (min)	15
	ICU Level of Service A

Lanes, Volumes, Timings
 2: Watson Road S. (WR 41) & Site Access 1

2026 Future Total AM












Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	1	89	101	7	21	6
Future Volume (vph)	1	89	101	7	21	6
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.991		0.968	
Flt Protected		0.999			0.963	
Satd. Flow (prot)	0	1861	1846	0	1736	0
Flt Permitted		0.999			0.963	
Satd. Flow (perm)	0	1861	1846	0	1736	0
Link Speed (k/h)		50	50		30	
Link Distance (m)		515.6	23.5		109.1	
Travel Time (s)		37.1	1.7		13.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	97	110	8	23	7
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	98	118	0	30	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	15.7%
Analysis Period (min)	15
	ICU Level of Service A

















Lanes, Volumes, Timings
3: Arkell Road (WR 37) & Site Access 2

2026 Future Total AM

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	1	3	117	1	1	117
Future Volume (vph)	1	3	117	1	1	117
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.899		0.999			
Flt Protected	0.988					
Satd. Flow (prot)	1655	0	1861	0	0	1863
Flt Permitted	0.988					
Satd. Flow (perm)	1655	0	1861	0	0	1863
Link Speed (k/h)	50		50			50
Link Distance (m)	178.3		275.0			149.1
Travel Time (s)	12.8		19.8			10.7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	3	127	1	1	127
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	128	0	0	128
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	17.0%			ICU Level of Service A		
Analysis Period (min)	15					

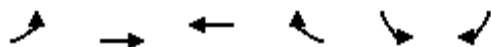
HCM Unsignalized Intersection Capacity Analysis
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2026 Future Total AM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	21	78	69	21	84	10	39	96	15	4	107	16
Future Volume (vph)	21	78	69	21	84	10	39	96	15	4	107	16
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	23	85	75	23	91	11	42	104	16	4	116	17
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	183	125	162	137								
Volume Left (vph)	23	23	42	4								
Volume Right (vph)	75	11	16	17								
Hadj (s)	-0.19	0.02	0.03	-0.03								
Departure Headway (s)	4.6	4.9	4.9	4.8								
Degree Utilization, x	0.24	0.17	0.22	0.18								
Capacity (veh/h)	721	678	691	687								
Control Delay (s)	9.1	8.9	9.2	8.9								
Approach Delay (s)	9.1	8.9	9.2	8.9								
Approach LOS	A	A	A	A								
Intersection Summary												
Delay			9.0									
Level of Service			A									
Intersection Capacity Utilization			37.0%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 2: Watson Road S. (WR 41) & Site Access 1

2026 Future Total AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	89	101	7	21	6
Future Volume (Veh/h)	1	89	101	7	21	6
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)	1	97	110	8	23	7
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	118			213	114	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	118			213	114	
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			97	99	
cM capacity (veh/h)	1470			775	939	
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	98	118	30			
Volume Left	1	0	23			
Volume Right	0	8	7			
cSH	1470	1700	808			
Volume to Capacity	0.00	0.07	0.04			
Queue Length 95th (m)	0.0	0.0	0.9			
Control Delay (s)	0.1	0.0	9.6			
Lane LOS	A		A			
Approach Delay (s)	0.1	0.0	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			15.7%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 3: Arkell Road (WR 37) & Site Access 2

















2026 Future Total AM



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	3	117	1	1	117
Future Volume (Veh/h)	1	3	117	1	1	117
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	3	127	1	1	127
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	256	128			128	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	256	128			128	
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)	732	923			1458	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	4	128	128			
Volume Left	1	0	1			
Volume Right	3	1	0			
cSH	866	1700	1458			
Volume to Capacity	0.00	0.08	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	9.2	0.0	0.1			
Lane LOS	A		A			
Approach Delay (s)	9.2	0.0	0.1			
Approach LOS	A					
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization		17.0%		ICU Level of Service		A
Analysis Period (min)			15			

Lanes, Volumes, Timings
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

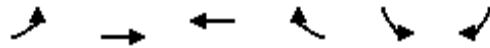
2026 Future Total PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	115	120	28	119	10	80	166	30	11	140	25
Future Volume (vph)	31	115	120	28	119	10	80	166	30	11	140	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.939			0.991			0.985			0.981	
Flt Protected		0.994			0.991			0.986			0.997	
Satd. Flow (prot)	0	1739	0	0	1829	0	0	1809	0	0	1822	0
Flt Permitted		0.994			0.991			0.986			0.997	
Satd. Flow (perm)	0	1739	0	0	1829	0	0	1809	0	0	1822	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			513.9			455.7			281.0	
Travel Time (s)		29.9			37.0			32.8			20.2	
Confl. Peds. (#/hr)			1	1			2		2	2		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	125	130	30	129	11	87	180	33	12	152	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	289	0	0	170	0	0	300	0	0	191	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	53.0%
Analysis Period (min)	15
	ICU Level of Service A

Lanes, Volumes, Timings
 2: Watson Road S. (WR 41) & Site Access 1

2026 Future Total PM












Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	7	139	145	18	15	2
Future Volume (vph)	7	139	145	18	15	2
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.985		0.985	
Flt Protected		0.997			0.957	
Satd. Flow (prot)	0	1857	1835	0	1756	0
Flt Permitted		0.997			0.957	
Satd. Flow (perm)	0	1857	1835	0	1756	0
Link Speed (k/h)		50	50		30	
Link Distance (m)		513.9	23.5		109.1	
Travel Time (s)		37.0	1.7		13.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	151	158	20	16	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	159	178	0	18	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	23.0%
Analysis Period (min)	15
	ICU Level of Service A

















Lanes, Volumes, Timings
3: Arkell Road (WR 37) & Site Access 2

2026 Future Total PM

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	4	193	1	6	164
Future Volume (vph)	0	4	193	1	6	164
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865		0.999			
Flt Protected						0.998
Satd. Flow (prot)	1611	0	1861	0	0	1859
Flt Permitted						0.998
Satd. Flow (perm)	1611	0	1861	0	0	1859
Link Speed (k/h)	50		50			50
Link Distance (m)	190.1		281.0			143.1
Travel Time (s)	13.7		20.2			10.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	4	210	1	7	178
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	211	0	0	185
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	23.5%		ICU Level of Service A			
Analysis Period (min)	15					

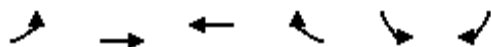
HCM Unsignalized Intersection Capacity Analysis
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2026 Future Total PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	31	115	120	28	119	10	80	166	30	11	140	25
Future Volume (vph)	31	115	120	28	119	10	80	166	30	11	140	25
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	34	125	130	30	129	11	87	180	33	12	152	27
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	289	170	300	191								
Volume Left (vph)	34	30	87	12								
Volume Right (vph)	130	11	33	27								
Hadj (s)	-0.21	0.03	0.03	-0.04								
Departure Headway (s)	5.4	5.9	5.6	5.7								
Degree Utilization, x	0.44	0.28	0.47	0.30								
Capacity (veh/h)	611	545	595	564								
Control Delay (s)	12.6	11.1	13.4	11.2								
Approach Delay (s)	12.6	11.1	13.4	11.2								
Approach LOS	B	B	B	B								
Intersection Summary												
Delay			12.3									
Level of Service			B									
Intersection Capacity Utilization			53.0%	ICU Level of Service								A
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
2: Watson Road S. (WR 41) & Site Access 1










2026 Future Total PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	139	145	18	15	2
Future Volume (Veh/h)	7	139	145	18	15	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)	8	151	158	20	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)						
pX, platoon unblocked						
vC, conflicting volume	178				335	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	178				335	168
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	100
cM capacity (veh/h)	1398				656	876
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	159	178	18			
Volume Left	8	0	16			
Volume Right	0	20	2			
cSH	1398	1700	675			
Volume to Capacity	0.01	0.10	0.03			
Queue Length 95th (m)	0.1	0.0	0.7			
Control Delay (s)	0.4	0.0	10.5			
Lane LOS	A		B			
Approach Delay (s)	0.4	0.0	10.5			
Approach LOS			B			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization		23.0%		ICU Level of Service		A
Analysis Period (min)			15			

















HCM Unsignalized Intersection Capacity Analysis
 3: Arkell Road (WR 37) & Site Access 2

2026 Future Total PM

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	4	193	1	6	164
Future Volume (Veh/h)	0	4	193	1	6	164
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	4	210	1	7	178
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	402	210			211	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	402	210			211	
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			99	
cM capacity (veh/h)	601	830			1360	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	4	211	185			
Volume Left	0	0	7			
Volume Right	4	1	0			
cSH	830	1700	1360			
Volume to Capacity	0.00	0.12	0.01			
Queue Length 95th (m)	0.1	0.0	0.1			
Control Delay (s)	9.4	0.0	0.3			
Lane LOS	A		A			
Approach Delay (s)	9.4	0.0	0.3			
Approach LOS	A					
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			23.5%	ICU Level of Service		A
Analysis Period (min)			15			

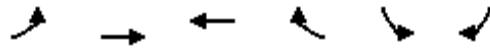
Lanes, Volumes, Timings
1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2031 Future Total AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	86	77	23	92	11	43	106	17	4	117	18
Future Volume (vph)	23	86	77	23	92	11	43	106	17	4	117	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.944			0.988			0.986			0.982	
Flt Protected		0.994			0.991			0.987			0.999	
Satd. Flow (prot)	0	1748	0	0	1824	0	0	1813	0	0	1827	0
Flt Permitted		0.994			0.991			0.987			0.999	
Satd. Flow (perm)	0	1748	0	0	1824	0	0	1813	0	0	1827	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			515.6			455.7			273.7	
Travel Time (s)		29.9			37.1			32.8			19.7	
Confl. Peds. (#/hr)	2		1	1		2	1		1	1		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	93	84	25	100	12	47	115	18	4	127	20
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	202	0	0	137	0	0	180	0	0	151	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	39.6%					ICU Level of Service A						
Analysis Period (min)	15											

Lanes, Volumes, Timings
 2: Watson Road S. (WR 41) & Site Access 1

2031 Future Total AM












Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	1	89	101	7	21	6
Future Volume (vph)	1	89	101	7	21	6
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.991		0.968	
Flt Protected		0.999			0.963	
Satd. Flow (prot)	0	1861	1846	0	1736	0
Flt Permitted		0.999			0.963	
Satd. Flow (perm)	0	1861	1846	0	1736	0
Link Speed (k/h)		50	50		30	
Link Distance (m)		515.6	23.5		109.1	
Travel Time (s)		37.1	1.7		13.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	97	110	8	23	7
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	98	118	0	30	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	15.7%
Analysis Period (min)	15
	ICU Level of Service A

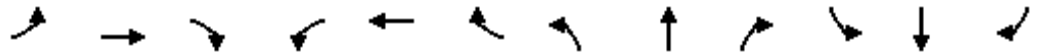
Lanes, Volumes, Timings
3: Arkell Road (WR 37) & Site Access 2

2031 Future Total AM

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	1	3	117	1	1	117
Future Volume (vph)	1	3	117	1	1	117
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.899		0.999			
Flt Protected	0.988					
Satd. Flow (prot)	1655	0	1861	0	0	1863
Flt Permitted	0.988					
Satd. Flow (perm)	1655	0	1861	0	0	1863
Link Speed (k/h)	50		50			50
Link Distance (m)	168.4		273.7			150.4
Travel Time (s)	12.1		19.7			10.8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1	3	127	1	1	127
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	128	0	0	128
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	17.0%			ICU Level of Service A		
Analysis Period (min)	15					

HCM Unsignalized Intersection Capacity Analysis
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2031 Future Total AM



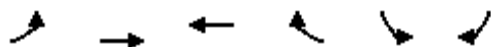
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	23	86	77	23	92	11	43	106	17	4	117	18
Future Volume (vph)	23	86	77	23	92	11	43	106	17	4	117	18
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	93	84	25	100	12	47	115	18	4	127	20

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	202	137	180	151
Volume Left (vph)	25	25	47	4
Volume Right (vph)	84	12	18	20
Hadj (s)	-0.19	0.02	0.03	-0.04
Departure Headway (s)	4.8	5.0	5.0	5.0
Degree Utilization, x	0.27	0.19	0.25	0.21
Capacity (veh/h)	701	654	669	665
Control Delay (s)	9.5	9.2	9.6	9.3
Approach Delay (s)	9.5	9.2	9.6	9.3
Approach LOS	A	A	A	A

Intersection Summary			
Delay		9.4	
Level of Service		A	
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
 2: Watson Road S. (WR 41) & Site Access 1

2031 Future Total AM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↔		↕	
Traffic Volume (veh/h)	1	89	101	7	21	6
Future Volume (Veh/h)	1	89	101	7	21	6
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)	1	97	110	8	23	7
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	118				213	114
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	118				213	114
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				97	99
cM capacity (veh/h)	1470				775	939
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	98	118	30			
Volume Left	1	0	23			
Volume Right	0	8	7			
cSH	1470	1700	808			
Volume to Capacity	0.00	0.07	0.04			
Queue Length 95th (m)	0.0	0.0	0.9			
Control Delay (s)	0.1	0.0	9.6			
Lane LOS	A		A			
Approach Delay (s)	0.1	0.0	9.6			
Approach LOS			A			
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			15.7%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
3: Arkell Road (WR 37) & Site Access 2

















2031 Future Total AM



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	3	117	1	1	117
Future Volume (Veh/h)	1	3	117	1	1	117
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	3	127	1	1	127
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	256	128			128	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	256	128			128	
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)	732	923			1458	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	4	128	128			
Volume Left	1	0	1			
Volume Right	3	1	0			
cSH	866	1700	1458			
Volume to Capacity	0.00	0.08	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	9.2	0.0	0.1			
Lane LOS	A		A			
Approach Delay (s)	9.2	0.0	0.1			
Approach LOS	A					
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			17.0%		ICU Level of Service	A
Analysis Period (min)			15			

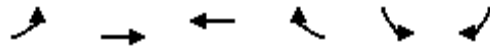
Lanes, Volumes, Timings
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2031 Future Total PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	34	126	133	31	132	11	88	183	33	12	154	27
Future Volume (vph)	34	126	133	31	132	11	88	183	33	12	154	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
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												
Frt		0.939			0.991			0.985			0.981	
Flt Protected		0.994			0.991			0.986			0.997	
Satd. Flow (prot)	0	1739	0	0	1829	0	0	1809	0	0	1822	0
Flt Permitted		0.994			0.991			0.986			0.997	
Satd. Flow (perm)	0	1739	0	0	1829	0	0	1809	0	0	1822	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		415.4			513.9			455.7			278.3	
Travel Time (s)		29.9			37.0			32.8			20.0	
Confl. Peds. (#/hr)			1	1			2		2	2		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	137	145	34	143	12	96	199	36	13	167	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	319	0	0	189	0	0	331	0	0	209	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway 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
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											
Intersection Capacity Utilization	57.2%						ICU Level of Service B					
Analysis Period (min)	15											

Lanes, Volumes, Timings
 2: Watson Road S. (WR 41) & Site Access 1

2031 Future Total PM












Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	7	139	145	18	15	2
Future Volume (vph)	7	139	145	18	15	2
Ideal Flow (vphp)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.985		0.985	
Flt Protected		0.997			0.957	
Satd. Flow (prot)	0	1857	1835	0	1756	0
Flt Permitted		0.997			0.957	
Satd. Flow (perm)	0	1857	1835	0	1756	0
Link Speed (k/h)		50	50		30	
Link Distance (m)		513.9	23.5		109.1	
Travel Time (s)		37.0	1.7		13.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	8	151	158	20	16	2
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	159	178	0	18	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		0.0	0.0		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	23.0%
ICU Level of Service	A
Analysis Period (min)	15
















Lanes, Volumes, Timings
3: Arkell Road (WR 37) & Site Access 2

2031 Future Total PM

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	4	193	1	6	164
Future Volume (vph)	0	4	193	1	6	164
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	0.865		0.999			
Flt Protected						0.998
Satd. Flow (prot)	1611	0	1861	0	0	1859
Flt Permitted						0.998
Satd. Flow (perm)	1611	0	1861	0	0	1859
Link Speed (k/h)	50		50			50
Link Distance (m)	172.3		278.3			145.8
Travel Time (s)	12.4		20.0			10.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	4	210	1	7	178
Shared Lane Traffic (%)						
Lane Group Flow (vph)	4	0	211	0	0	185
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	23.5%			ICU Level of Service A		
Analysis Period (min)	15					

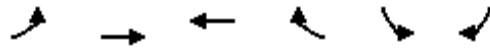
HCM Unsignalized Intersection Capacity Analysis
 1: Arkell Road (WR 37) & Watson Road S. (WR 41)

2031 Future Total PM

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	34	126	133	31	132	11	88	183	33	12	154	27
Future Volume (vph)	34	126	133	31	132	11	88	183	33	12	154	27
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	37	137	145	34	143	12	96	199	36	13	167	29
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	319	189	331	209								
Volume Left (vph)	37	34	96	13								
Volume Right (vph)	145	12	36	29								
Hadj (s)	-0.22	0.03	0.03	-0.04								
Departure Headway (s)	5.7	6.3	5.9	6.1								
Degree Utilization, x	0.51	0.33	0.54	0.35								
Capacity (veh/h)	579	502	566	519								
Control Delay (s)	14.6	12.3	15.7	12.4								
Approach Delay (s)	14.6	12.3	15.7	12.4								
Approach LOS	B	B	C	B								
Intersection Summary												
Delay			14.1									
Level of Service			B									
Intersection Capacity Utilization			57.2%	ICU Level of Service	B							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 2: Watson Road S. (WR 41) & Site Access 1










2031 Future Total PM



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	139	145	18	15	2
Future Volume (Veh/h)	7	139	145	18	15	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)	8	151	158	20	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)						
pX, platoon unblocked						
vC, conflicting volume	178				335	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	178				335	168
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	100
cM capacity (veh/h)	1398				656	876
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	159	178	18			
Volume Left	8	0	16			
Volume Right	0	20	2			
cSH	1398	1700	675			
Volume to Capacity	0.01	0.10	0.03			
Queue Length 95th (m)	0.1	0.0	0.7			
Control Delay (s)	0.4	0.0	10.5			
Lane LOS	A		B			
Approach Delay (s)	0.4	0.0	10.5			
Approach LOS			B			
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			23.0%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
3: Arkell Road (WR 37) & Site Access 2

2031 Future Total PM

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	4	193	1	6	164
Future Volume (Veh/h)	0	4	193	1	6	164
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	4	210	1	7	178
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	402	210			211	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	402	210			211	
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			99	
cM capacity (veh/h)	601	830			1360	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	4	211	185			
Volume Left	0	0	7			
Volume Right	4	1	0			
cSH	830	1700	1360			
Volume to Capacity	0.00	0.12	0.01			
Queue Length 95th (m)	0.1	0.0	0.1			
Control Delay (s)	9.4	0.0	0.3			
Lane LOS	A		A			
Approach Delay (s)	9.4	0.0	0.3			
Approach LOS	A					
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			23.5%		ICU Level of Service	A
Analysis Period (min)			15			

APPENDIX F

TTS Data

Wed Aug 16 2023 22:26:10 GMT-0400 (Eastern Daylight Time) - Run Time: 2393ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06_orig

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - gta06_dest In 8303

and

Start time of trip - start_time In 0630-0930

and

Trip purpose of destination - purp_dest In H

Trip 2016

Table:

	8303
8057	15
8171	24
8195	24

Wed Aug 16 2023 22:42:01 GMT-0400 (Eastern Daylight Time) - Run Time: 2432ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06_dest

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - gta06_orig In 8303

and

Start time of trip - start_time In 0630-0930

and

Trip purpose of origin - purp_orig In H

Trip 2016

Table:

	8303
52	12
3357	36
4126	13
7016	24
8035	12
8057	36
8086	24
8091	12
8092	22
8107	36
8151	12
8165	30
8195	24
8199	49

Wed Aug 16 2023 22:56:15 GMT-0400 (Eastern Daylight Time) - Run Time: 2512ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06_orig

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - gta06_dest In 8303

and

Start time of trip - start_time In 1530-1830

and

Trip purpose of destination - purp_dest In H

Trip 2016

Table:

	8303
52	12
3357	36
4143	24
7016	24
8029	36
8035	12
8048	21
8057	36
8086	24
8107	36
8165	30
8195	24
8307	15

Wed Aug 16 2023 23:15:50 GMT-0400 (Eastern Daylight Time) - Run Time: 2427ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of destination - gta06_dest

Column: 2006 GTA zone of origin - gta06_orig

Filters:

2006 GTA zone of origin - gta06_orig In 8303

and

Start time of trip - start_time In 1530-1830

and

Trip purpose of origin - purp_orig In H

Trip 2016

Table:

	8303
8029	36
8048	21
8057	15
8082	72
8169	12
8195	24

**FUNCTIONAL SERVICING AND STORMWATER
MANAGEMENT REPORT**

**ARKELL SUBDIVISION
RESIDENTIAL DEVELOPMENT**

TOWNSHIP OF PUSLINCH

PREPARED FOR:

**TIMBERWORX CUSTOM HOMES, SLOOT
CONSTRUCTION, JOHN SLOOT INVESTMENTS**

PREPARED BY:

**C.F. CROZIER & ASSOCIATES INC.
55 WYNDHAM STREET NORTH, SUITE 215
GUELPH, ON N1H 7T8**

JANUARY 2026

CFCA FILE NO. 2433-6646

The material in this report reflects best judgment in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. C.F. Crozier & Associates Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.



Revision Number	Date	Comments
Rev. 0	March 2024	Issued for First Submission (ZBA)
Rev. 1	May 2024	Re-Issued for First Submission (ZBA)
Rev. 2	August 2025	Issued for Second Submission (ZBA)
Rev. 3	January 2026	Issued for Third Submission (ZBA)

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1.0 Introduction

C.F. Crozier & Associates Inc. (Crozier) was retained by Timberworx Custom Homes, Slood Construction, and John Slood Investments (Owners) to prepare a Functional Servicing and Stormwater Management Report in support of the Zoning By-Law Amendment Application for the residential development located at lots 7, 8, 9, Concession 10, Township of Puslinch, County of Wellington (Site; see Figure 1). The purpose of this report is to demonstrate that the proposed development is feasible from a functional servicing and stormwater management perspective and conforms with the requirements of the Township of Puslinch (Township), Wellington County (County), and the Grand River Conservation Authority (GRCA).

The relevant background studies and reports include:

- Township of Puslinch Municipal Development Standards (September 2019)
- Hydrogeological and Predictive Nitrate Assessment prepared by R.J. Burnside & Associates Ltd. (July 2006)
- Preliminary Stormwater Management Report prepared by Richardson Foster Ltd. (August 2006)
- Groundwater Supply Assessment prepared by ARL Groundwater Resources Ltd. (March 2023)
- 1669 tp Logs – Arkell prepared by Chung & Vander Doelen Engineering Ltd. (December 2023)
- The Ontario Building Code (OBC) (2012)
- Ministry of Transportation Drainage Management Manual (1997)
- Ministry of Environment Stormwater Management Planning and Design Manual (March 2003)
- Golden Horseshoe CA Erosion and Sediment Control Guideline for Urban Construction (2006)
- TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guide (2010)
- City of Guelph Development Engineering Manual (October 2023)

This report has been prepared to support the second submission of the Zoning By-Law Amendment Application for the proposed residential development.

2.0 Site Description

The Site encompasses an area of 20.45 ha with a developable area of approximately 17.45 ha. The Site currently consists of a single detached dwelling, garage, existing woodlot, and agricultural fields. The Site is bounded by agricultural fields to the north, Arkell Road to the West, Guelph Junction Railway (GJR) to the East, Watson Road, and existing detached homes to the South.

According to the Conceptual Plan prepared by Stovel and Associates Inc. (July 29, 2025) included in Appendix A, it is understood that the Site will consist of the following elements:

- Forty-Four (44) residential lots with associated onsite sewage systems and private wells.
- One (1) stormwater management facility for flood control.
- One (1) swale to act as a bypass for drainage external to the Site and one (1) bioswale to infiltrate and convey Site stormwater during minor and major storm events.
- A half (0.5) hectare of land to remain undeveloped.
- An access road connecting to Watson Road in the southwest and a secondary access road connecting to Arkell Road in the northwest.

3.0 Soil and Groundwater Conditions

Chung & Vander Doelen Engineering Limited (CVD) was retained by the Owners to excavate test pits across the property. Ten (10) test pits were excavated in December 2023 to depths of up to 6.10m below ground surface (mbgs). According to CVD's test pit logs, subsurface conditions generally consisted of 250 to 450 mm of topsoil underlain by a thin layer of silt to silty sand and gravel followed by sand and gravel with trace silt to the maximum depth of investigation (6.10 mbgs). All test pits were dry at completion.

The sand and gravel is expected to be the receiving soil for the onsite sewage systems. Based on the grain size analysis of the sand and gravel, this material is classified a GP soil per the Unified Soil Classification System (USCS). According to Supplementary Standard SB-6 of the OBC, GP soils are described as poorly graded gravels and gravel-sand mixtures with little to no fines with a percolation rate of less than 1 min/cm. A conservative percolation rate of 15 min/cm was assigned for the onsite sewage system design.

In 2006, R.J. Burnside & Associates Limited (R.J. Burnside) completed a hydrogeological assessment on the property. As part of this assessment, ten (10) boreholes were advanced, two (2) of which were installed as groundwater monitoring wells. The stratigraphy encountered was similar to CVD's observations during the 2023 test pitting program, which was described as a later of topsoil (200 to 400 mm thick, or up to 1.5 mbgs in some locations), underlain by sandy gravel or sand and gravel. Groundwater was encountered between 7.43 and 10.37 mbgs, or 333.02 to 334.53 masl in January 2006. Refer to the Hydrogeological and Predictive Nitrate Assessment (R.J. Burnside, 2006) for additional details.

4.0 Water Servicing

4.1 Existing Water Servicing

There are no municipal water services available in the vicinity of the Site. Surrounding properties are serviced by private water supply wells.

4.2 Proposed Water Servicing

Each lot will be serviced as an individual water supply well. A groundwater supply assessment was completed by ARL Groundwater Resources Ltd. (ARL) to assess the suitability of servicing each lot by a water supply well and to meet the requirements of MECP Guideline D-5-5 (provided under separate cover). ARL concluded that the Gasport formation aquifer can support the water quantity requirements for development. Refer to the Groundwater Supply Assessment Report (ARL, 2003) for additional details.

Conceptual well locations have been included on the Onsite Sewage Servicing Schematic (Drawing C102). However, the depth, size, and location of the wells will be determined during detailed design of each individual lot.

Required fire flow calculations will be completed following zoning approvals. However, preliminary calculations were completed to estimate the required fire storage volume for the proposed development. The fire storage volume was calculated using the Ontario Fire Marshalls Fire Protection Water Supply Guideline (1999), as required in the OBC.

The fire storage volume was calculated assuming a house footprint of 240 m² and a height of 6 m, Group C (residential) occupancy. Table 1 summarizes the preliminary fire storage volumes calculated for the proposed development.

Table 1: Fire Storage Volume Requirements

Lot	Total Area (m ²)	Height (m)	Volume (m ³)	K ¹	S _{side} ²	Required Fire Storage Volume, Q (L)
35	240	6	1440	23	1.4	81,000

1. K values represent the water supply coefficient based upon building occupancy.
2. S_{side} values determined from distance to other structures using Figure 1 in Section A-3.2.5.7 of the OBC.

A storage volume of 81,000L is the required minimum fire storage volume that must be supplied at a rate of 45 L/s for a duration of 0.5-hours. The fire flows determined from the OBC fire flow method is a conservative estimate and is for comparison purposes.

5.0 Sanitary Servicing

There are no municipal sanitary services available in the vicinity of the Site. Surrounding properties are privately serviced via onsite sewage systems. Therefore, each lot within the proposed development will be serviced by individual onsite sewage systems.

5.1 Sanitary Design Calculations

The proposed development will consist of forty-four (44) residential lots with private servicing. It is Crozier's understanding that the proposed residential dwellings will be three (3) to four (4) bedrooms with the possibility of two (2) bedrooms in the basement. For the purposes of this assessment, preliminary sewage system design flows were calculated for a six (6) bedroom dwelling with 240m² of finished floor area, four (4) bathroom groups, two (2) powder rooms, two (2) basement rough-ins and additional fixtures for a total of 62 fixture units.

The preliminary sewage system design flows were calculated in accordance with OBC, Part 8 and are presented below in Table 2.

Table 2: Preliminary Sewage System Daily 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)
240 m ² Residential Dwelling	6	240	61.5	2,500	400	2,075	4,575

As shown, the preliminary sewage system design flows are 4,575 L/day per lot. These flows were calculated based on the information provided 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 may change, which may affect the size of the onsite sewage systems and the serviceability of the development.

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 (MECP). Given the preliminary sewage system design flow is less than 10,000 L/day per individual lot, an ECA is not required. Building permits will be required for each sewage system prior to construction.

5.2 Proposed Sanitary Servicing

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

Crozier prepared nitrate loading calculations to determine the effluent concentration of nitrate-nitrogen each sewage system must achieve for the proposed development to meet MECP Guideline D-5-4 and are provided under separate cover. At least a 50% reduction of nitrate-nitrogen (effluent concentration of 20 mg/L) is required to meet 10 mg/L of nitrate-nitrogen at the downgradient property boundary. 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 50% 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 50% nitrate-nitrogen reduction.

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 below 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)
240 m ² Residential Dwelling	4,575	91.5	104	80.74	104

The Onsite Sewage Servicing Schematic (Drawing C102) illustrates 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 50% 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 following sections detail the drainage conditions of the Site under both pre-development and post-development scenarios.

6.1 Existing Drainage Conditions

The Site currently consists of an existing detached residential dwelling and accessory buildings, vacant grassed agricultural fields, and forested areas. The Site generally slopes from south to north and drains from Guelph Junction Railway (GJR) towards Arkell Road and ultimately outlets to a culvert on Arkell Road. The ultimate receiving watercourse of Site drainage is the Eramosa River.

As discussed in Section 3, test pits have been completed by CVD site suggesting that native soils are very coarse, and groundwater elevations are well below anticipated basement levels. These preliminary findings are consistent with other building sites in the area.

Additional monitoring is required, but initial indications suggest that soil conditions are conducive to the type of development proposed and that infiltration measures should be considered as part of the stormwater management strategy.

The site is divided into four (4) catchments under pre-development drainage conditions, as indicated on the Pre-development Drainage Plan (Figure 2).

The majority of the catchment area contributing to the Site outlet is external to the site and runoff from the external catchment area enters the Site from the lands north and south of the GJR. The external drainage primarily consists of agricultural fields and woodlot areas. Catchment Ext. 1 located north of the railroad is known as Starkey Hill Conservation Area. Runoff from Starkey Hill concentrates at the toe of the embankment adjacent to GJR. This runoff continues to drain overland across the subject property before reaching the outlet at Arkell Road. Catchment Ext. 2 located south of the railroad consists of woodlot and agricultural fields. The drainage flows from the southeast to the northwest before entering a rectangular culvert situated underneath the railroad to the south of the property. Catchment Ext. 2, much like catchment Ext. 1, continues to drain overland across the subject property before reaching the culvert at Arkell Road.

Catchment 101 encompasses the Site itself and consists of grassed agricultural lands, and woodlot. Catchment 101 drains overland from south to north of the property before reaching the outlet at Arkell Road.

Table 4 describes the pre-development catchment areas and land-uses as illustrated in Figure 2.

Table 4: Pre-Development Hydrologic Parameters

Catchment ID	Land-Use Description	Impervious Area (ha)	Pervious Area (ha)	Total Area (ha)	Percent Impervious (%)	Outlet
Ext. 1	Conservation lands and residential	0.03	24.35	24.38	0.1	400 mm dia. Culvert on Arkell Road
Ext. 2	Woodlot, agriculture, and residential	1.43	19.21	20.64	6.9	
Ext. 3	Vacant grassed agricultural fields, residential, and grassed lands	1.39	5.48	6.87	20.3	
101	Vacant grassed agricultural fields, residential, and grassed lands	0.08	18.74	18.82	0.45	
Total Area (ha) = 70.71		2.93	67.78	70.71	4.1	

Considering the size of the study area (70.7 ha), a preliminary hydrologic model was prepared to determine the peak flows from each catchment and establish a target release rate to govern the site following development. The peak flow rates for the 2 through to 100-year City of Guelph 3 Hour Chicago Storm events under pre-development conditions can be seen in Table 5 below.

Table 5: Pre-Development Peak Flows

Catchment ID	Outlet	Peak Flow Rates (L/s)					
		2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Ext. 1	Arkell Road (Culvert)	29	60	89	138	178	224
Ext. 2	Arkell Road (Culvert)	61	123	178	269	342	423
Ext. 3	Arkell Road (Culvert)	43	81	113	164	205	249
101	Arkell Road (Culvert)	37	73	104	157	199	247

The peak flow from the combined hydrograph of catchments in Table 5 represents the target peak flow at the outlet of the Site under post-development conditions. The target release rates are summarized in Table 6 below.

Table 6: Target Flow Rates

Location	Target Flow Rates (L/s)					
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Arkell Road (Culvert)	135	270	392	593	756	940

6.2 Proposed Drainage Conditions

Based on the Conceptual Plan prepared by Stovel and Associates Inc, dated February 6, 2024, the proposed development will consist of forty-four (44) single detached residential lots, paved internal roadways (Road A, B, C & D), a stormwater management facility, and undeveloped land. Access to the site will be provided from the proposed entrances on Arkell Road and Watson Road South.

6.2.1 Post-development Drainage Catchment Areas

The proposed Site grading divides the Site into four (4) drainage catchment areas and four (4) external drainage areas to the north and south of GJR which are unaffected by the proposed development. All drainage culminates at the same outlet (Arkell Road). Referring to the Post-Development Drainage Plan (Figure 3), the catchment areas are described as follows:

- Catchment Ext. 1 (A = 23.84) consists of drainage from Starky Hill conservation lands and woodlots. Runoff generated within this catchment is directed to the north of GJR where it concentrates at the toe of railroad embankment and continues south before entering the subject property where it will be collected by the south bypass swale. The flow follows the swale along the western property line flowing from south to north before reaching the outlet culvert on Arkell Road.
- Catchment Ext. 2 (A = 20.64) consists of drainage from the existing cultivated lands and woodlot. Runoff drains to the south of the GJR draining before passing through the rectangular culvert crossing underneath GJR and then being picked up by the south bypass swale. The flow follows the swale along the western property line flowing from south to north before reaching the outlet culvert on Arkell Road.
- Catchment Ext. 3 (A = 6.87) consists of drainage from existing residential lots and Watson Road South. All the runoff generated in this catchment will be conveyed into the south bypass swale along the southwest property line before reaching the outlet culvert located at Arkell Road.
- Catchment Ext.4 (A = 0.53) consists of drainage from Starky Hill conservation lands and woodlots. Runoff generated within this catchment flows through UN01 and into the proposed north bioswale.
- Catchment 201 (A = 10.55) consists of drainage from proposed residential lots and internal roads (roads A, B, C, D). Runoff from the residential lots and internal roadways are conveyed to storm sewers before being directed to the north bioswale.
- Catchment 202 (A = 2.39) consists of drainage from the rear and side yards of the proposed residential lots that contribute directly to the south bypass swale.

- Catchment UC01 (A = 1.35) consists of drainage from the existing woodlot east of the development. Runoff generated in this catchment drains east to west before being intercepted by the proposed north bioswale.
- Catchment UC02 (A = 4.54) consists of drainage from the existing woodlot east of the development. Runoff generated in this catchment drains east to west before being intercepted by the proposed south bypass swale.

The post-development catchments, land use descriptions, and respective percent imperviousness are shown in Table 7 below.

Table 7: Post-Development Hydrologic Parameters

Catchment ID	Description	Impervious Area (ha)	Pervious Area (ha)	Total Area (ha)	Percent Impervious (%)	Outlet
EXT 1	Conservation lands and existing residential	0.03	23.81	23.84	0.1	400 mm dia. Culvert on Arkeil Road
EXT 2	Woodlot, agriculture, and existing residential	1.43	19.21	20.64	6.9	
201	Internal roadway, residential, SWMF, and undeveloped land	4.49	6.06	10.55	42.6	
202	Internal rear yards and rear roof drainage	0.85	1.54	2.39	35.6	
EXT 3	Existing residential dwelling and Watson Road South	1.39	5.48	6.87	20.3	
EXT 4	Conservation lands	0.00	0.53	0.53	0	
UC01	Existing woodlot	0.00	1.35	1.35	0.0	
UC02	Existing woodlot	0.38	4.16	4.54	8.5	
Total Area (ha) = 70.71		8.57	62.14	70.71	12.1	

Drainage from Catchments Ext. 1, Ext. 2, 202, UC02, and Ext. 3 will discharge to the south swale in the before leaving the site via the outlet culvert at Arkeil Road. Any minor land use changes within these catchments will be naturally attenuated and mitigated in the long bypass swale (approximately 830 m long) which exhibits excellent infiltration capacity due to sandy soils and gradual slope.

Finally, drainage from Catchment 201 will be controlled via a storm sewer network, swale system with a series of control weirs, and a stormwater management facility (SWMF) in the form of a dry pond. The post-development peak flows from Catchment 201 will be controlled to pre-development peak flows or less. Uncontrolled post-development peak flows for the 2 through to the 100-year City of Guelph 3 Hour Chicago Storm events are summarized in Table 8 below.

Table 8: Post-Development Peak Flows (Unmitigated)

Catchment ID	Outlet	Peak Flow Rates (L/s)					
		2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Ext. 1	South Swale	28	58	87	134	173	218
Ext. 2	South Swale	61	123	178	269	342	423
201	North Swale	573	770	898	1064	1181	1301
Ext. 3	South Swale	43	81	113	164	205	249
Ext. 4	North Swale	1	2	4	6	7	9
UC01	North Swale	2	4	6	10	12	16
UC02	South Swale	11	22	33	51	65	81
Total	Arkell Road (Culvert)	597	810	952	1140	1275	1418
Target (Pre-Dev)	Arkell Road (Culvert)	135	270	392	593	756	940

Each proposed site entrance will be complete with culvert(s) sized to convey the 5 year storm ditch flows across the site entrance. Additionally, one (1) swale culvert is proposed at the South swale crossing of Road A. Preliminary culvert sizing is included in Appendix B and shown on drawing C101.

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, Grand River Conservation Authority (GRCA), and Ministry of Environment and Climate Change (MECP, formerly MOE). It is important to note that efforts have been made to preserve and maintain the rural character of the property. As such, passive stormwater management practices have been incorporated throughout the design.

The stormwater management criteria for the development are summarized below:

Water Quality Control

The Puslinch Municipal Development requires as a minimum the “Enhanced” level of protection (i.e. 80% TSS removal) as described in the Ministry of Environment Stormwater Management Planning and Design Manual (2003).

Water Balance

According to the Puslinch Municipal Development Standards an annual water budget shall be prepared for the development site as described in the MOE SWMPD Manual (March 2003). Crozier prepared a Water Balance Assessment (August 2025) which calculated the infiltration deficit associated with the development of the proposed lands. Pre-development infiltration was estimated to be at 251 mm/year, which was reduced by 99 mm/year to an infiltration of 152 mm/year under post development conditions.

Low impact development best management practices shall be designed in accordance with the MOE SWMPD Manual, and the TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guide (2010) to mitigate the infiltration deficit.

Erosion Control

According to the Puslinch Municipal Development Standards an Erosion and Sediment Control Plan will be provided, showing sediment and erosion control measures proposed to mitigate the effect of the construction on surrounding areas and infrastructure.

Water Quantity Control

According to the Township of Puslinch Municipal Development Standards Manual (2019), water quantity controls are required for the Site. The water quantity requirements include controlling the post-development peak flow event to the pre-development peak flow event for design storms up to and including the 100-year event.

Upon development, all runoff generated within the internal roadway or runoff that mixes with the roadway runoff will be conveyed to proposed bioswales and a dry pond for quantity and quality control. The bioswales have been designed based on a hydraulic conductivity of 35 mm/hr, representing a moderate infiltration rate reflective of the hydrologic group A soils in the area. No stormwater volume reduction associated with the infiltration component of the bioswale has been applied to the hydrologic modeling at this stage. Infiltration rates will be confirmed at the detailed design stage through in situ testing using a Guelph permeameter to confirm design drawdown times.

7.1 Stormwater Quality Control

Stormwater quality controls for the proposed development will be achieved by retaining, treating, and infiltrating runoff in a treatment train consisting of an Oil and Grit Separator (OGS), a bioswale system, and a dry pond. Runoff from the proposed development will be conveyed overland to one of four (4) storm sewer networks, each including an OGS within the downstream-most maintenance hole. The storm sewer networks outlet to the proposed bioswale that conveys the drainage to the dry pond. Runoff from the remainder of the site consists of natural heritage and landscaped areas and is therefore not subject to water quality treatment requirements.

The bioswale system treating runoff from the proposed development was sized to maximize the storage provided for quantity control while facilitating infiltration in the swale.

Table 9 summarizes the water quality storage required for enhanced 80% long term suspended solids removal and the water quality storage provided in the proposed bioswale system.

Table 9: Provided Water Quality Storage to Achieve Enhanced Water Quality Protection

Catchment	Catchment Area (ha)	25 mm Runoff Volume (mm)	25 mm Runoff Required Treatment Volume (m ³)	MOE Table 3.2 Enhanced Water Quality Storage Requirements (m ³)	Total Provided Treatment Volume (m ³)
201	10.55	6.32	667	304	1586

At a minimum, a total of 667 m³ of runoff is required to be treated and infiltrated to remove 80% of TSS and achieve “Enhanced Protection”. The proposed bioswale system provides sufficient

treatment for this volume in addition to the pre-treatment provided in the OGS units. Additional treatment capacity will be provided downstream of the bioswale system in the form of a dry pond. The bioswale system accepts runoff from the internal storm sewer network. To optimize the amount of runoff infiltrating into the water table, runoff is retained behind weir structures (0.7 m tall) and spaced at varying intervals that are dictated based on the existing slope/gradient. The ponded runoff behind the control weirs will infiltrate into the water table in accordance with the CVC/TRCA Low Impact Development SWM Planning Design Guide (Version 1.0, 2010).

The bioswale system treatment capacity is governed by the surface ponding volume within the various control weirs. Further calculations and details regarding the control weirs will be provided as the site designs continue to advance.

Refer to the Preliminary Grading and Servicing Plan (Drawing C101) and Appendix B for OGS sizing details.

7.2 Low Impact Development Design

Water balance and erosion control measures will be designed to satisfy all relevant criteria and constraints. The above will be demonstrated and discussed at the detailed design stage.

7.3 Stormwater Quantity Controls

Design Storm – 3-hour Chicago

The City of Guelph IDF parameters (October 2023) were used to generate a 3-hour Chicago design storm, per Puslinch Municipal Development Standards. The quantity volume modeled only includes the proposed dry pond, though the bioswale could also provide additional stormwater quantity storage. An orifice size of 125 mm was used for the preliminary outfall design.

The required preliminary storage volumes and uncontrolled peak flow rates are presented in Table 10.

Table 10: Preliminary Storage Volume Requirements (3-hour Chicago)

Storm (3-hour Chicago)	Pre-Dev. Uncontrolled Peak Flow Rate¹ (L/s)	Post-Dev. Uncontrolled Peak Flow Rate² (L/s)	Post-Dev. Controlled Peak Flow Rate² (L/s)	Total Preliminary Storage Volume Required (m³)
2-year	135	597	130	710
5-year	270	810	255	1044
10-year	392	952	365	1318
25-year	593	1140	547	1735
50-year	756	1275	693	2051
100-year	940	1418	857	2399

1. Includes runoff directed to outlet culvert located at Arkell Road (Catchment 101, EXT 1, 2, & 3)

2. Includes runoff directed to outlet culvert located at Arkell Road (Catchment 201, EXT 1, 2, & 3, UC01, UC02). The maximum storage required for the 3-hour Chicago storm distribution is roughly 2400 m³ during the 100-year storm event and the quantity control will be provided for the required storage volume using the proposed dry pond.

The proposed dry pond is sized to store 2630 m³ of volume below the sill of the emergency spillway. The emergency spillway is sized to convey the uncontrolled 100 Year and Regional flows at a flow depth of approximately 0.1 meters, leaving approximately 0.3 meters of freeboard.

7.4 Stormwater Management Inspection and Maintenance

It is understood that that the Township of Puslinch will be responsible for the operation and maintenance of the stormwater management system. Maintenance procedures associated with the stormwater management system are detailed below.

Grass Swales

Table 11 outlines routine inspection and maintenance tasks and recommended minimum frequencies for grass swales.

Table 11: Routine Maintenance Tasks for Grassed Swales

Frequency	Routine Maintenance Task
Annually or as needed	Replace dead vegetation, remove invasive growth, dethatch, and aerate.
	Repair eroded or sparsely vegetated areas.
	Remove accumulated sediment on the swale surface when dry and exceeds 25 mm.
	If gullies are observed along the swale, regrading and revegetating may be required.
At least twice annually or as needed. More frequently if desired for aesthetic reasons.	Regular watering may be required during the first two (2) years while vegetation is becoming established.
	Mow grass to maintain height between 75 mm to 150 mm.
	Remove trash and debris from swale surface, inlets, and outlets.

In-Line Oil-Grit Separator (OGS) Units

According to the manufacturer (Imbrium Systems Inc.), inspection and maintenance is crucial for the long-term performance of the OGS Units. The recommended maintenance frequency is outlined below.

- Inspect every six months for the first year to determine the pollutant accumulation rate.
- In subsequent years, inspections can be based on accumulation rates, observations or typical township frequencies.
- Inspect the unit immediately after an oil, fuel or chemical spill. A licensed waste management company should remove oil and sediment and dispose responsibly.

Stormwater Management Dry Pond

Inspections of the proposed dry pond are to be conducted after every significant storm during the first two years after construction to ensure proper function of the facility and its infrastructure. After this period, inspections should be conducted on an annual basis at a minimum.

Recommended inspections should include observations of water levels. If water levels remain high several days after a storm, pond outlet should be inspected for trash, debris, and accumulated sediment. Sediment levels in the pond should also be inspected to ensure proper functioning the system.

8.0 Erosion and Sediment Controls During Construction

Erosion and sediment controls will be implemented prior to the commencement of any site servicing works for the development and will be maintained throughout construction until the Site is stabilized or as directed by the Site Engineer and/or Township of Puslinch. It will be critical for sediment to be controlled, and proper measures put in place to ensure the integrity of any site infiltration measures and bio-swales are maintained during construction.

Controls will be inspected after each significant rainfall event and maintained in proper working condition. A formal Erosion and Sediment Control Plan outlining the site-specific erosion and sediment controls will be prepared and provided to applicable review agencies during subsequent design submissions. This plan will include silt fencing, a mud mat, and more robust measures, such as check dams, in areas of concentrated flow.

Further details on the erosion and control measures to be included have been summarized below:

Sediment Control Silt Fence

Sediment Control Silt Fence will be installed on the perimeter of the Site where sheet flow can be identified. Additional Sediment Control Silt Fence may be added based on field decisions by the Site Engineer and Owner prior to, during, and following construction.

Mud Mat

A rock mud mat will be installed at the entrance to the Site off Watson Road South. The rock mud mat will help to prevent mud tracking. The primary construction entrance will have to be verified prior to construction commencing.

Rock Check Dams

Rock check dams installed according to OPSD 219.210 should be installed in the proposed swale to protect from erosion conveyance during construction.

9.0 Conclusions & Recommendations

This report was prepared in support of the Zoning By-Law Amendment Application for the property located at lots 7, 8, 9, Concession 10, Township of Puslinch, County of Wellington. The proposed development can be serviced for water, sanitary, and stormwater management in accordance with the Township of Puslinch, Wellington County, and the Grand River Conservation Authority requirements and standards. Our conclusions and recommendations include:

Proposed Water and Sanitary Servicing

1. Municipal servicing infrastructure is not available in the vicinity of the site, and therefore the proposed development will be serviced by individual onsite sewage systems and water supply wells.
2. The preliminary sewage system design flows are expected to be approximately 4,575 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 104 m². 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 50% nitrate-nitrogen reduction to meet MECP Guideline D-5-4.
3. Individual lots will be serviced with private drilled wells in accordance with O. Reg. 903 for potable water supply.

Stormwater Management

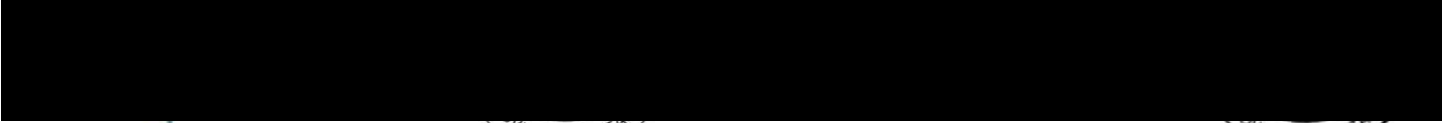
1. A passive stormwater management approach is proposed to preserve and maintain the rural character of the property using bioswale systems to control and infiltrate stormwater runoff.
2. Water quality controls, erosion protection, and water balance for the proposed development will be provided by the proposed bioswale systems pretreated by OGS units within the municipal roadway storm system. The bioswale system with OGS pretreatment and dry pond treatment train will provide water quality treatment that exceeds the "Enhanced Protection" criteria by retaining, treating, and infiltrating runoff volume equal to, or greater than, the runoff volume generated during a 25 mm rainfall event. The water quality storage provided in the bioswale system and dry pond provides active storage to simultaneously provide the necessary quantity controls for the Site.
3. No additional water quantity storage is required beyond what is provided in the bioswale system and dry pond. The post-development peak flows will be controlled to less than pre-development peak flows at outlet culvert located at Arkell Road for the 2-year to 100-year design storm events.
4. Runoff generated from catchments Ext. 1, Ext. 2, Ext. 3, 202, and UC02 will drain uncontrolled overland before being intercepted by the proposed conveyance bypass swale that safely directs towards the outlet culvert located at Arkell Road. This flow routing will maintain the existing drainage conditions of the subject property.
5. Water balance and erosion control measures will be designed to satisfy all relevant criteria and constraints. The above will be demonstrated and discussed at the detailed design stage.

Based on the above conclusions, we recommend the approval of the Zoning By-Law Amendment Application from the perspective of functional servicing and stormwater management.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

C.F. CROZIER & ASSOCIATES INC.



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Project Engineer, Land Development

Limited
to SWM

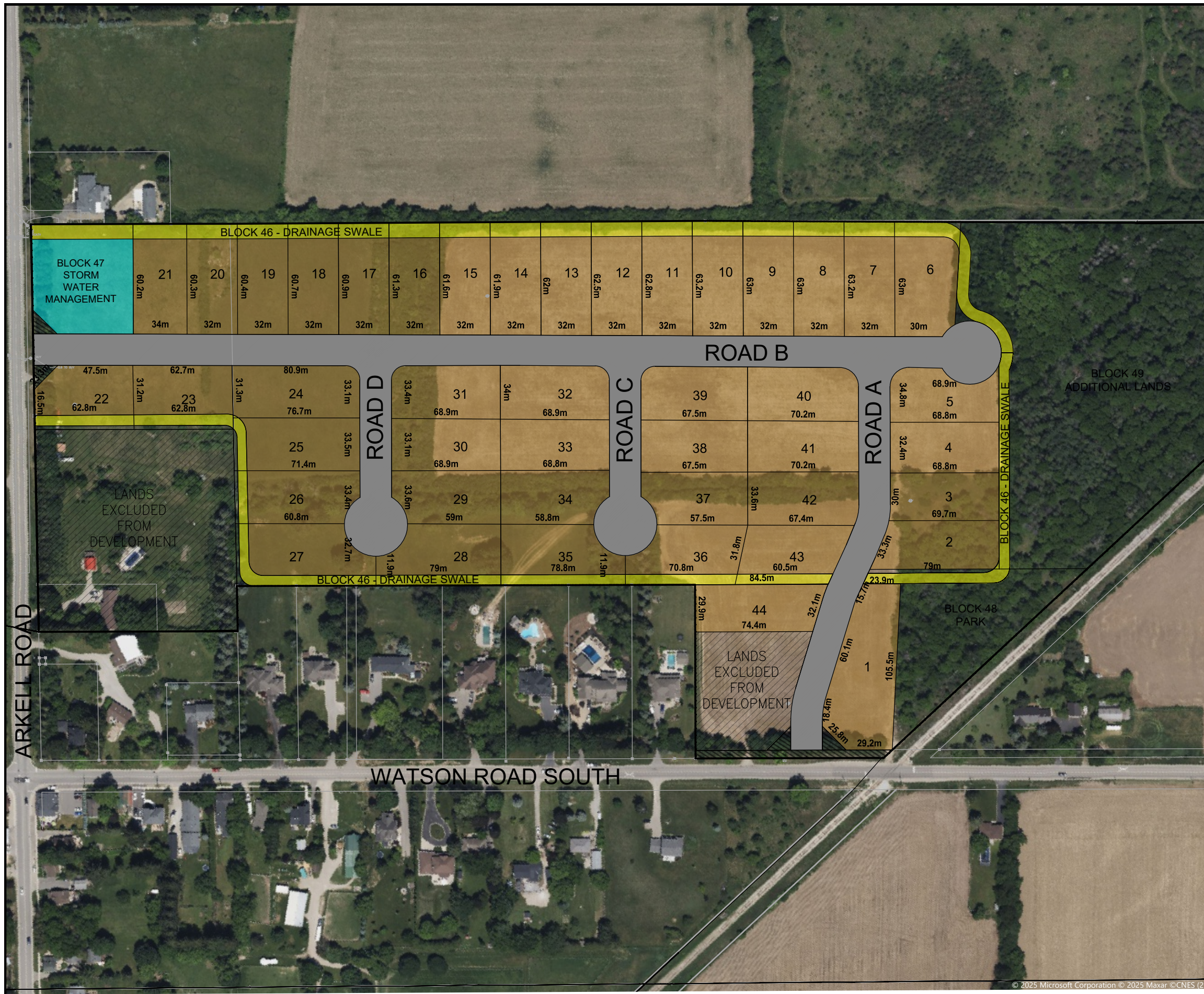
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APPENDIX A

Background Information

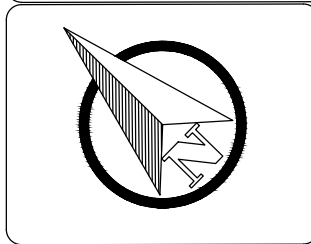
Lot No	Frontage (m)	Depth (m)	Area (ha)
1	94.2	44	0.39
2	33.3	79	0.23
3	30	69.7	0.21
4	32.4	68.8	0.21
5	34.8	68.8	0.21
6	37.9	63	0.24
7-20	32	63.2-60.3	0.2
21	34	60.2	0.21
22	47.5	31.2	0.19
23	62.7	31.2	0.19
24	33.1	76.7	0.26
25	33.5	71.4	0.24
26	33.4	60.8	0.23
27	32.7	60.8	0.23
28	32.5	79	0.22
29	33.6	59	0.22
30	33.1	68.9	0.23
31	33.4	68.9	0.23
32	34	68.9	0.22
33	32.5	68.8	0.22
34	33.9	58.8	0.22
35	32.5	78.8	0.22
36	32.5	70.8	0.2
37	33.6	57.5	0.22
38	32.5	67.5	0.22
39	34	67.5	0.23
40	34	70.2	0.24
41	32.5	70.2	0.23
42	33.6	67.4	0.24
43	33.5	60.5	0.2
44	32.1	74.4	0.24



Conceptual Plan
44 Lots
 PART OF LOTS 7, 8, & 9, CONCESSION 10
 ASSESSMENT ROLL NUMBER 230100008034800000
 ARKELL, ONTARIO

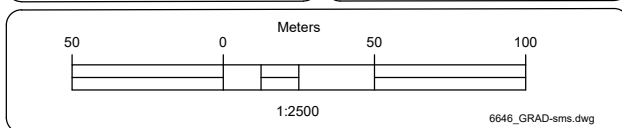
1. This is Not a Plan Of Survey.
2. Locations of Natural Features Have Been Extracted From The Government of Ontario: Land Information Ontario Open Data.
3. Distances Shown on This Plan Are Adjusted Ground Distances and Can Be Converted To Grid Distances by Multiplying by An Averaged Combined Scale Factor of 0.999636.
4. Coordinates on This Plan Are UTM, ZONE 17, NAD83 (CSRS-2010) Adjustment and Are Based on GPS Observations From a Network of Permanent GPS Reference Stations.

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DRAFT

July 29, 2025



APPENDIX B

Design Calculations

APPENDIX B1

Onsite Sewage Calculations



ONSITE SEWAGE SYSTEM RESIDENTIAL CALCULATION SHEET

Project Name: Arkell Development
 Project Number: 2433-6646

2026-01-16
 Designed By: ZS
 Checked By: KR

input required

Fixtures	Number of Fixtures	Fixture Units per Fixture	Total Fixture Units
Bathroom Group (flush tank)	4	6	24.0
2 Piece Bathroom	2	5.5	11.0
Basement Rough-in	2	6	12.0
Sinks (Domestic Lavatory w. 1/2" trap, kitchen sink, single compartment laundry tray)	4	1.5	6.0
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	61.5

Assumed fixture units based on similar house sizes

APPENDIX B2

Hydrologic Parameters



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME 101
 D.A. AREA (ha) 18.82

Hydrologic Parameters: CALIB NASHYD Command
 Post Development Drainage Area: Catchment 101

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	18.82
				0
				0
				0
Total Area				18.82

Impervious Landuses Present:												
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS		96		96		96	0.08	96		50	0.085	8.12
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
Subtotal	0.00		0.00		0.00		0.08		0.00			

Pervious Landuses Present:												
Soils	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	6.47	38					5.51	41	6.76	65	18.74	910.98
0		38						41		65	0.00	0.00
0		38						41		65	0.00	0.00
0		38						41		65	0.00	0.00
Subtotal	6.47		0		0		5.51		6.76			

Composite Area Calculations										Total Pervious Area	18.74
										Total Impervious Area	0.08
										% Impervious	0.45%
										Composite Curve Number	48.8
										Total Area Check	18.82

Initial Abstraction and Tp Calculations

Landuse	Initial Abstraction			Composite Runoff Coefficient								
	IA (mm)	Area (ha)	A * IA	Gravelly Sand		0		0		0		A*RC
				RC	Area	RC	Area	RC	Area			
Woodland	10	6.47	64.69	0.25	6		0		0		0	1.62
Meadow	8	0.00	0.00		0		0		0		0	0.00
Wetland	16	0.00	0.00		0		0		0		0	0.00
Lawn	5	5.51	27.53	0.25	6		0		0		0	1.38
Cultivated	7	6.76	47.32		7		0		0		0	0.00
Impervious	2	0.08	0.17	0.90	0		0		0		0	0.08
Composite		18.82	7.42	Composite Runoff Coefficient								0.16

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	907.4	11.03	1.2%	-	-	-	-	-	0.62	0.41	1.44	0.96

Appropriate calculated time to peak: 0.96 Appropriate Method: Airport



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME EXT1 (PRE)
 D.A. AREA (ha) 24.38

Hydrologic Parameters: CALIB NASHYD Command
 Post Development Drainage Area: Catchment EXT1 (PRE)

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	24.38
				0
				0
				0
Total Area				24.38

Impervious Landuses Present:												Subtotals	
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Area	A*CN	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN			
GS	0.029	96	0	96	0	96	0	96		50	0.029	2.75	
0		96		96		96		96		50	0	0	
0		96		96		96		96		50	0	0	
0		96		96		96		96		50	0	0	
Subtotal	0.029		0		0		0		0				

Pervious Landuses Present:												Subtotals	
Soils	Woodland		Meadow		Wetland		Lawn		Cultivated		Area	A*CN	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN			
GS	20.06	38					4.29	41			24.35	938.24	
0		38					0	41			0.00	0.00	
0		38					0	41			0.00	0.00	
0		38					0	41			0.00	0.00	
Subtotal			0		0		4.29		0				

Composite Area Calculations										Subtotals	
										Total Pervious Area	24.35
										Total Impervious Area	0.03
										% Impervious	0.12%
										Composite Curve Number	38.6
										Total Area Check	24.38

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Gravelly Sand		0		0		0		A*RC
				RC	Area	RC	Area	RC	Area			
Woodland	10	20.06	200.57	0.25	20		0		0		0	5.01
Meadow	8	0.00	0.00		0		0		0		0	0.00
Wetland	16	0.00	0.00		0		0		0		0	0.00
Lawn	5	4.29	21.47	0.25	4		0		0		0	1.07
Cultivated	7	0.00	0.00		0		0		0		0	0.00
Impervious	2	0.03	0.06	0.90	0		0		0		0	0.03
Composite		24.38	9.11	Composite Runoff Coefficient								0.25

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	939.8	20.5	2.2%	-	-	-	-	-	0.56	0.37	1.09	0.73

Appropriate calculated time to peak: 0.73 Appropriate Method: Airport



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME EXT1 (POST)
 D.A. AREA (ha) 23.84

Hydrologic Parameters: CALIB NASHYD Command
 Post Development Drainage Area: Catchment EXT1 (POST)

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	23.84
				0
				0
				0
Total Area				23.84

Impervious Landuses Present:												
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	0.029	96	0	96	0	96	0	96		50	0.029	2.75
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
Subtotal	0.029		0		0		0		0			

Pervious Landuses Present:												
Soils	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	20.06	38					3.75	41			23.81	916.10
0		38					0	41			0.00	0.00
0		38					0	41			0.00	0.00
0		38					0	41			0.00	0.00
Subtotal			0		0		3.75		0			

Composite Area Calculations											Subtotals	
Total Pervious Area											23.81	
Total Impervious Area											0.03	
% Impervious											0.12%	
Composite Curve Number											38.5	
Total Area Check											23.84	

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Gravelly Sand		0		0		0		A*RC
				RC	Area	RC	Area	RC	Area			
Woodland	10	20.06	200.57	0.25	20		0		0		0	5.01
Meadow	8	0.00	0.00		0		0		0		0	0.00
Wetland	16	0.00	0.00		0		0		0		0	0.00
Lawn	5	3.75	18.77	0.25	4		0		0		0	0.94
Cultivated	7	0.00	0.00		0		0		0		0	0.00
Impervious	2	0.03	0.06	0.90	0		0		0		0	0.03
Composite		23.84	9.20	Composite Runoff Coefficient								0.25

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	939.8	20.5	2.2%	-	-	-	-	-	0.56	0.37	1.09	0.73

Appropriate calculated time to peak: 0.73 Appropriate Method: Airport



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME EXT2
 D.A. AREA (ha) 20.64

Hydrologic Parameters: CALIB NASHYD Command
 Post Development Drainage Area: Catchment EXT2

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	20.64
				0
				0
				0
Total Area				20.64

Impervious Landuses Present:												
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	1.30	96		96		96	0.12	96		50	1.426	136.86
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
Subtotal	1.30		0.00		0.00		0.12		0.00			

Pervious Landuses Present:												
Soils	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	9.98	38						41	9.23	65	19.21	979.38
0		38						41		65	0.00	0.00
0		38						41		65	0.00	0.00
0		38						41		65	0.00	0.00
Subtotal	9.98		0		0		0.00		9.23			

Composite Area Calculations											Total Pervious Area	19.21
											Total Impervious Area	1.43
											% Impervious	6.91%
											Composite Curve Number	54.1
											Total Area Check	20.64

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Gravelly Sand		0		0		0		A*RC
				RC	Area	RC	Area	RC	Area			
Woodland	10	9.98	99.83	0.25	10		0		0		0	2.50
Meadow	8	0.00	0.00		0		0		0		0	0.00
Wetland	16	0.00	0.00		0		0		0		0	0.00
Lawn	5	0.00	0.00	0.25	0		0		0		0	0.00
Cultivated	7	9.23	64.62		9		0		0		0	0.00
Impervious	2	1.43	2.85	0.90	1		0		0		0	1.28
Composite		20.64	8.11	Composite Runoff Coefficient								0.18

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	642.6	19	3.0%	-	-	-	-	-	0.36	0.24	0.88	0.59

Appropriate calculated time to peak: 0.59 Appropriate Method: Airport



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME EXT3
 D.A. AREA (ha) 6.87

Hydrologic Parameters: CALIB NASHYD Command
 Post Development Drainage Area: Catchment EXT3

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	6.87
				0
				0
				0
Total Area				6.87

Impervious Landuses Present:												
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	0.78	96		96		96	0.61	96		50	1.39	133.84
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
Subtotal	0.78		0.00		0.00		0.61		0.00			

Pervious Landuses Present:												
Soils	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS		38					5.476	41		65	5.48	224.51
0		38						41		65	0.00	0.00
0		38						41		65	0.00	0.00
0		38						41		65	0.00	0.00
Subtotal	0.00		0		0		5.48		0.00			

Composite Area Calculations											Total Pervious Area	5.48
											Total Impervious Area	1.39
											% Impervious	20.29%
											Composite Curve Number	52.2
											Total Area Check	6.87

Initial Abstraction and Tp Calculations

Landuse	Initial Abstraction			Composite Runoff Coefficient								
	IA (mm)	Area (ha)	A * IA	Gravelly Sand		0		0		0		A*RC
				RC	Area	RC	Area	RC	Area			
Woodland	10	0.00	0.00	0.25	0		0		0		0	0.00
Meadow	8	0.00	0.00		0		0		0		0	0.00
Wetland	16	0.00	0.00		0		0		0		0	0.00
Lawn	5	5.48	27.38	0.25	5		0		0		0	1.37
Cultivated	7	0.00	0.00	0.25	0		0		0		0	0.00
Impervious	2	1.39	2.79	0.90	1		0		0		0	1.25
Composite		6.87	4.39	Composite Runoff Coefficient								0.38

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	131.9	3.83	2.9%	-	-	-	-	-	0.08	0.06	0.32	0.21

Appropriate calculated time to peak: 0.21 Appropriate Method: Airport



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME EXT4
 D.A. AREA (ha) 0.53

Hydrologic Parameters: CALIB NASHYD Command
 Post Development Drainage Area: Catchment EXT4

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	0.53
				0
				0
				0
Total Area				0.53

Impervious Landuses Present:												
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS		96		96		96		96		50	0.00	0.00
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
Subtotal		0.00		0.00		0.00		0.00		0.00		

Pervious Landuses Present:												
Soils	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	0.53	38						41		65	0.53	20.14
0		38						41		65	0.00	0.00
0		38						41		65	0.00	0.00
0		38						41		65	0.00	0.00
Subtotal		0.53		0		0		0.00		0.00		

Composite Area Calculations										Subtotals	
Total Pervious Area										0.53	
Total Impervious Area										0.00	
% Impervious										0.00%	
Composite Curve Number										38.0	
Total Area Check										0.53	

Initial Abstraction and Tp Calculations

Landuse	Initial Abstraction			Composite Runoff Coefficient								
	IA (mm)	Area (ha)	A * IA	Gravelly Sand		0		0		0		A*RC
				RC	Area	RC	Area	RC	Area			
Woodland	10	0.53	5.30	0.25	1		0		0		0	0.13
Meadow	8	0.00	0.00		0		0		0		0	0.00
Wetland	16	0.00	0.00		0		0		0		0	0.00
Lawn	5	0.00	0.00	0.25	0		0		0		0	0.00
Cultivated	7	0.00	0.00	0.25	0		0		0		0	0.00
Impervious	2	0.00	0.00	0.90	0		0		0		0	0.00
Composite		0.53	10.00	Composite Runoff Coefficient								0.25

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	131.9	3.83	2.9%	-	-	-	-	-	0.11	0.07	0.37	0.25

Appropriate calculated time to peak: 0.25 Appropriate Method: Airport



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME 201
 D.A. AREA (ha) 10.55

Hydrologic Parameters: CALIB STANHYD Command

Post Development
 Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	10.55
				0
				0
				0
Total Area Check				10.55

Impervious Landuses Present:												
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	2.05	98		98		98	2.24	98	0.205	98	4.492	440.22
	0	98		98		98		98		98	0	0
	0	98		98		98		98		98	0	0
	0	98		98		98		98		98	0	0
Subtotal Area	2.05		0.00		0.00		2.24		0.21			

Pervious Landuses Present:												
Soils	Woodland		Meadow		Permeable Pavers		Lawn		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS							5.85	41	0.21	50	6.06	250.22
	0							41			0	0
	0							41			0	0
	0							41			0	0
Subtotal Area	0.00		0		0		5.85		0.21			

	Pervious Area Calculations	Total Pervious Area	6.06
		Composite Pervious Curve Number	41
	Impervious Area Calculations	Total Directly Connected Area	2.48
		Total Indirectly Connected Area	2.01
		Total Impervious Area	4.49
		% X imp	23.5
		% T imp	42.6
		Total Area Check	10.55

Initial Abstraction and Tp Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0	0
Meadow	8	0	0
Permeable Pavers	16	0	0
Lawn	5	5.85	29.27
SWMF	5	0.21	1.03
Composite IA		6.06	5.00

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.00	2.00%	81	0.25
Impervious	2.00	0.50%	104	0.013



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME 202
 D.A. AREA (ha) 2.39

Hydrologic Parameters: CALIB STANHYD Command

Post Development
 Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	2.39
				0
				0
				0
Total Area Check				2.39

Impervious Landuses Present:												Subtotals	
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Area	A*CN	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN			
GS	0.09	98		98		98	0.76	98		98	0.850	83.30	
	0	98		98		98		98		98	0	0	
	0	98		98		98		98		98	0	0	
	0	98		98		98		98		98	0	0	
Subtotal Area	0.09		0.00		0.00		0.76		0.00				

Pervious Landuses Present:												Subtotals	
Soils	Woodland		Meadow		Permeable Pavers		Lawn		SWMF		Area	A*CN	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN			
GS							1.54	41		50	1.54	63.14	
	0							41			0	0	
	0							41			0	0	
	0							41			0	0	
Subtotal Area	0.00		0		0		1.54		0.00				

		Pervious Area Calculations		Total Pervious Area	1.54
				Composite Pervious Curve Number	41
		Impervious Area Calculations		Total Directly Connected Area	0.09
				Total Indirectly Connected Area	0.76
				Total Impervious Area	0.85
				% X imp	3.8 min 10% used
				% T imp	35.6
				Total Area Check	2.39

Initial Abstraction and Tp Calculations

Landuse	IA (mm)	Area (ha)	A * IA
Woodland	10	0	0
Meadow	8	0	0
Permeable Pavers	16	0	0
Lawn	5	1.54	7.70
SWMF	5	0	0
Composite IA		1.54	5.00

Land Use	IA (mm)	Slope (%)	Travel Length (m)	Manning's n
Pervious	5.00	2.00%	81	0.25
Impervious	2.00	0.50%	104	0.013



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: BAS

D.A. NAME UC01
 D.A. AREA (ha) 1.35

Hydrologic Parameters: CALIB NASHYD Command
Post Development Drainage Area: Catchment UC01

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	1.35
				0
				0
				0
Total Area				1.35

Impervious Landuses Present:												
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS		96		96		96		96		50	0.00	0.00
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
Subtotal	0.00		0.00		0.00		0.00		0.00			

Pervious Landuses Present:												
Soils	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	1.35	38						41			1.35	51.30
0		38						41			0.0	0.0
0		38						41			0.0	0.0
0		38						41			0.0	0.0
Subtotal	1.35		0.00		0.00		0.00		0.00			

Composite Area Calculations										Total Pervious Area	1.35
										Total Impervious Area	0.00
										% Impervious	0.00%
										Composite Curve Number	38.0
										Total Area Check	1.35

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Gravelly Sand		0		0		0		A*RC
				RC	Area	RC	Area	RC	Area	RC	Area	
Woodland	10	1.35	13.50	0.25	1		0		0		0	0.34
Meadow	8	0.00	0.00		0		0		0		0	0.00
Wetland	16	0.00	0.00		0		0		0		0	0.00
Lawn	5	0.00	0.00	0.25	0		0		0		0	0.00
Cultivated	7	0.00	0.00		0		0		0		0	0.00
Impervious	2	0.00	0.00	0.90	0		0		0		0	0.00
Composite		1.35	10.00	Composite Runoff Coefficient								0.25

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	394.4	8.9	2.3%	-	-	-	-	-	0.31	0.21	0.70	0.47

Appropriate calculated time to peak: 0.47 Appropriate Method: Airport



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: 2026-01-15
 Completed By: NOC

D.A. NAME UC02
 D.A. AREA (ha) 4.54

Hydrologic Parameters: CALIB NASHYD Command
Post Development Drainage Area: Catchment UC02

Curve Number Calculation

Soil Types Present:				
Type	ID	Hydrologic Group	% Area	Area
Gravelly Sand	GS	A	100	4.54
				0
				0
				0
Total Area				4.54

Impervious Landuses Present:												
Soils	Roadway		Sidewalk		Driveway		Building		SWMF		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS		96		96		96	0.38	96		50	0.38	36.86
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
0		96		96		96		96		50	0	0
Subtotal	0.00		0.00		0.00		0.38		0.00			

Pervious Landuses Present:												
Soils	Woodland		Meadow		Wetland		Lawn		Cultivated		Subtotals	
	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area (ha)	CN	Area	A*CN
GS	3.43	38					0.73	41			4.16	160.11
0		38						41			0.0	0.0
0		38						41			0.0	0.0
0		38						41			0.0	0.0
Subtotal	3.43		0.00		0.00		0.73		0.00			

Composite Area Calculations										Total Pervious Area	4.16
										Total Impervious Area	0.38
										% Impervious	8.46%
										Composite Curve Number	43.4
										Total Area Check	4.54

Initial Abstraction and Tp Calculations

Initial Abstraction				Composite Runoff Coefficient								
Landuse	IA (mm)	Area (ha)	A * IA	Gravelly Sand		0		0		0		A*RC
				RC	Area	RC	Area	RC	Area	RC	Area	
Woodland	10	3.43	34.30	0.25	3		0		0		0	0.86
Meadow	8	0.00	0.00		0		0		0		0	0.00
Wetland	16	0.00	0.00		0		0		0		0	0.00
Lawn	5	0.73	3.63	0.25	1		0		0		0	0.18
Cultivated	7	0.00	0.00		0		0		0		0	0.00
Impervious	2	0.38	0.77	0.90	0		0		0		0	0.35
Composite		4.54	8.52	Composite Runoff Coefficient								0.30

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	274.4	6.3	2.3%	-	-	-	-	-	0.19	0.13	0.55	0.37

Appropriate calculated time to peak: 0.37 Appropriate Method: Airport

APPENDIX B3

Pond, Swale, and Culvert Calculations



Project Name: Arkell Subdivision
 Project Number: 2433-6646
 Date: January 15, 2026
 Completed By: NOC

Dry Pond Facility

Orifice 1

Orifice 1 Coefficient: 0.620
 Orifice 1 Diameter: 0.125 m
 Orifice 1 Invert Elevation: 338.50 m
 Orifice 1 Centroid Elevation: 338.56 m

Emergency Weir

Weir Coefficient: 1.56
 Emergency Spill Elev: 339.6 m
 Em. Spill Bot. Width: 24 m
 Trap. Side Slopes: 15 :1 H:V

Operating Level	Elev.	Depth Above Bottom of Pond	Depth Above PP / ED Orifice	Area	Total Storage Volume	Storage Volume Above PP	Discharge Orifice 1	Emerg. Weir Avg. Width	Emerg. Weir Discharge	Total Discharge
	(m)	(m)	(m)	(sq.m)	(cu.m)	(cu.m)	(cu.m/s)	(m)	(cu.m/s)	(cu.m/s)
Bottom of Pond	338.50	0.00	338.38	2,068	0	0	0.000			0.000
	338.60	0.10	338.48	2,127	210	210	0.007			0.007
	338.70	0.20	338.58	2,187	425	425	0.012			0.012
	338.80	0.30	338.68	2,246	647	647	0.016			0.016
	338.90	0.40	338.78	2,305	875	875	0.020			0.020
	339.00	0.50	338.88	2,365	1,108	1108	0.022			0.022
	339.10	0.60	338.98	2,424	1,348	1348	0.025			0.025
	339.20	0.70	339.08	2,483	1,593	1593	0.027			0.027
	339.30	0.80	339.18	2,543	1,844	1844	0.029			0.029
	339.40	0.90	339.28	2,602	2,102	2102	0.031			0.031
	339.50	1.00	339.38	2,661	2,365	2365	0.033			0.033
Emergency Weir Sill	339.60	1.10	339.48	2,721	2,634	2634	0.034	24,000		0.034
	339.70	1.20	339.58	2,780	2,909	2909	0.036	25,483	1.257	1.293
	339.80	1.30	339.68	2,839	3,190	3190	0.036	26,966	3.763	3.799
	339.90	1.40	339.78	2,899	3,477	3477	0.037	28,449	7.292	7.329
Top of Pond	340.00	1.50	339.88	2,958	3,770	3770	0.037	29,932	11.813	11.849



Project: Arkell Subdivision
Project No.: 2433-6743
Description: Catchment 201 Water Quality Storage Requirements

Date: 2024-01-22
Revised: 2026-01-15
Designed By: AO
Checked By: NOC

Catchment 201 Water Quality Storage Requirements

Bioswale Catchment Area (ha): 10.55 Catchment 201
Imperviousness Level (%): 42.60

MOE Table 3.2

Storage Volume for enhanced 80% long term SS removal (m³/ha): 28.80

Design Storage Volume per MOE Table 3.2 (m³): 304

= Bioswale Catchment Area *
MOE Storage Volume Rate

VO Results Volume:

25 mm Runoff (mm): 6.32

Design Storage Volume per VO Results (m³): 667

Design Storage Required (m³): 667

Design Storage Provided (m³): 1586

See Weir Control Sizing Calculation Sheet



Project: Arkell Subdivision
Project No.: 2433-6743
Description: Bioswale Control Weir Sizing

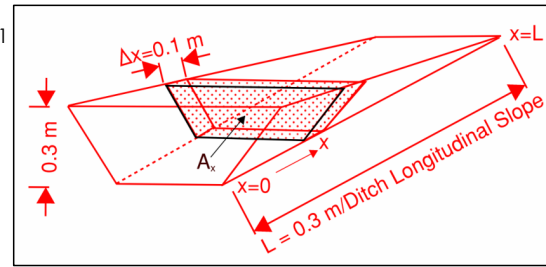
Date: 2024-01-22
Revised: 2026-01-15
Designed By: AO
Checked By: NOC

Bioswale Weir Control Sizing - Catchment 201

Ditch Bottom Width = 1.5 m
 Ditch Top Width = 7.50 m
 Roadside Ditch Side Slope = 3:1
 Lot Line Ditch Slope = 3:1
 Ditch Height = 1.00 m
 Proposed Control Weir Height = 0.70 m

Road Segment Length = 487
 Proposed Longitudinal Ditch Slope = 0.30%
 Control Weir Spacing = 54 m
 Number of Control Weir Ponding Areas = 9
 Weir Control Ponding Storage per Area (V) = 176.22 m³/area
Surface Ponding Volume Provided = 1,585.98 m³

Catchment 201



$$V = \int_{x=0}^{x=L} dV \cong A_{x=\Delta x}\Delta x + A_{x=2\Delta x}\Delta x + A_{x=3\Delta x}\Delta x + \dots + A_{x=L}\Delta x$$

where $\Delta x = 0.1 \text{ m}$ and $A_x = \text{Cross sectional area of retained water @ } x$



Project: Arkell Subdivision
Project No.: 2433-6743
Description: Bioswale Sizing

Date: 2024-01-22
Revised: 2026-01-15
Designed By: AO
Checked By: NOC

Roadside Bioswale Sizing - Catchment 201

Parameter	Value	Units	Catchment 201
Provided Bioswale Design Parameters			
Surface Ponding Volume Provided Behind Weir Control Structures =	1,586	m ³	
Percolation Rate =	70.0	mm/hr	Table 9.6; Hydrology of Floods in Canada: A Guide to Planning and Design (National Research Council of Canada, 1989)
Safety Correction Factor =	2.00		
Design Percolation Rate (P) =	35.00	mm/hr	
LID Length =	486	m	
LID Width =	1.5	m	
Provided footprint (A) =	729	m ²	= Length * width
Gravel Storage Depth =	0.40	m	<div style="border: 1px solid black; padding: 5px;"> $A = 1000 * V / [P * n * t]$ Equation 4.3 (MOE SWM Planning and Design Manual, 2003) </div>
Void Space Ratio (n) =	0.40		
Total Bioswale Gravel Storage Volume Provided (V) =	117	m ³	≥ Surface Ponding Storage = 1,586 m ³
Infiltration Rate =	10.2	m ³ /hr	
Retention Time (t) =	11	hours	

NOTES:

1. Surface storage and filter media storage not included in bioswale volume calculation to be conservative.

Proposed Bio-swale (North)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00300	m/m
Normal Depth	1.00	m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	1.50	m

Results

Discharge	5.68	m ³ /s
Flow Area	4.50	m ²
Wetted Perimeter	7.82	m
Hydraulic Radius	0.58	m
Top Width	7.50	m
Critical Depth	0.73	m
Critical Slope	0.01208	m/m
Velocity	1.26	m/s
Velocity Head	0.08	m
Specific Energy	1.08	m
Froude Number	0.52	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	1.00	m
Critical Depth	0.73	m
Channel Slope	0.00300	m/m

Proposed Bio-swale (North)

GVF Output Data

Critical Slope 0.01208 m/m

Proposed By-Pass Swale (South)

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00300	m/m
Normal Depth	0.85	m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	1.50	m

Results

Discharge	3.96	m ³ /s
Flow Area	3.44	m ²
Wetted Perimeter	6.88	m
Hydraulic Radius	0.50	m
Top Width	6.60	m
Critical Depth	0.61	m
Critical Slope	0.01268	m/m
Velocity	1.15	m/s
Velocity Head	0.07	m
Specific Energy	0.92	m
Froude Number	0.51	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.85	m
Critical Depth	0.61	m
Channel Slope	0.00300	m/m

Proposed By-Pass Swale (South)

GVF Output Data

Critical Slope 0.01268 m/m

100 Year Depth - North Bioswale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00300	m/m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	1.50	m
Discharge	1.31	m ³ /s

Results

Normal Depth	0.50	m
Flow Area	1.52	m ²
Wetted Perimeter	4.69	m
Hydraulic Radius	0.32	m
Top Width	4.52	m
Critical Depth	0.34	m
Critical Slope	0.01477	m/m
Velocity	0.86	m/s
Velocity Head	0.04	m
Specific Energy	0.54	m
Froude Number	0.47	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.50	m
Critical Depth	0.34	m
Channel Slope	0.00300	m/m

100 Year Depth - North Bioswale

GVF Output Data

Critical Slope 0.01477 m/m

Worksheet for 100 Year Depth - South Bypass Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00300	m/m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	1.50	m
Discharge	0.83	m ³ /s

Results

Normal Depth	0.40	m
Flow Area	1.09	m ²
Wetted Perimeter	4.04	m
Hydraulic Radius	0.27	m
Top Width	3.91	m
Critical Depth	0.26	m
Critical Slope	0.01579	m/m
Velocity	0.76	m/s
Velocity Head	0.03	m
Specific Energy	0.43	m
Froude Number	0.46	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.40	m
Critical Depth	0.26	m
Channel Slope	0.00300	m/m

Worksheet for 100 Year Depth - South Bypass Swale

GVF Output Data

Critical Slope 0.01579 m/m

Culvert Calculator Report

Box Culvert -Street A

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	344.300 m	Headwater Depth/Height	0.87
Computed Headwater Elev:	344.300 m	Discharge	2.0248 m ³ /s
Inlet Control HW Elev.	344.287 m	Tailwater Elevation	343.400 m
Outlet Control HW Elev.	344.300 m	Control Type	Entrance Control

Grades			
Upstream Invert	343.500 m	Downstream Invert	343.400 m
Length	25.000 m	Constructed Slope	0.004000 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.488 m
Slope Type	Steep	Normal Depth	0.488 m
Flow Regime	Supercritical	Critical Depth	0.500 m
Velocity Downstream	2.268 m/s	Critical Slope	0.003735 m/m

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.829 m
Section Size	6 x 3 ft	Rise	0.914 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	344.300 m	Upstream Velocity Head	0.250 m
Ke	0.20	Entrance Loss	0.050 m

Inlet Control Properties			
Inlet Control HW Elev.	344.287 m	Flow Control	N/A
Inlet Type	90° headwall w 45° bevels	Area Full	1.67 m ²
K	0.49500	HDS 5 Chart	10
M	0.66700	HDS 5 Scale	2
C	0.03140	Equation Form	2
Y	0.82000		

Culvert Calculator Report

Arkell Road Site Entrance Culvert

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	339.600 m	Headwater Depth/Height	1.71
Computed Headwater Elev.	339.600 m	Discharge	0.2484 m ³ /s
Inlet Control HW Elev.	339.562 m	Tailwater Elevation	338.850 m
Outlet Control HW Elev.	339.600 m	Control Type	Outlet Control

Grades			
Upstream Invert	339.080 m	Downstream Invert	338.850 m
Length	22.900 m	Constructed Slope	0.010044 m/m

Hydraulic Profile			
Profile	CompositeM2PressureProfile	Depth, Downstream	0.268 m
Slope Type	Mild	Normal Depth	N/A m
Flow Regime	Subcritical	Critical Depth	0.268 m
Velocity Downstream	1.829 m/s	Critical Slope	0.011643 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	HDPE (Smooth Interior)	Span	0.305 m
Section Size	12 inch	Rise	0.305 m
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	339.600 m	Upstream Velocity Head	0.148 m
Ke	0.20	Entrance Loss	0.030 m

Inlet Control Properties			
Inlet Control HW Elev.	339.562 m	Flow Control	Submerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	0.15 m ²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

Culvert Calculator Report

Watson Road South Site Entrance Culvert

Solve For: Discharge

Culvert Summary			
Allowable HW Elevation	346.550 m	Headwater Depth/Height	0.69
Computed Headwater Elev.	346.550 m	Discharge	0.0352 m ³ /s
Inlet Control HW Elev.	346.539 m	Tailwater Elevation	346.000 m
Outlet Control HW Elev.	346.550 m	Control Type	Entrance Control

Grades			
Upstream Invert	346.340 m	Downstream Invert	346.000 m
Length	30.000 m	Constructed Slope	0.011333 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.115 m
Slope Type	Steep	Normal Depth	0.115 m
Flow Regime	Supercritical	Critical Depth	0.143 m
Velocity Downstream	1.397 m/s	Critical Slope	0.005111 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	HDPE (Smooth Interior)	Span	0.305 m
Section Size	12 inch	Rise	0.305 m
Number Sections	1		

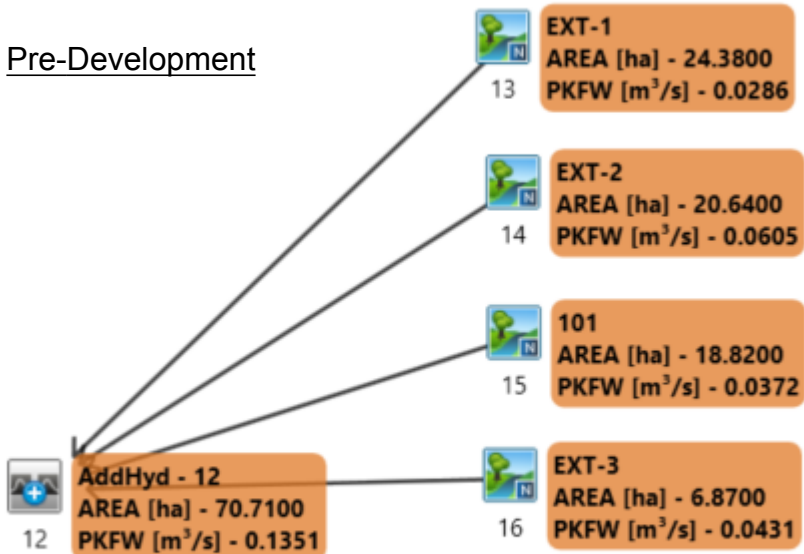
Outlet Control Properties			
Outlet Control HW Elev.	346.550 m	Upstream Velocity Head	0.055 m
Ke	0.20	Entrance Loss	0.011 m

Inlet Control Properties			
Inlet Control HW Elev.	346.539 m	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	0.07 m ²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

APPENDIX B4

Hydrologic Model Output

Pre-Development



=====

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 A A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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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\voindat

Output filename:
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3249b-c777-4303-a77c-ac0c6e622bd1\sce
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3249b-c777-4303-a77c-ac0c6e622bd1\sce

DATE: 01-15-2026 TIME: 12:28:12

USER:

COMMENTS: _____

** SIMULATION : 1 - 2yr 3hr 10min Chicago **

CHICAGO STORM | IDF curve parameters: A= 475.610
| Ptotal= 30.88 mm | B= 0.000
C= 0.738

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	3.17	0.83	86.95	1.67	5.04	2.50	3.05
0.17	3.77	1.00	15.73	1.83	4.42	2.67	2.85
0.33	4.72	1.17	9.66	2.00	3.95	2.83	2.67
0.50	6.58	1.33	7.25	2.17	3.59		
0.67	12.69	1.50	5.91	2.33	3.30		

CALIB	
NASHYD (0013)	Area (ha)= 24.38 Curve Number (CN)= 35.0
ID= 1 DT= 5.0 min	Ia (mm)= 9.11 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.73

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Unit Hyd Qpeak (cms)= 1.276

PEAK FLOW (cms)= 0.029 (i)
TIME TO PEAK (hrs)= 2.083
RUNOFF VOLUME (mm)= 0.961
TOTAL RAINFALL (mm)= 30.883
RUNOFF COEFFICIENT = 0.031

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

CALIB
 NASHYD (0014) | Area (ha)= 20.64 Curve Number (CN)= 53.0
 ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.59

0.583 6.58 | 1.333 9.66 | 2.083 3.95 | 2.83 2.85
 0.667 6.58 | 1.417 7.25 | 2.167 3.95 | 2.92 2.67
 0.750 12.69 | 1.500 7.25 | 2.250 3.59 | 3.00 2.67

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.061 (i)
 TIME TO PEAK (hrs)= 1.833
 RUNOFF VOLUME (mm)= 2.091
 TOTAL RAINFALL (mm)= 30.883
 RUNOFF COEFFICIENT = 0.068

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

CALIB
 NASHYD (0015) | Area (ha)= 18.82 Curve Number (CN)= 48.0
 ID= 1 DT= 5.0 min | Ia (mm)= 7.42 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.96

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85

Unit Hyd Qpeak (cms)= 0.749

PEAK FLOW (cms)= 0.037 (i)
 TIME TO PEAK (hrs)= 2.417
 RUNOFF VOLUME (mm)= 1.843
 TOTAL RAINFALL (mm)= 30.883
 RUNOFF COEFFICIENT = 0.060

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

CALIB
 NASHYD (0016) | Area (ha)= 6.87 Curve Number (CN)= 46.0
 ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.21

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.043 (i)
 TIME TO PEAK (hrs)= 1.167
 RUNOFF VOLUME (mm)= 2.158
 TOTAL RAINFALL (mm)= 30.883
 RUNOFF COEFFICIENT = 0.070

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

ADD HYD (0012)				
1 + 2 = 3				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0013):	24.38	0.029	2.08	0.96
+ ID2= 2 (0014):	20.64	0.061	1.83	2.09
=====				
ID = 3 (0012):	45.02	0.088	1.92	1.48

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0012)				
3 + 2 = 1				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0012):	45.02	0.088	1.92	1.48
+ ID2= 2 (0015):	18.82	0.037	2.42	1.84
=====				
ID = 1 (0012):	63.84	0.122	2.08	1.59

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0012)				
1 + 2 = 3				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0012):	63.84	0.122	2.08	1.59
+ ID2= 2 (0016):	6.87	0.043	1.17	2.16
=====				
ID = 3 (0012):	70.71	0.135	2.00	1.64

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
VV I SSSS UUUU A A LLLL

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0 0 T T H H Y M M 0 0
000 T T H H Y M M 000

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

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 cda9d-b6d6-4fa7-9313-0c87802336dd\sce

DATE: 01-15-2026 TIME: 12:28:12

USER:

COMMENTS: _____

 ** SIMULATION : 2 - 5yr 3hr 10min Chicago **

CHICAGO STORM | IDF curve parameters: A= 632.750
 | Ptotal= 40.45 mm | B= 0.000
 | C= 0.741

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	4.11	0.83	114.88	1.67	6.54	2.50	3.95
0.17	4.88	1.00	20.52	1.83	5.73	2.67	3.69
0.33	6.13	1.17	12.57	2.00	5.13	2.83	3.46
0.50	8.55	1.33	9.43	2.17	4.65		
0.67	16.54	1.50	7.68	2.33	4.27		

```

-----
| CALIB |
| NASHYD ( 0013) | Area (ha)= 24.38 Curve Number (CN)= 35.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.11 # of Linear Res.(N)= 3.00
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| U.H. Tp(hrs)= 0.73

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

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

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 1.276

```

PEAK FLOW (cms)= 0.060 (i)
TIME TO PEAK (hrs)= 2.000
RUNOFF VOLUME (mm)= 1.953
TOTAL RAINFALL (mm)= 40.451
RUNOFF COEFFICIENT = 0.048

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

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-----
| CALIB |
| NASHYD ( 0014) | Area (ha)= 20.64 Curve Number (CN)= 53.0
| ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.59

```

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	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95

```

0.500 6.13 | 1.250 12.57 | 2.000 5.73 | 2.75 3.69
0.583 8.55 | 1.333 12.57 | 2.083 5.13 | 2.83 3.69
0.667 8.55 | 1.417 9.43 | 2.167 5.13 | 2.92 3.46
0.750 16.54 | 1.500 9.43 | 2.250 4.65 | 3.00 3.46

```

Unit Hyd Qpeak (cms)= 1.336

```

PEAK FLOW (cms)= 0.123 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 4.060
TOTAL RAINFALL (mm)= 40.451
RUNOFF COEFFICIENT = 0.100

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

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-----
| CALIB |
| NASHYD ( 0015) | Area (ha)= 18.82 Curve Number (CN)= 48.0
| ID= 1 DT= 5.0 min | Ia (mm)= 7.42 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.96

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

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

```

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 0.749

```

PEAK FLOW (cms)= 0.073 (i)
TIME TO PEAK (hrs)= 2.333
RUNOFF VOLUME (mm)= 3.540
TOTAL RAINFALL (mm)= 40.451
RUNOFF COEFFICIENT = 0.088

```

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

CALIB
 NASHYD (0016) | Area (ha)= 6.87 Curve Number (CN)= 46.0
 ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.21

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	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.081 (i)
 TIME TO PEAK (hrs)= 1.167
 RUNOFF VOLUME (mm)= 3.885
 TOTAL RAINFALL (mm)= 40.451
 RUNOFF COEFFICIENT = 0.096

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

ADD HYD (0012) |
 | 1 + 2 = 3 |
 ID1= 1 (0013): 24.38 0.060 2.00 1.95
 + ID2= 2 (0014): 20.64 0.123 1.75 4.06
 ID = 3 (0012): 45.02 0.180 1.83 2.92

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0012) |
 | 3 + 2 = 1 |
 ID1= 3 (0012): 45.02 0.180 1.83 2.92

+ ID2= 2 (0015): 18.82 0.073 2.33 3.54
 ID = 1 (0012): 63.84 0.245 2.00 3.10

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0012) |
 | 1 + 2 = 3 |
 ID1= 1 (0012): 63.84 0.245 2.00 3.10
 + ID2= 2 (0016): 6.87 0.081 1.17 3.88
 ID = 3 (0012): 70.71 0.270 1.92 3.18

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS 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 UUUU A A LLLLL
 000 TTTT TTTT H H Y Y M M 000 TM
 0 0 T T H H Y Y MM MM 0 0
 0 0 T T H H Y M M 0 0
 000 T T H H Y M M 000

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

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DATE: 01-15-2026

TIME: 12:28:12

USER:

0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40
0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

COMMENTS: _____

Unit Hyd Qpeak (cms)= 1.276

PEAK FLOW (cms)= 0.089 (i)
 TIME TO PEAK (hrs)= 2.000
 RUNOFF VOLUME (mm)= 2.870
 TOTAL RAINFALL (mm)= 47.366
 RUNOFF COEFFICIENT = 0.061

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

 ** SIMULATION : 3 - 10yr 3hr 10min Chicago **

CHICAGO STORM
 Ptotal= 47.37 mm

IDF curve parameters: A= 721.920
 B= 0.000
 C= 0.736

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	4.90	0.83	132.58	1.67	7.77	2.50	4.72
0.17	5.82	1.00	24.19	1.83	6.82	2.67	4.40
0.33	7.29	1.17	14.88	2.00	6.10	2.83	4.13
0.50	10.14	1.33	11.18	2.17	5.54		
0.67	19.52	1.50	9.12	2.33	5.09		

CALIB
 NASHYD (0013)
 ID= 1 DT= 5.0 min

Area (ha)= 24.38 Curve Number (CN)= 35.0
 Ia (mm)= 9.11 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.73

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	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72

CALIB
 NASHYD (0014)
 ID= 1 DT= 5.0 min

Area (ha)= 20.64 Curve Number (CN)= 53.0
 Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.59

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	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40
0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.178 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 5.826
 TOTAL RAINFALL (mm)= 47.366
 RUNOFF COEFFICIENT = 0.123

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

```

-----
| CALIB |
| NASHYD ( 0015) | Area (ha)= 18.82 Curve Number (CN)= 48.0
| ID= 1 DT= 5.0 min | Ia (mm)= 7.42 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.96

```

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	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40
0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

Unit Hyd Qpeak (cms)= 0.749

```

PEAK FLOW (cms)= 0.104 (i)
TIME TO PEAK (hrs)= 2.333
RUNOFF VOLUME (mm)= 5.064
TOTAL RAINFALL (mm)= 47.366
RUNOFF COEFFICIENT = 0.107

```

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

```

-----
| CALIB |
| NASHYD ( 0016) | Area (ha)= 6.87 Curve Number (CN)= 46.0
| ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.21

```

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	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72

0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40
0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

Unit Hyd Qpeak (cms)= 1.250

```

PEAK FLOW (cms)= 0.113 (i)
TIME TO PEAK (hrs)= 1.167
RUNOFF VOLUME (mm)= 5.405
TOTAL RAINFALL (mm)= 47.366
RUNOFF COEFFICIENT = 0.114

```

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

```

-----
| ADD HYD ( 0012) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm)
ID1= 1 ( 0013): 24.38 0.089 2.00 2.87
+ ID2= 2 ( 0014): 20.64 0.178 1.75 5.83
=====
ID = 3 ( 0012): 45.02 0.263 1.83 4.22

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012) |
| 3 + 2 = 1 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm)
ID1= 3 ( 0012): 45.02 0.263 1.83 4.22
+ ID2= 2 ( 0015): 18.82 0.104 2.33 5.06
=====
ID = 1 ( 0012): 63.84 0.357 1.92 4.47

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm)
ID1= 1 ( 0012): 63.84 0.357 1.92 4.47
+ ID2= 2 ( 0016): 6.87 0.113 1.17 5.41
=====
ID = 3 ( 0012): 70.71 0.392 1.83 4.56

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| Ptotal= 57.15 mm |

B= 0.000

C= 0.725

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

V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
WV I SSSS UUUU A A LLLLL

000 TTTT TTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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Table with 8 columns: TIME, RAIN, TIME, RAIN, TIME, RAIN, TIME, RAIN. Values range from 0.00 to 0.67 hours and 6.14 to 23.97 mm/hr.

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

| CALIB |

| NASHYD (0013) |

Area (ha)= 24.38 Curve Number (CN)= 35.0

Ia (mm)= 9.11 # of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 0.73

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\V02\voindat

Output filename:

C:\Users\noconnor\AppData\Local\Civica\...
6b755-4b27-4ebe-8e50-ec659a72a394\sce

Summary filename:

C:\Users\noconnor\AppData\Local\Civica\...
6b755-4b27-4ebe-8e50-ec659a72a394\sce

DATE: 01-15-2026

TIME: 12:28:12

USER:

COMMENTS: _____

---- TRANSFORMED HYETOGRAPH ----

Table with 8 columns: TIME, RAIN, TIME, RAIN, TIME, RAIN, TIME, RAIN. Values range from 0.083 to 0.750 hours and 6.14 to 23.97 mm/hr.

Unit Hyd Qpeak (cms)= 1.276

PEAK FLOW (cms)= 0.138 (i)

TIME TO PEAK (hrs)= 2.000

RUNOFF VOLUME (mm)= 4.441

TOTAL RAINFALL (mm)= 57.153

RUNOFF COEFFICIENT = 0.078

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

| CHICAGO STORM | IDF curve parameters: A= 822.740

```

-----
| CALIB
| NASHYD ( 0014) | Area (ha)= 20.64 Curve Number (CN)= 53.0
| ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.59

```

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

```

-----
          ---- TRANSFORMED HYETOGRAPH ----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
0.083  6.14 | 0.833  23.97 | 1.583  11.32 | 2.33   6.94
0.167  6.14 | 0.917  154.98 | 1.667  11.32 | 2.42   6.38
0.250  7.28 | 1.000  154.98 | 1.750   9.68 | 2.50   6.38
0.333  7.28 | 1.083  29.61 | 1.833   9.68 | 2.58   5.92
0.417  9.09 | 1.167  29.61 | 1.917   8.51 | 2.67   5.92
0.500  9.09 | 1.250  18.34 | 2.000   8.51 | 2.75   5.53
0.583  12.58 | 1.333  18.34 | 2.083   7.63 | 2.83   5.53
0.667  12.58 | 1.417  13.85 | 2.167   7.63 | 2.92   5.19
0.750  23.97 | 1.500  13.85 | 2.250   6.94 | 3.00   5.19

```

Unit Hyd Qpeak (cms)= 1.336

```

PEAK FLOW (cms)= 0.269 (i)
TIME TO PEAK (hrs)= 1.750
RUNOFF VOLUME (mm)= 8.769
TOTAL RAINFALL (mm)= 57.153
RUNOFF COEFFICIENT = 0.153

```

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

```

-----
| CALIB
| NASHYD ( 0015) | Area (ha)= 18.82 Curve Number (CN)= 48.0
| ID= 1 DT= 5.0 min | Ia (mm)= 7.42 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.96

```

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

```

-----
          ---- TRANSFORMED HYETOGRAPH ----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
0.083  6.14 | 0.833  23.97 | 1.583  11.32 | 2.33   6.94
0.167  6.14 | 0.917  154.98 | 1.667  11.32 | 2.42   6.38
0.250  7.28 | 1.000  154.98 | 1.750   9.68 | 2.50   6.38
0.333  7.28 | 1.083  29.61 | 1.833   9.68 | 2.58   5.92

```

```

0.417  9.09 | 1.167  29.61 | 1.917  8.51 | 2.67   5.92
0.500  9.09 | 1.250  18.34 | 2.000  8.51 | 2.75   5.53
0.583  12.58 | 1.333  18.34 | 2.083  7.63 | 2.83   5.53
0.667  12.58 | 1.417  13.85 | 2.167  7.63 | 2.92   5.19
0.750  23.97 | 1.500  13.85 | 2.250  6.94 | 3.00   5.19

```

Unit Hyd Qpeak (cms)= 0.749

```

PEAK FLOW (cms)= 0.157 (i)
TIME TO PEAK (hrs)= 2.333
RUNOFF VOLUME (mm)= 7.613
TOTAL RAINFALL (mm)= 57.153
RUNOFF COEFFICIENT = 0.133

```

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

```

-----
| CALIB
| NASHYD ( 0016) | Area (ha)= 6.87 Curve Number (CN)= 46.0
| ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.21

```

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

```

-----
          ---- TRANSFORMED HYETOGRAPH ----
TIME    RAIN | TIME    RAIN | TIME    RAIN | TIME    RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
0.083  6.14 | 0.833  23.97 | 1.583  11.32 | 2.33   6.94
0.167  6.14 | 0.917  154.98 | 1.667  11.32 | 2.42   6.38
0.250  7.28 | 1.000  154.98 | 1.750   9.68 | 2.50   6.38
0.333  7.28 | 1.083  29.61 | 1.833   9.68 | 2.58   5.92
0.417  9.09 | 1.167  29.61 | 1.917   8.51 | 2.67   5.92
0.500  9.09 | 1.250  18.34 | 2.000   8.51 | 2.75   5.53
0.583  12.58 | 1.333  18.34 | 2.083   7.63 | 2.83   5.53
0.667  12.58 | 1.417  13.85 | 2.167   7.63 | 2.92   5.19
0.750  23.97 | 1.500  13.85 | 2.250   6.94 | 3.00   5.19

```

Unit Hyd Qpeak (cms)= 1.250

```

PEAK FLOW (cms)= 0.164 (i)
TIME TO PEAK (hrs)= 1.167
RUNOFF VOLUME (mm)= 7.920
TOTAL RAINFALL (mm)= 57.153
RUNOFF COEFFICIENT = 0.139

```

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

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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\V02\voin.dat

Output filename:
C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\dea0f33f-e710-4fa3-a6ae-82ed1b93151a\sce
Summary filename:
C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\dea0f33f-e710-4fa3-a6ae-82ed1b93151a\sce

DATE: 01-15-2026 TIME: 12:28:12

USER:

COMMENTS: _____

** SIMULATION : 5 - 50yr 3hr 10min Chicago **

CHICAGO STORM | IDF curve parameters: A= 893.800
| Ptotal= 64.05 mm | B= 0.000
C= 0.719

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	7.02	0.83	170.70	1.67	11.03	2.50	6.77
0.17	8.31	1.00	33.42	1.83	9.71	2.67	6.33
0.33	10.36	1.17	20.79	2.00	8.71	2.83	5.95
0.50	14.30	1.33	15.73	2.17	7.93		
0.67	27.09	1.50	12.89	2.33	7.29		

```

-----
| ADD HYD ( 0012)|
| 1 + 2 = 3      |
-----
ID1= 1 ( 0013):  24.38  0.138  2.00  4.44
+ ID2= 2 ( 0014):  20.64  0.269  1.75  8.77
=====
ID = 3 ( 0012):  45.02  0.401  1.83  6.42

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012)|
| 3 + 2 = 1      |
-----
ID1= 3 ( 0012):  45.02  0.401  1.83  6.42
+ ID2= 2 ( 0015):  18.82  0.157  2.33  7.61
=====
ID = 1 ( 0012):  63.84  0.541  1.92  6.78

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012)|
| 1 + 2 = 3      |
-----
ID1= 1 ( 0012):  63.84  0.541  1.92  6.78
+ ID2= 2 ( 0016):  6.87  0.164  1.17  7.92
=====
ID = 3 ( 0012):  70.71  0.593  1.83  6.89

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

=====
V  V  I  SSSS  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
WV   I  SSSS  UUUU  A  A  LLLLL

000  TTTT  TTTT  H  H  Y  Y  M  M  000  TM
O  O  T  T  H  H  Y  Y  MM  MM  O  O
O  O  T  T  H  H  Y  Y  M  M  O  O
000  T  T  H  H  Y  Y  M  M  000

```

```

-----
| CALIB |
| NASHYD ( 0013) | Area (ha)= 24.38 Curve Number (CN)= 35.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.11 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.73

```

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93
0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29
0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33
0.667	14.30	1.417	15.73	2.167	8.71	2.92	5.95
0.750	27.09	1.500	15.73	2.250	7.93	3.00	5.95

Unit Hyd Qpeak (cms)= 1.276

PEAK FLOW (cms)= 0.178 (i)
 TIME TO PEAK (hrs)= 2.000
 RUNOFF VOLUME (mm)= 5.732
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.089

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

```

-----
| CALIB |
| NASHYD ( 0014) | Area (ha)= 20.64 Curve Number (CN)= 53.0
| ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.59

```

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93
0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29

0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33
0.667	14.30	1.417	15.73	2.167	8.71	2.92	5.95
0.750	27.09	1.500	15.73	2.250	7.93	3.00	5.95

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.341 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 11.130
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.174

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

```

-----
| CALIB |
| NASHYD ( 0015) | Area (ha)= 18.82 Curve Number (CN)= 48.0
| ID= 1 DT= 5.0 min | Ia (mm)= 7.42 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.96

```

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93
0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29
0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33
0.667	14.30	1.417	15.73	2.167	8.71	2.92	5.95
0.750	27.09	1.500	15.73	2.250	7.93	3.00	5.95

Unit Hyd Qpeak (cms)= 0.749

PEAK FLOW (cms)= 0.199 (i)
 TIME TO PEAK (hrs)= 2.333
 RUNOFF VOLUME (mm)= 9.666
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.151

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

```

-----
| CALIB |
| NASHYD ( 0016) | Area (ha)= 6.87 Curve Number (CN)= 46.0
| ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.21

```

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

```

-----
          ---- TRANSFORMED HYETOGRAPH ----
    TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
    hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
    0.083 7.02 | 0.833 27.09 | 1.583 12.89 | 2.33 7.93
    0.167 7.02 | 0.917 170.70 | 1.667 12.89 | 2.42 7.29
    0.250 8.31 | 1.000 170.70 | 1.750 11.03 | 2.50 7.29
    0.333 8.31 | 1.083 33.42 | 1.833 11.03 | 2.58 6.77
    0.417 10.36 | 1.167 33.42 | 1.917 9.71 | 2.67 6.77
    0.500 10.36 | 1.250 20.79 | 2.000 9.71 | 2.75 6.33
    0.583 14.30 | 1.333 20.79 | 2.083 8.71 | 2.83 6.33
    0.667 14.30 | 1.417 15.73 | 2.167 8.71 | 2.92 5.95
    0.750 27.09 | 1.500 15.73 | 2.250 7.93 | 3.00 5.95

```

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.205 (i)
 TIME TO PEAK (hrs)= 1.167
 RUNOFF VOLUME (mm)= 9.932
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.155

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

```

-----
| ADD HYD ( 0012) |
| 1 + 2 = 3 |
-----
          AREA   QPEAK   TPEAK   R.V.
          (ha)   (cms)   (hrs)   (mm)
    ID1= 1 ( 0013):  24.38  0.178  2.00  5.73
    + ID2= 2 ( 0014):  20.64  0.341  1.75  11.13
    -----
    ID = 3 ( 0012):  45.02  0.513  1.83  8.21

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012) |
| 3 + 2 = 1 |
-----
          AREA   QPEAK   TPEAK   R.V.

```

```

-----
          (ha)   (cms)   (hrs)   (mm)
    ID1= 3 ( 0012):  45.02  0.513  1.83  8.21
    + ID2= 2 ( 0015):  18.82  0.199  2.33  9.67
    -----
    ID = 1 ( 0012):  63.84  0.691  1.92  8.64

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012) |
| 1 + 2 = 3 |
-----
          AREA   QPEAK   TPEAK   R.V.
          (ha)   (cms)   (hrs)   (mm)
    ID1= 1 ( 0012):  63.84  0.691  1.92  8.64
    + ID2= 2 ( 0016):  6.87  0.205  1.17  9.93
    -----
    ID = 3 ( 0012):  70.71  0.756  1.83  8.76

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS 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 A A A A L
V V I SS U U A A L
V V I SSSSS UUUUU A A LLLLL

```

```

000 TTTT TTTT H H Y Y M M 000 TM
0 0 T T H H Y Y MM MM 0 0
0 0 T T H H Y M M 0 0
000 T T H H Y M M 000

```

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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\V02\voin.dat

Output filename:
 C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\55c89b47-39b0-4332-8840-257d83fc52f8\sc
 Summary filename:
 C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\55c89b47-39b0-4332-8840-257d83fc52f8\sc

DATE: 01-15-2026

TIME: 12:28:12

USER:

COMMENTS: _____

0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Unit Hyd Qpeak (cms)= 1.276

PEAK FLOW (cms)= 0.224 (i)
 TIME TO PEAK (hrs)= 2.000
 RUNOFF VOLUME (mm)= 7.225
 TOTAL RAINFALL (mm)= 71.214
 RUNOFF COEFFICIENT = 0.101

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

 ** SIMULATION : 6 - 100yr 3hr 10min Chicago **

CHICAGO STORM | IDF curve parameters: A= 953.290
 Ptotal= 71.21 mm | B= 0.000
 | C= 0.711
 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	8.02	0.83	185.45	1.67	12.53	2.50	7.73
0.17	9.47	1.00	37.49	1.83	11.04	2.67	7.23
0.33	11.77	1.17	23.45	2.00	9.92	2.83	6.80
0.50	16.19	1.33	17.80	2.17	9.04		
0.67	30.45	1.50	14.61	2.33	8.32		

CALIB |
 NASHYD (0014) | Area (ha)= 20.64 Curve Number (CN)= 53.0
 ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.59

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32
0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.423 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 13.810
 TOTAL RAINFALL (mm)= 71.214
 RUNOFF COEFFICIENT = 0.194

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

CALIB |
 NASHYD (0013) | Area (ha)= 24.38 Curve Number (CN)= 35.0
 ID= 1 DT= 5.0 min | Ia (mm)= 9.11 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.73

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32

```

-----
| CALIB |
| NASHYD ( 0015) | Area (ha)= 18.82 Curve Number (CN)= 48.0
| ID= 1 DT= 5.0 min | Ia (mm)= 7.42 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.96

```

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

```

-----
| TRANSFORMED HYETOGRAPH |
|-----|
| TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN |
| hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr |
|-----|-----|-----|-----|
| 0.083 8.02 | 0.833 30.45 | 1.583 14.61 | 2.33 9.04 |
| 0.167 8.02 | 0.917 185.45 | 1.667 14.61 | 2.42 8.32 |
| 0.250 9.47 | 1.000 185.45 | 1.750 12.53 | 2.50 8.32 |
| 0.333 9.47 | 1.083 37.49 | 1.833 12.53 | 2.58 7.73 |
| 0.417 11.77 | 1.167 37.49 | 1.917 11.04 | 2.67 7.73 |
| 0.500 11.77 | 1.250 23.45 | 2.000 11.04 | 2.75 7.23 |
| 0.583 16.19 | 1.333 23.45 | 2.083 9.92 | 2.83 7.23 |
| 0.667 16.19 | 1.417 17.80 | 2.167 9.92 | 2.92 6.80 |
| 0.750 30.45 | 1.500 17.80 | 2.250 9.04 | 3.00 6.80 |

```

Unit Hyd Qpeak (cms)= 0.749

```

PEAK FLOW (cms)= 0.247 (i)
TIME TO PEAK (hrs)= 2.333
RUNOFF VOLUME (mm)= 12.006
TOTAL RAINFALL (mm)= 71.214
RUNOFF COEFFICIENT = 0.169

```

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

```

-----
| CALIB |
| NASHYD ( 0016) | Area (ha)= 6.87 Curve Number (CN)= 46.0
| ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
-----
| U.H. Tp(hrs)= 0.21

```

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

```

-----
| TRANSFORMED HYETOGRAPH |
|-----|
| TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN |
| hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr |
|-----|-----|-----|-----|
| 0.083 8.02 | 0.833 30.45 | 1.583 14.61 | 2.33 9.04 |
| 0.167 8.02 | 0.917 185.45 | 1.667 14.61 | 2.42 8.32 |
| 0.250 9.47 | 1.000 185.45 | 1.750 12.53 | 2.50 8.32 |

```

```

0.333 9.47 | 1.083 37.49 | 1.833 12.53 | 2.58 7.73
0.417 11.77 | 1.167 37.49 | 1.917 11.04 | 2.67 7.73
0.500 11.77 | 1.250 23.45 | 2.000 11.04 | 2.75 7.23
0.583 16.19 | 1.333 23.45 | 2.083 9.92 | 2.83 7.23
0.667 16.19 | 1.417 17.80 | 2.167 9.92 | 2.92 6.80
0.750 30.45 | 1.500 17.80 | 2.250 9.04 | 3.00 6.80

```

Unit Hyd Qpeak (cms)= 1.250

```

PEAK FLOW (cms)= 0.249 (i)
TIME TO PEAK (hrs)= 1.167
RUNOFF VOLUME (mm)= 12.215
TOTAL RAINFALL (mm)= 71.214
RUNOFF COEFFICIENT = 0.172

```

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

```

-----
| ADD HYD ( 0012) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm) |
|-----|-----|-----|-----|
| ID1= 1 ( 0013): 24.38 0.224 2.00 7.23 |
| + ID2= 2 ( 0014): 20.64 0.423 1.75 13.81 |
|=====|
| ID = 3 ( 0012): 45.02 0.638 1.83 10.24 |

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012) |
| 3 + 2 = 1 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm) |
|-----|-----|-----|-----|
| ID1= 3 ( 0012): 45.02 0.638 1.83 10.24 |
| + ID2= 2 ( 0015): 18.82 0.247 2.33 12.01 |
|=====|
| ID = 1 ( 0012): 63.84 0.859 1.92 10.76 |

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm) |
|-----|-----|-----|-----|
| ID1= 1 ( 0012): 63.84 0.859 1.92 10.76 |
| + ID2= 2 ( 0016): 6.87 0.249 1.17 12.21 |
|=====|

```

ID = 3 (0012): 70.71 0.940 1.83 10.90

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS 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 A A A A L
V V I SS U U A A L
V V I SSSSS UUUUU A A LLLLL

000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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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\V02\voin.dat

Output filename:

C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\fcf
d4b67-9043-4556-aca9-1bb23a06bf19\sce

Summary filename:

C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\fcf
d4b67-9043-4556-aca9-1bb23a06bf19\sce

DATE: 01-15-2026

TIME: 12:28:12

USER:

COMMENTS: _____

** SIMULATION : 7 - 25mm **

READ STORM
Ptotal= 24.99 mm

Filename: C:\Users\noconnor\AppData
ata\Local\Temp\
e371b535-ff13-4e8d-b96e-67f00c4b43f\1e3bc16b
Comments: 25MM_S~1

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.44	6.00	0.77	12.00	1.20	18.00	0.60
0.17	0.44	6.17	0.77	12.17	1.20	18.17	0.60
0.33	0.44	6.33	0.77	12.33	1.20	18.33	0.60
0.50	0.44	6.50	0.77	12.50	1.05	18.50	0.60
0.67	0.44	6.67	0.78	12.67	1.05	18.67	0.60
0.83	0.44	6.83	0.77	12.83	1.05	18.83	0.60
1.00	0.44	7.00	0.95	13.00	1.05	19.00	0.60
1.17	0.44	7.17	0.95	13.17	1.05	19.17	0.60
1.33	0.44	7.33	0.95	13.33	1.05	19.33	0.60
1.50	0.44	7.50	0.95	13.50	0.95	19.50	0.60
1.67	0.44	7.67	0.95	13.67	0.95	19.67	0.60
1.83	0.44	7.83	0.95	13.83	0.95	19.83	0.60
2.00	0.51	8.00	1.25	14.00	0.79	20.00	0.46
2.17	0.51	8.17	1.25	14.17	0.79	20.17	0.46
2.33	0.51	8.33	1.25	14.33	0.79	20.33	0.46
2.50	0.51	8.50	1.75	14.50	0.79	20.50	0.46
2.67	0.51	8.67	1.75	14.67	0.79	20.67	0.46
2.83	0.51	8.83	1.75	14.83	0.79	20.83	0.46
3.00	0.51	9.00	2.45	15.00	0.79	21.00	0.46
3.17	0.51	9.17	2.45	15.17	0.79	21.17	0.46
3.33	0.51	9.33	2.45	15.33	0.79	21.33	0.46
3.50	0.51	9.50	5.90	15.50	0.79	21.50	0.46
3.67	0.51	9.67	10.60	15.67	0.79	21.67	0.46
3.83	0.51	9.83	15.30	15.83	0.79	21.83	0.46
4.00	0.61	10.00	3.40	16.00	0.60	22.00	0.46
4.17	0.61	10.17	3.40	16.17	0.60	22.17	0.46
4.33	0.61	10.33	3.40	16.33	0.60	22.33	0.46
4.50	0.61	10.50	2.05	16.50	0.60	22.50	0.46
4.67	0.61	10.67	2.05	16.67	0.60	22.67	0.46
4.83	0.61	10.83	2.05	16.83	0.60	22.83	0.46
5.00	0.61	11.00	1.50	17.00	0.60	23.00	0.46
5.17	0.61	11.17	1.50	17.17	0.60	23.17	0.46
5.33	0.61	11.33	1.50	17.33	0.60	23.33	0.46
5.50	0.61	11.50	1.50	17.50	0.60	23.50	0.46
5.67	0.61	11.67	1.40	17.67	0.60	23.67	0.46
5.83	0.61	11.83	1.30	17.83	0.60	23.83	0.46

CALIB

| NASHYD (0013) | Area (ha)= 24.38 Curve Number (CN)= 35.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 9.11 # of Linear Res.(N)= 3.00
 ----- U.H. Tp(hrs)= 0.73

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

----- TRANSFORMED HYETOGRAPH -----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46

3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Unit Hyd Qpeak (cms)= 1.276

PEAK FLOW (cms)= 0.004 (i)
 TIME TO PEAK (hrs)= 11.333
 RUNOFF VOLUME (mm)= 0.517
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.021

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

 | CALIB |
 | NASHYD (0014) | Area (ha)= 20.64 Curve Number (CN)= 53.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
 ----- U.H. Tp(hrs)= 0.59

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46

3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.009 (i)
 TIME TO PEAK (hrs)= 10.833
 RUNOFF VOLUME (mm)= 1.176
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.047

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

 | CALIB |
 | NASHYD (0015) | Area (ha)= 18.82 Curve Number (CN)= 48.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 7.42 # of Linear Res.(N)= 3.00

 U.H. Tp(hrs)= 0.96

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46

4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Unit Hyd Qpeak (cms)= 0.749

PEAK FLOW (cms)= 0.006 (i)
 TIME TO PEAK (hrs)= 11.500
 RUNOFF VOLUME (mm)= 1.054
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.042

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

 CALIB
 NASHYD (0016) | Area (ha)= 6.87 Curve Number (CN)= 46.0
 ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.21

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60

0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46

4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.008 (i)
 TIME TO PEAK (hrs)= 10.083
 RUNOFF VOLUME (mm)= 1.329
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.053

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

ADD HYD (0012)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0013):	24.38	0.004	11.33	0.52
+ ID2= 2 (0014):	20.64	0.009	10.83	1.18
=====				
ID = 3 (0012):	45.02	0.012	11.00	0.82

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0012)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
ID1= 3 (0012):	45.02	0.012	11.00	0.82

```

+ ID2= 2 ( 0015):  18.82  0.006  11.50  1.05
=====
ID = 1 ( 0012):  63.84  0.018  11.17  0.89

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0012)|
| 1 + 2 = 3 |
-----
          AREA    QPEAK    TPEAK    R.V.
          (ha)    (cms)    (hrs)    (mm)
ID1= 1 ( 0012):  63.84  0.018  11.17  0.89
+ ID2= 2 ( 0016):  6.87  0.008  10.08  1.33
=====
ID = 3 ( 0012):  70.71  0.021  11.08  0.93

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

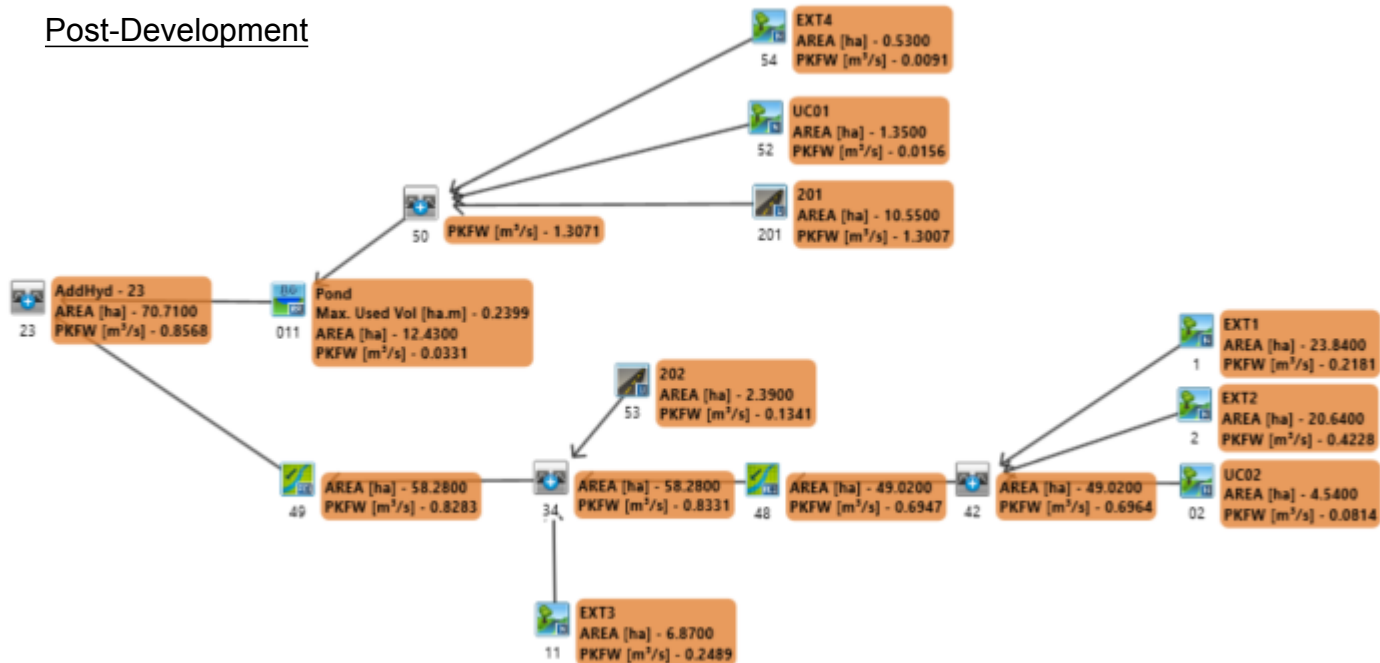
FINISH

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Post-Development



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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 A A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

000 TTTTT TTTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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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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ef064-0a7a-4364-a20b-f2ff37b9f254\sce
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ef064-0a7a-4364-a20b-f2ff37b9f254\sce

DATE: 01-15-2026 TIME: 04:40:13

USER:

COMMENTS: _____

** SIMULATION : 1 - 2yr 3hr 10min Chicago **

CHICAGO STORM | IDF curve parameters: A= 475.610
| Ptotal= 30.88 mm | B= 0.000
| C= 0.738

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	3.17	0.83	86.95	1.67	5.04	2.50	3.05
0.17	3.77	1.00	15.73	1.83	4.42	2.67	2.85
0.33	4.72	1.17	9.66	2.00	3.95	2.83	2.67
0.50	6.58	1.33	7.25	2.17	3.59		
0.67	12.69	1.50	5.91	2.33	3.30		

| CALIB |
| NASHYD (0001) | Area (ha)= 23.84 Curve Number (CN)= 35.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.20 # of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 0.73

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Unit Hyd Qpeak (cms)= 1.247

PEAK FLOW (cms)= 0.028 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 0.953
TOTAL RAINFALL (mm)= 30.883
RUNOFF COEFFICIENT = 0.031

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

CALIB
 NASHYD (0002) | Area (ha)= 20.64 Curve Number (CN)= 53.0
 ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.59

0.583 6.58 | 1.333 9.66 | 2.083 3.95 | 2.83 2.85
 0.667 6.58 | 1.417 7.25 | 2.167 3.95 | 2.92 2.67
 0.750 12.69 | 1.500 7.25 | 2.250 3.59 | 3.00 2.67

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.061 (i)
 TIME TO PEAK (hrs)= 1.833
 RUNOFF VOLUME (mm)= 2.091
 TOTAL RAINFALL (mm)= 30.883
 RUNOFF COEFFICIENT = 0.068

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

CALIB
 NASHYD (0002) | Area (ha)= 4.54 Curve Number (CN)= 41.0
 ID= 1 DT= 5.0 min | Ia (mm)= 8.52 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.37

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85

Unit Hyd Qpeak (cms)= 0.469

PEAK FLOW (cms)= 0.010 (i)
 TIME TO PEAK (hrs)= 1.500
 RUNOFF VOLUME (mm)= 1.289
 TOTAL RAINFALL (mm)= 30.883
 RUNOFF COEFFICIENT = 0.042

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

ADD HYD (0042)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0002):	4.54	0.010	1.50	1.29
+ ID2= 2 (0001):	23.84	0.028	2.17	0.95
=====				
ID = 3 (0042):	28.38	0.035	2.00	1.01

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0042)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
ID1= 3 (0042):	28.38	0.035	2.00	1.01
+ ID2= 2 (0002):	20.64	0.061	1.83	2.09
=====				
ID = 1 (0042):	49.02	0.095	1.83	1.46

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0048)
 IN= 2---> OUT= 1 | Routing time step (min)'= 5.00

----- DATA FOR SECTION (1.1) ----->

Distance	Elevation	Manning	
0.00	342.60	0.0350	
2.55	341.75	0.0350 /0.0350	Main Channel
4.05	341.75	0.0350 /0.0350	Main Channel
6.50	342.60	0.0350	

<----- TRAVEL TIME TABLE ----->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV. TIME (min)
0.04	341.79	.203E+02	0.0	0.35	13.28
0.09	341.84	.438E+02	0.1	0.54	8.60
0.13	341.88	.706E+02	0.2	0.69	6.73
0.18	341.93	.101E+03	0.3	0.81	5.68
0.22	341.97	.134E+03	0.4	0.93	4.99
0.27	342.02	.171E+03	0.6	1.03	4.50
0.31	342.06	.210E+03	0.8	1.12	4.13
0.36	342.11	.254E+03	1.1	1.21	3.83
0.40	342.15	.300E+03	1.4	1.29	3.59
0.45	342.20	.350E+03	1.7	1.36	3.39
0.49	342.24	.403E+03	2.1	1.44	3.22
0.54	342.29	.459E+03	2.5	1.51	3.07
0.58	342.33	.518E+03	2.9	1.57	2.94
0.63	342.38	.581E+03	3.4	1.64	2.82
0.67	342.42	.647E+03	4.0	1.70	2.72
0.72	342.47	.716E+03	4.5	1.76	2.63
0.76	342.51	.789E+03	5.2	1.82	2.54
0.81	342.55	.865E+03	5.8	1.88	2.46
0.85	342.60	.944E+03	6.6	1.93	2.39

0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.043 (i)
 TIME TO PEAK (hrs)= 1.167
 RUNOFF VOLUME (mm)= 2.158
 TOTAL RAINFALL (mm)= 30.883
 RUNOFF COEFFICIENT = 0.070

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

CALIB
 STANDHYD (0053) | Area (ha)= 2.39
 ID= 1 DT= 5.0 min | Total Imp(%)= 35.60 Dir. Conn.(%)= 10.00

IMPERVIOUS PERVIOUS (i)
 Surface Area (ha)= 0.85 1.54
 Dep. Storage (mm)= 2.00 5.00
 Average Slope (%)= 0.50 2.00
 Length (m)= 104.00 81.00
 Mannings n = 0.013 0.250

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

<---- hydrograph ----> <-pipe / channel->

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0042)	49.02	0.10	1.83	1.46	0.09	0.55
OUTFLOW: ID= 1 (0048)	49.02	0.09	2.00	1.46	0.09	0.55

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Max.Eff.Inten.(mm/hr)= 86.95 2.34
 over (min) 5.00 55.00
 Storage Coeff. (min)= 3.41 (ii) 51.77 (ii)
 Unit Hyd. Tpeak (min)= 5.00 55.00
 Unit Hyd. peak (cms)= 0.26 0.02

TOTALS
 0.055 (iii)

PEAK FLOW (cms)= 0.06 0.01

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

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85

CALIB
 NASHYD (0011) | Area (ha)= 6.87 Curve Number (CN)= 46.0
 ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.21

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

TIME TO PEAK (hrs)= 1.00 1.92 1.00
 RUNOFF VOLUME (mm)= 28.88 2.04 4.72
 TOTAL RAINFALL (mm)= 30.88 30.88 30.88
 RUNOFF COEFFICIENT = 0.94 0.07 0.15

***** 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* = 35.0 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 (0034)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0011):	6.87	0.043	1.17	2.16
+ ID2= 2 (0048):	49.02	0.095	2.00	1.46
=====				
ID = 3 (0034):	55.89	0.109	1.83	1.55

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0034)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
ID1= 3 (0034):	55.89	0.109	1.83	1.55
+ ID2= 2 (0053):	2.39	0.055	1.00	4.72
=====				
ID = 1 (0034):	58.28	0.118	1.83	1.68

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0049)
 IN= 2--> OUT= 1 Routing time step (min)'= 5.00

<----- DATA FOR SECTION (1.1) ----->			
Distance	Elevation	Manning	
0.00	342.60	0.0350	
2.55	341.75	0.0350 /0.0350	Main Channel
4.05	341.75	0.0350 /0.0350	Main Channel
6.50	342.60	0.0350	

<----- TRAVEL TIME TABLE ----->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.04	341.79	.323E+02	0.0	0.35	21.13
0.09	341.84	.697E+02	0.1	0.54	13.69
0.13	341.88	.112E+03	0.2	0.69	10.71
0.18	341.93	.160E+03	0.3	0.81	9.04
0.22	341.97	.213E+03	0.4	0.93	7.95
0.27	342.02	.272E+03	0.6	1.03	7.17
0.31	342.06	.335E+03	0.8	1.12	6.57
0.36	342.11	.404E+03	1.1	1.21	6.10
0.40	342.15	.477E+03	1.4	1.29	5.72
0.45	342.20	.557E+03	1.7	1.36	5.40
0.49	342.24	.641E+03	2.1	1.44	5.13
0.54	342.29	.730E+03	2.5	1.51	4.89
0.58	342.33	.825E+03	2.9	1.57	4.68
0.63	342.38	.925E+03	3.4	1.64	4.50
0.67	342.42	.103E+04	4.0	1.70	4.33
0.72	342.47	.114E+04	4.5	1.76	4.18
0.76	342.51	.126E+04	5.2	1.82	4.05
0.81	342.55	.138E+04	5.8	1.88	3.92
0.85	342.60	.150E+04	6.6	1.93	3.81

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0034)	58.28	0.12	1.83	1.68	0.11	0.58
OUTFLOW: ID= 1 (0049)	58.28	0.11	2.08	1.68	0.10	0.58

CALIB
 NASHYD (0052) | Area (ha)= 1.35 Curve Number (CN)= 35.0
 ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.47

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05

0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Unit Hyd Qpeak (cms)= 0.110

PEAK FLOW (cms)= 0.002 (i)
 TIME TO PEAK (hrs)= 1.667
 RUNOFF VOLUME (mm)= 0.884
 TOTAL RAINFALL (mm)= 30.883
 RUNOFF COEFFICIENT = 0.029

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

CALIB			
STANDHYD (0201)	Area (ha)=	10.55	
ID= 1 DT= 5.0 min	Total Imp(%)=	42.60	Dir. Conn.(%)= 23.50

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	4.49	6.06
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	0.50	2.00
Length	(m)=	104.00	81.00
Mannings n	=	0.013	0.250

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

CALIB			
NASHYD (0054)	Area (ha)=	0.53	Curve Number (CN)= 35.0
ID= 1 DT= 5.0 min	Ia (mm)=	10.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.25	

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	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Unit Hyd Qpeak (cms)= 0.081

PEAK FLOW (cms)= 0.001 (i)
 TIME TO PEAK (hrs)= 1.333
 RUNOFF VOLUME (mm)= 0.883
 TOTAL RAINFALL (mm)= 30.883
 RUNOFF COEFFICIENT = 0.029

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

----- TRANSFORMED HYETOGRAPH -----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	3.17	0.833	12.69	1.583	5.91	2.33	3.59
0.167	3.17	0.917	86.95	1.667	5.91	2.42	3.30
0.250	3.77	1.000	86.95	1.750	5.04	2.50	3.30
0.333	3.77	1.083	15.73	1.833	5.04	2.58	3.05
0.417	4.72	1.167	15.73	1.917	4.42	2.67	3.05
0.500	4.72	1.250	9.66	2.000	4.42	2.75	2.85
0.583	6.58	1.333	9.66	2.083	3.95	2.83	2.85
0.667	6.58	1.417	7.25	2.167	3.95	2.92	2.67
0.750	12.69	1.500	7.25	2.250	3.59	3.00	2.67

Max.Eff.Inten.(mm/hr)=	86.95	1.99
over (min)	5.00	60.00
Storage Coeff. (min)=	3.41 (ii)	55.07 (ii)
Unit Hyd. Tpeak (min)=	5.00	60.00
Unit Hyd. peak (cms)=	0.26	0.02

TOTALS

PEAK FLOW (cms)=	0.57	0.02	0.573 (iii)
TIME TO PEAK (hrs)=	1.00	2.08	1.00
RUNOFF VOLUME (mm)=	28.88	1.93	8.26
TOTAL RAINFALL (mm)=	30.88	30.88	30.88
RUNOFF COEFFICIENT =	0.94	0.06	0.27

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 35.0 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 (0050)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0201):	10.55	0.573	1.00	8.26
+ ID2= 2 (0052):	1.35	0.002	1.67	0.88
=====				
ID = 3 (0050):	11.90	0.573	1.00	7.43

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0050)	AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0050):	11.90	0.573	1.00	7.43
+ ID2= 2 (0054):	0.53	0.001	1.33	0.88
=====				
ID = 1 (0050):	12.43	0.573	1.00	7.15

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0011)	OVERFLOW IS OFF			
IN= 2--> OUT= 1	OUTFLOW	STORAGE	OUTFLOW	STORAGE
DT= 5.0 min	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	0.0290	0.1844
	0.0070	0.0210	0.0310	0.2102
	0.0120	0.0425	0.0330	0.2365
	0.0160	0.0647	0.0340	0.2634
	0.0200	0.0875	0.0360	0.2909
	0.0220	0.1108	1.2930	0.3190
	0.0250	0.1348	3.8000	0.3477
	0.0270	0.1593	7.3300	0.3769

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 (0050)	12.430	0.573	1.00	7.15
OUTFLOW: ID= 1 (0011)	12.430	0.017	3.08	7.09

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.98
 TIME SHIFT OF PEAK FLOW (min)=125.00
 MAXIMUM STORAGE USED (ha.m.)= 0.0710

ADD HYD (0023)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)

	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0011):	12.43	0.017	3.08	7.09
+ ID2= 2 (0049):	58.28	0.115	2.08	1.68
=====				
ID = 3 (0023):	70.71	0.130	2.08	2.63

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A L
V V I SS U U A A L
V V I SSSS UUUU A A LLLLL
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000 TTTT TTTT H H Y Y M M 000 TM
0 0 T T H H Y Y MM MM 0 0
0 0 T T H H Y M M 0 0
000 T T H H Y M M 000
```

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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\V02\voin.dat

Output filename:
 C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\8605cbaa-f661-4e40-8104-d42836994678\sce
 Summary filename:
 C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\8605cbaa-f661-4e40-8104-d42836994678\sce

DATE: 01-15-2026

TIME: 04:40:13

USER:

COMMENTS: _____

 ** SIMULATION : 2 - 5yr 3hr 10min Chicago **

RUNOFF VOLUME (mm)= 1.942
 TOTAL RAINFALL (mm)= 40.451
 RUNOFF COEFFICIENT = 0.048

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

 | CHICAGO STORM | IDF curve parameters: A= 632.750
 | Ptotal= 40.45 mm | B= 0.000
 | | C= 0.741
 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

 | CALIB |
 | NASHYD (0002) | Area (ha)= 20.64 Curve Number (CN)= 53.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
 | | U.H. Tp(hrs)= 0.59

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	4.11	0.83	114.88	1.67	6.54	2.50	3.95
0.17	4.88	1.00	20.52	1.83	5.73	2.67	3.69
0.33	6.13	1.17	12.57	2.00	5.13	2.83	3.46
0.50	8.55	1.33	9.43	2.17	4.65		
0.67	16.54	1.50	7.68	2.33	4.27		

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.123 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 4.060
 TOTAL RAINFALL (mm)= 40.451
 RUNOFF COEFFICIENT = 0.100

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

 | CALIB |
 | NASHYD (0002) | Area (ha)= 4.54 Curve Number (CN)= 41.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 8.52 # of Linear Res.(N)= 3.00
 | | U.H. Tp(hrs)= 0.37

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

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 1.247

PEAK FLOW (cms)= 0.058 (i)
 TIME TO PEAK (hrs)= 2.000

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 0.469

PEAK FLOW (cms)= 0.022 (i)
 TIME TO PEAK (hrs)= 1.417
 RUNOFF VOLUME (mm)= 2.565
 TOTAL RAINFALL (mm)= 40.451
 RUNOFF COEFFICIENT = 0.063

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

ADD HYD (0042)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0002):	4.54	0.022	1.42	2.56
+ ID2= 2 (0001):	23.84	0.058	2.00	1.94
=====				
ID = 3 (0042):	28.38	0.074	1.83	2.04

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0042)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
ID1= 3 (0042):	28.38	0.074	1.83	2.04
+ ID2= 2 (0002):	20.64	0.123	1.75	4.06
=====				
ID = 1 (0042):	49.02	0.196	1.83	2.89

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0048)
 IN= 2--> OUT= 1 | Routing time step (min)'= 5.00

----->

<----- DATA FOR SECTION (1.1) ----->

Distance	Elevation	Manning
0.00	342.60	0.0350
2.55	341.75	0.0350 /0.0350
4.05	341.75	0.0350 /0.0350
6.50	342.60	0.0350

Main Channel
Main Channel

<----- TRAVEL TIME TABLE ----->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.04	341.79	.203E+02	0.0	0.35	13.28
0.09	341.84	.438E+02	0.1	0.54	8.60
0.13	341.88	.706E+02	0.2	0.69	6.73
0.18	341.93	.101E+03	0.3	0.81	5.68
0.22	341.97	.134E+03	0.4	0.93	4.99
0.27	342.02	.171E+03	0.6	1.03	4.50
0.31	342.06	.210E+03	0.8	1.12	4.13
0.36	342.11	.254E+03	1.1	1.21	3.83
0.40	342.15	.300E+03	1.4	1.29	3.59
0.45	342.20	.350E+03	1.7	1.36	3.39
0.49	342.24	.403E+03	2.1	1.44	3.22
0.54	342.29	.459E+03	2.5	1.51	3.07
0.58	342.33	.518E+03	2.9	1.57	2.94
0.63	342.38	.581E+03	3.4	1.64	2.82
0.67	342.42	.647E+03	4.0	1.70	2.72
0.72	342.47	.716E+03	4.5	1.76	2.63
0.76	342.51	.789E+03	5.2	1.82	2.54
0.81	342.55	.865E+03	5.8	1.88	2.46
0.85	342.60	.944E+03	6.6	1.93	2.39

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0042)	49.02	0.20	1.83	2.89	0.14	0.71
OUTFLOW: ID= 1 (0048)	49.02	0.19	1.92	2.89	0.14	0.71

----->

CALIB

NASHYD (0011) | Area (ha)= 6.87 Curve Number (CN)= 46.0
 ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.21

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	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.081 (i)
 TIME TO PEAK (hrs)= 1.167
 RUNOFF VOLUME (mm)= 3.885
 TOTAL RAINFALL (mm)= 40.451
 RUNOFF COEFFICIENT = 0.096

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

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-----
| CALIB
| STANDHYD ( 0053) | Area (ha)= 2.39
| ID= 1 DT= 5.0 min | Total Imp(%)= 35.60 Dir. Conn.(%)= 10.00
-----

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	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.85	1.54
Dep. Storage (mm)=	2.00	5.00
Average Slope (%)=	0.50	2.00
Length (m)=	104.00	81.00
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	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Max.Eff.Inten.(mm/hr)=	114.88	5.27	
over (min)	5.00	40.00	
Storage Coeff. (min)=	3.05 (ii)	38.02 (ii)	
Unit Hyd. Tpeak (min)=	5.00	40.00	
Unit Hyd. peak (cms)=	0.27	0.03	
TOTALS			
PEAK FLOW (cms)=	0.07	0.01	0.075 (iii)
TIME TO PEAK (hrs)=	1.00	1.58	1.00
RUNOFF VOLUME (mm)=	38.45	3.63	7.10
TOTAL RAINFALL (mm)=	40.45	40.45	40.45
RUNOFF COEFFICIENT =	0.95	0.09	0.18

***** 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* = 35.0 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 ( 0034) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm)
-----
ID1= 1 ( 0011): 6.87 0.081 1.17 3.88
+ ID2= 2 ( 0048): 49.02 0.195 1.92 2.89
=====
ID = 3 ( 0034): 55.89 0.222 1.75 3.01
-----

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0034) |
| 3 + 2 = 1 | AREA QPEAK TPEAK R.V.
| (ha) (cms) (hrs) (mm)
-----
ID1= 3 ( 0034): 55.89 0.222 1.75 3.01
+ ID2= 2 ( 0053): 2.39 0.075 1.00 7.10
=====
ID = 1 ( 0034): 58.28 0.238 1.75 3.18
-----

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ROUTE CHN( 0049) |
-----

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| IN= 2---> OUT= 1 | Routing time step (min)'= 5.00

<----- DATA FOR SECTION (1.1) ----->
 Distance Elevation Manning
 0.00 342.60 0.0350
 2.55 341.75 0.0350 /0.0350 Main Channel
 4.05 341.75 0.0350 /0.0350 Main Channel
 6.50 342.60 0.0350

<----- TRAVEL TIME TABLE ----->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV. TIME (min)
0.04	341.79	.323E+02	0.0	0.35	21.13
0.09	341.84	.697E+02	0.1	0.54	13.69
0.13	341.88	.112E+03	0.2	0.69	10.71
0.18	341.93	.160E+03	0.3	0.81	9.04
0.22	341.97	.213E+03	0.4	0.93	7.95
0.27	342.02	.272E+03	0.6	1.03	7.17
0.31	342.06	.335E+03	0.8	1.12	6.57
0.36	342.11	.404E+03	1.1	1.21	6.10
0.40	342.15	.477E+03	1.4	1.29	5.72
0.45	342.20	.557E+03	1.7	1.36	5.40
0.49	342.24	.641E+03	2.1	1.44	5.13
0.54	342.29	.730E+03	2.5	1.51	4.89
0.58	342.33	.825E+03	2.9	1.57	4.68
0.63	342.38	.925E+03	3.4	1.64	4.50
0.67	342.42	.103E+04	4.0	1.70	4.33
0.72	342.47	.114E+04	4.5	1.76	4.18
0.76	342.51	.126E+04	5.2	1.82	4.05
0.81	342.55	.138E+04	5.8	1.88	3.92
0.85	342.60	.150E+04	6.6	1.93	3.81

<---- hydrograph ----> <-pipe / channel->

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0034)	58.28	0.24	1.75	3.18	0.16	0.75
OUTFLOW: ID= 1 (0049)	58.28	0.23	1.92	3.18	0.16	0.74

 | CALIB |
 | NASHYD (0052) | Area (ha)= 1.35 Curve Number (CN)= 35.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
 | U.H. Tp(hrs)= 0.47

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	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 0.110

PEAK FLOW (cms)= 0.004 (i)
 TIME TO PEAK (hrs)= 1.667
 RUNOFF VOLUME (mm)= 1.846
 TOTAL RAINFALL (mm)= 40.451
 RUNOFF COEFFICIENT = 0.046

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

 | CALIB |
 | NASHYD (0054) | Area (ha)= 0.53 Curve Number (CN)= 35.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
 | U.H. Tp(hrs)= 0.25

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	4.11	0.833	16.54	1.583	7.68	2.33	4.65
0.167	4.11	0.917	114.88	1.667	7.68	2.42	4.27
0.250	4.88	1.000	114.88	1.750	6.54	2.50	4.27
0.333	4.88	1.083	20.52	1.833	6.54	2.58	3.95
0.417	6.13	1.167	20.52	1.917	5.73	2.67	3.95
0.500	6.13	1.250	12.57	2.000	5.73	2.75	3.69
0.583	8.55	1.333	12.57	2.083	5.13	2.83	3.69
0.667	8.55	1.417	9.43	2.167	5.13	2.92	3.46
0.750	16.54	1.500	9.43	2.250	4.65	3.00	3.46

Unit Hyd Qpeak (cms)= 0.081

PEAK FLOW (cms)= 0.002 (i)
 TIME TO PEAK (hrs)= 1.250

RUNOFF VOLUME (mm)= 1.844
 TOTAL RAINFALL (mm)= 40.451
 RUNOFF COEFFICIENT = 0.046

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

CN* = 35.0 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 ( 0201) | Area (ha)= 10.55
| ID= 1 DT= 5.0 min | Total Imp(%)= 42.60 Dir. Conn.(%)= 23.50
-----
                IMPERVIOUS    PERVIOUS (i)
Surface Area (ha)= 4.49      6.06
Dep. Storage (mm)= 2.00     5.00
Average Slope (%)= 0.50     2.00
Length (m)= 104.00         81.00
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 4.11 | 0.833 16.54 | 1.583 7.68 | 2.33 4.65
0.167 4.11 | 0.917 114.88 | 1.667 7.68 | 2.42 4.27
0.250 4.88 | 1.000 114.88 | 1.750 6.54 | 2.50 4.27
0.333 4.88 | 1.083 20.52 | 1.833 6.54 | 2.58 3.95
0.417 6.13 | 1.167 20.52 | 1.917 5.73 | 2.67 3.95
0.500 6.13 | 1.250 12.57 | 2.000 5.73 | 2.75 3.69
0.583 8.55 | 1.333 12.57 | 2.083 5.13 | 2.83 3.69
0.667 8.55 | 1.417 9.43 | 2.167 5.13 | 2.92 3.46
0.750 16.54 | 1.500 9.43 | 2.250 4.65 | 3.00 3.46
  
```

```

Max.Eff.Inten.(mm/hr)= 114.88      4.39
over (min) = 5.00      45.00
Storage Coeff. (min)= 3.05 (ii) 40.66 (ii)
Unit Hyd. Tpeak (min)= 5.00      45.00
Unit Hyd. peak (cms)= 0.27      0.03

*TOTALS*
PEAK FLOW (cms)= 0.77      0.04      0.770 (iii)
TIME TO PEAK (hrs)= 1.00      1.67      1.00
RUNOFF VOLUME (mm)= 38.45      3.45      11.67
TOTAL RAINFALL (mm)= 40.45      40.45      40.45
RUNOFF COEFFICIENT = 0.95      0.09      0.29
  
```

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

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

```

-----
| ADD HYD ( 0050) |
| 1 + 2 = 3 |
-----
                AREA    QPEAK    TPEAK    R.V.
                (ha)    (cms)    (hrs)    (mm)
ID1= 1 ( 0201): 10.55 0.770 1.00 11.67
+ ID2= 2 ( 0052): 1.35 0.004 1.67 1.85
=====
ID = 3 ( 0050): 11.90 0.770 1.00 10.56
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0050) |
| 3 + 2 = 1 |
-----
                AREA    QPEAK    TPEAK    R.V.
                (ha)    (cms)    (hrs)    (mm)
ID1= 3 ( 0050): 11.90 0.770 1.00 10.56
+ ID2= 2 ( 0054): 0.53 0.002 1.25 1.84
=====
ID = 1 ( 0050): 12.43 0.771 1.00 10.19
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR( 0011) | OVERFLOW IS OFF
| IN= 2--> OUT= 1 |
| DT= 5.0 min |
-----
                OUTFLOW    STORAGE    OUTFLOW    STORAGE
                (cms)    (ha.m.)    (cms)    (ha.m.)
0.0000 0.0000 | 0.0290 0.1844
0.0070 0.0210 | 0.0310 0.2102
0.0120 0.0425 | 0.0330 0.2365
0.0160 0.0647 | 0.0340 0.2634
0.0200 0.0875 | 0.0360 0.2909
0.0220 0.1108 | 1.2930 0.3190
0.0250 0.1348 | 3.8000 0.3477
0.0270 0.1593 | 7.3300 0.3769
  
```

```

                AREA    QPEAK    TPEAK    R.V.
                (ha)    (cms)    (hrs)    (mm)
INFLOW : ID= 2 ( 0050) 12.430 0.771 1.00 10.19
OUTFLOW: ID= 1 ( 0011) 12.430 0.021 3.25 10.12
  
```

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.78

TIME SHIFT OF PEAK FLOW (min)=135.00
 MAXIMUM STORAGE USED (ha.m.)= 0.1044

```

-----
| ADD HYD ( 0023)|
| 1 + 2 = 3 |
-----
      AREA   QPEAK   TPEAK   R.V.
      (ha)   (cms)   (hrs)   (mm)
ID1= 1 ( 0011): 12.43  0.021  3.25  10.12
+ ID2= 2 ( 0049): 58.28  0.235  1.92  3.18
=====
ID = 3 ( 0023): 70.71  0.255  1.92  4.40
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS 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
W  I  SSSSS  UUUUU  A  A  LLLLL

000  TTTTT  TTTTT  H  H  Y  Y  M  M  000  TM
O  O  T  T  H  H  Y  Y  MM  MM  O  O
O  O  T  T  H  H  Y  M  M  O  O
000  T  T  H  H  Y  M  M  000
  
```

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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\noconnor\AppData\Local\Civica\H5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\b9f1746c-d833-4333-ac33-2cfd38f28a1d\scse

Summary filename:

C:\Users\noconnor\AppData\Local\Civica\H5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\b9f1746c-d833-4333-ac33-2cfd38f28a1d\scse

DATE: 01-15-2026

TIME: 04:40:13

USER:

COMMENTS: _____

```

-----
*****
** SIMULATION : 3 - 10yr 3hr 10min Chicago **
*****
  
```

```

-----
| CHICAGO STORM | IDF curve parameters: A= 721.920
| Ptotal= 47.37 mm | B= 0.000
| | C= 0.736
-----
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	4.90	0.83	132.58	1.67	7.77	2.50	4.72
0.17	5.82	1.00	24.19	1.83	6.82	2.67	4.40
0.33	7.29	1.17	14.88	2.00	6.10	2.83	4.13
0.50	10.14	1.33	11.18	2.17	5.54		
0.67	19.52	1.50	9.12	2.33	5.09		

```

-----
| CALIB |
| NASHYD ( 0001) | Area (ha)= 23.84 Curve Number (CN)= 35.0
| ID= 1 DT= 5.0 min | Ia (mm)= 9.20 # of Linear Res.(N)= 3.00
| | U.H. Tp(hrs)= 0.73
-----
  
```

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	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40

0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

Unit Hyd Qpeak (cms)= 1.247

PEAK FLOW (cms)= 0.086 (i)
 TIME TO PEAK (hrs)= 2.000
 RUNOFF VOLUME (mm)= 2.857
 TOTAL RAINFALL (mm)= 47.366
 RUNOFF COEFFICIENT = 0.060

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

```

-----
| CALIB |
| NASHYD ( 0002) | Area (ha)= 20.64 Curve Number (CN)= 53.0
| ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= 0.59

```

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 4.90 | 0.833 19.52 | 1.583 9.12 | 2.33 5.54
0.167 4.90 | 0.917 132.58 | 1.667 9.12 | 2.42 5.09
0.250 5.82 | 1.000 132.58 | 1.750 7.77 | 2.50 5.09
0.333 5.82 | 1.083 24.19 | 1.833 7.77 | 2.58 4.72
0.417 7.29 | 1.167 24.19 | 1.917 6.82 | 2.67 4.72
0.500 7.29 | 1.250 14.88 | 2.000 6.82 | 2.75 4.40
0.583 10.14 | 1.333 14.88 | 2.083 6.10 | 2.83 4.40
0.667 10.14 | 1.417 11.18 | 2.167 6.10 | 2.92 4.13
0.750 19.52 | 1.500 11.18 | 2.250 5.54 | 3.00 4.13

```

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.178 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 5.826
 TOTAL RAINFALL (mm)= 47.366
 RUNOFF COEFFICIENT = 0.123

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

```

-----
| CALIB |

```

```

| NASHYD ( 0002) | Area (ha)= 4.54 Curve Number (CN)= 41.0
| ID= 1 DT= 5.0 min | Ia (mm)= 8.52 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= 0.37

```

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 4.90 | 0.833 19.52 | 1.583 9.12 | 2.33 5.54
0.167 4.90 | 0.917 132.58 | 1.667 9.12 | 2.42 5.09
0.250 5.82 | 1.000 132.58 | 1.750 7.77 | 2.50 5.09
0.333 5.82 | 1.083 24.19 | 1.833 7.77 | 2.58 4.72
0.417 7.29 | 1.167 24.19 | 1.917 6.82 | 2.67 4.72
0.500 7.29 | 1.250 14.88 | 2.000 6.82 | 2.75 4.40
0.583 10.14 | 1.333 14.88 | 2.083 6.10 | 2.83 4.40
0.667 10.14 | 1.417 11.18 | 2.167 6.10 | 2.92 4.13
0.750 19.52 | 1.500 11.18 | 2.250 5.54 | 3.00 4.13

```

Unit Hyd Qpeak (cms)= 0.469

PEAK FLOW (cms)= 0.033 (i)
 TIME TO PEAK (hrs)= 1.417
 RUNOFF VOLUME (mm)= 3.731
 TOTAL RAINFALL (mm)= 47.366
 RUNOFF COEFFICIENT = 0.079

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

```

-----
| ADD HYD ( 0042) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
|-----| (ha) (cms) (hrs) (mm)
ID1= 1 ( 0002): 4.54 0.033 1.42 3.73
+ ID2= 2 ( 0001): 23.84 0.086 2.00 2.86
=====
ID = 3 ( 0042): 28.38 0.110 1.83 3.00

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0042) |
| 3 + 2 = 1 | AREA QPEAK TPEAK R.V.
|-----| (ha) (cms) (hrs) (mm)
ID1= 3 ( 0042): 28.38 0.110 1.83 3.00
+ ID2= 2 ( 0002): 20.64 0.178 1.75 5.83

```

=====
 ID = 1 (0042): 49.02 0.287 1.75 4.19

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 | ROUTE CHN(0048)|
 | IN= 2--> OUT= 1 | Routing time step (min)'= 5.00

<----- DATA FOR SECTION (1.1) ----->
 Distance Elevation Manning
 0.00 342.60 0.0350
 2.55 341.75 0.0350 /0.0350 Main Channel
 4.05 341.75 0.0350 /0.0350 Main Channel
 6.50 342.60 0.0350

<----- TRAVEL TIME TABLE ----->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.04	341.79	.203E+02	0.0	0.35	13.28
0.09	341.84	.438E+02	0.1	0.54	8.60
0.13	341.88	.706E+02	0.2	0.69	6.73
0.18	341.93	.101E+03	0.3	0.81	5.68
0.22	341.97	.134E+03	0.4	0.93	4.99
0.27	342.02	.171E+03	0.6	1.03	4.50
0.31	342.06	.210E+03	0.8	1.12	4.13
0.36	342.11	.254E+03	1.1	1.21	3.83
0.40	342.15	.300E+03	1.4	1.29	3.59
0.45	342.20	.350E+03	1.7	1.36	3.39
0.49	342.24	.403E+03	2.1	1.44	3.22
0.54	342.29	.459E+03	2.5	1.51	3.07
0.58	342.33	.518E+03	2.9	1.57	2.94
0.63	342.38	.581E+03	3.4	1.64	2.82
0.67	342.42	.647E+03	4.0	1.70	2.72
0.72	342.47	.716E+03	4.5	1.76	2.63
0.76	342.51	.789E+03	5.2	1.82	2.54
0.81	342.55	.865E+03	5.8	1.88	2.46
0.85	342.60	.944E+03	6.6	1.93	2.39

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0042)	49.02	0.29	1.75	4.19	0.18	0.80
OUTFLOW: ID= 1 (0048)	49.02	0.29	1.83	4.19	0.18	0.80

CALIB

| NASHYD (0011)| Area (ha)= 6.87 Curve Number (CN)= 46.0
 |ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
 ----- U.H. Tp(hrs)= 0.21

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	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40
0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.113 (i)
 TIME TO PEAK (hrs)= 1.167
 RUNOFF VOLUME (mm)= 5.405
 TOTAL RAINFALL (mm)= 47.366
 RUNOFF COEFFICIENT = 0.114

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

 | CALIB |
 | STANDHYD (0053)| Area (ha)= 2.39
 |ID= 1 DT= 5.0 min | Total Imp(%)= 35.60 Dir. Conn.(%)= 10.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)	0.85	1.54
Dep. Storage (mm)	2.00	5.00
Average Slope (%)	0.50	2.00
Length (m)	104.00	81.00
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	4.90	0.833	19.52	1.583	9.12	2.33	5.54

0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40
0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

Max.Eff.Inten.(mm/hr)= 132.58 8.05
over (min) 5.00 35.00
Storage Coeff. (min)= 2.88 (ii) 32.41 (ii)
Unit Hyd. Tpeak (min)= 5.00 35.00
Unit Hyd. peak (cms)= 0.28 0.03

TOTALS

PEAK FLOW (cms)= 0.09 0.02 0.088 (iii)
TIME TO PEAK (hrs)= 1.00 1.50 1.00
RUNOFF VOLUME (mm)= 45.37 5.03 9.05
TOTAL RAINFALL (mm)= 47.37 47.37 47.37
RUNOFF COEFFICIENT = 0.96 0.11 0.19

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 35.0 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 (0034)				
1 + 2 = 3				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0011):	6.87	0.113	1.17	5.41
+ ID2= 2 (0048):	49.02	0.286	1.83	4.19
=====				
ID = 3 (0034):	55.89	0.326	1.75	4.34

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0034)				
3 + 2 = 1				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0034):	55.89	0.326	1.75	4.34

+ ID2= 2 (0053): 2.39 0.088 1.00 9.05
=====

ID = 1 (0034): 58.28 0.348 1.75 4.53

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

| ROUTE CHN(0049)|
| IN= 2---> OUT= 1 | Routing time step (min)'= 5.00

<----- DATA FOR SECTION (1.1) ----->

Distance	Elevation	Manning	
0.00	342.60	0.0350	
2.55	341.75	0.0350 /0.0350	Main Channel
4.05	341.75	0.0350 /0.0350	Main Channel
6.50	342.60	0.0350	

<----- TRAVEL TIME TABLE ----->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.04	341.79	.323E+02	0.0	0.35	21.13
0.09	341.84	.697E+02	0.1	0.54	13.69
0.13	341.88	.112E+03	0.2	0.69	10.71
0.18	341.93	.160E+03	0.3	0.81	9.04
0.22	341.97	.213E+03	0.4	0.93	7.95
0.27	342.02	.272E+03	0.6	1.03	7.17
0.31	342.06	.335E+03	0.8	1.12	6.57
0.36	342.11	.404E+03	1.1	1.21	6.10
0.40	342.15	.477E+03	1.4	1.29	5.72
0.45	342.20	.557E+03	1.7	1.36	5.40
0.49	342.24	.641E+03	2.1	1.44	5.13
0.54	342.29	.730E+03	2.5	1.51	4.89
0.58	342.33	.825E+03	2.9	1.57	4.68
0.63	342.38	.925E+03	3.4	1.64	4.50
0.67	342.42	.103E+04	4.0	1.70	4.33
0.72	342.47	.114E+04	4.5	1.76	4.18
0.76	342.51	.126E+04	5.2	1.82	4.05
0.81	342.55	.138E+04	5.8	1.88	3.92
0.85	342.60	.150E+04	6.6	1.93	3.81

	<---- hydrograph ---->	<-pipe / channel->				
	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0034)	58.28	0.35	1.75	4.53	0.19	0.85
OUTFLOW: ID= 1 (0049)	58.28	0.34	1.83	4.53	0.19	0.85

CALIB
 NASHYD (0052) | Area (ha)= 1.35 Curve Number (CN)= 35.0
 ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.47

0.583 10.14 | 1.333 14.88 | 2.083 6.10 | 2.83 4.40
 0.667 10.14 | 1.417 11.18 | 2.167 6.10 | 2.92 4.13
 0.750 19.52 | 1.500 11.18 | 2.250 5.54 | 3.00 4.13

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	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40
0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

Unit Hyd Qpeak (cms)= 0.110

PEAK FLOW (cms)= 0.006 (i)
 TIME TO PEAK (hrs)= 1.583
 RUNOFF VOLUME (mm)= 2.742
 TOTAL RAINFALL (mm)= 47.366
 RUNOFF COEFFICIENT = 0.058

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

Unit Hyd Qpeak (cms)= 0.081

PEAK FLOW (cms)= 0.003 (i)
 TIME TO PEAK (hrs)= 1.250
 RUNOFF VOLUME (mm)= 2.739
 TOTAL RAINFALL (mm)= 47.366
 RUNOFF COEFFICIENT = 0.058

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

 CALIB
 STANDHYD (0201) | Area (ha)= 10.55
 ID= 1 DT= 5.0 min | Total Imp(%)= 42.60 Dir. Conn.(%)= 23.50

IMPERVIOUS PERVIOUS (i)
 Surface Area (ha)= 4.49 6.06
 Dep. Storage (mm)= 2.00 5.00
 Average Slope (%)= 0.50 2.00
 Length (m)= 104.00 81.00
 Mannings n = 0.013 0.250

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

 CALIB
 NASHYD (0054) | Area (ha)= 0.53 Curve Number (CN)= 35.0
 ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.25

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	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	4.90	0.833	19.52	1.583	9.12	2.33	5.54
0.167	4.90	0.917	132.58	1.667	9.12	2.42	5.09
0.250	5.82	1.000	132.58	1.750	7.77	2.50	5.09
0.333	5.82	1.083	24.19	1.833	7.77	2.58	4.72
0.417	7.29	1.167	24.19	1.917	6.82	2.67	4.72
0.500	7.29	1.250	14.88	2.000	6.82	2.75	4.40
0.583	10.14	1.333	14.88	2.083	6.10	2.83	4.40
0.667	10.14	1.417	11.18	2.167	6.10	2.92	4.13
0.750	19.52	1.500	11.18	2.250	5.54	3.00	4.13

Max.Eff.Inten.(mm/hr)= 132.58 6.59
 over (min) 5.00 35.00
 Storage Coeff. (min)= 2.88 (ii) 34.85 (ii)
 Unit Hyd. Tpeak (min)= 5.00 35.00
 Unit Hyd. peak (cms)= 0.28 0.03
 TOTALS
 PEAK FLOW (cms)= 0.89 0.06 0.898 (iii)

TIME TO PEAK (hrs)= 1.00 1.50 1.00
 RUNOFF VOLUME (mm)= 45.37 4.78 14.32
 TOTAL RAINFALL (mm)= 47.37 47.37 47.37
 RUNOFF COEFFICIENT = 0.96 0.10 0.30

0.0270 0.1593 | 7.3300 0.3769

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0050)	12.430	0.900	1.00	12.57
OUTFLOW: ID= 1 (0011)	12.430	0.025	3.33	12.51

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 35.0 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.

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.74
 TIME SHIFT OF PEAK FLOW (min)=140.00
 MAXIMUM STORAGE USED (ha.m.)= 0.1318

ADD HYD (0050)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0201):	10.55	0.898	1.00	14.32
+ ID2= 2 (0052):	1.35	0.006	1.58	2.74
ID = 3 (0050):	11.90	0.899	1.00	13.01

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0050)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
3 + 2 = 1				
ID1= 3 (0050):	11.90	0.899	1.00	13.01
+ ID2= 2 (0054):	0.53	0.003	1.25	2.74
ID = 1 (0050):	12.43	0.900	1.00	12.57

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0011)	OVERFLOW IS OFF	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
IN= 2---> OUT= 1					
DT= 5.0 min					
		0.0000	0.0000	0.0290	0.1844
		0.0070	0.0210	0.0310	0.2102
		0.0120	0.0425	0.0330	0.2365
		0.0160	0.0647	0.0340	0.2634
		0.0200	0.0875	0.0360	0.2909
		0.0220	0.1108	1.2930	0.3190
		0.0250	0.1348	3.8000	0.3477

ADD HYD (0023)	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
1 + 2 = 3				
ID1= 1 (0011):	12.43	0.025	3.33	12.51
+ ID2= 2 (0049):	58.28	0.343	1.83	4.53
ID = 3 (0023):	70.71	0.365	1.83	5.93

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS 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 A A A A L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL
  
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000 TTTT TTTT H H Y Y M M 000 TM
0 0 T T H H Y Y MM MM 0 0
0 0 T T H H Y M M 0 0
000 T T H H Y M M 000
  
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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\nocconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\878
 83151-ed4b-4318-bc5c-19ae2e3b10b8\sce

Summary filename:
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 83151-ed4b-4318-bc5c-19ae2e3b10b8\sce

DATE: 01-15-2026 TIME: 04:40:13

USER:

COMMENTS: _____

 ** SIMULATION : 4 - 25yr 3hr 10min Chicago **

CHICAGO STORM
 Ptotal= 57.15 mm

IDF curve parameters: A= 822.740
 B= 0.000
 C= 0.725

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	6.14	0.83	154.98	1.67	9.68	2.50	5.92
0.17	7.28	1.00	29.61	1.83	8.51	2.67	5.53
0.33	9.09	1.17	18.34	2.00	7.63	2.83	5.19
0.50	12.58	1.33	13.85	2.17	6.94		
0.67	23.97	1.50	11.32	2.33	6.38		

CALIB
 NASHYD (0001)

Area (ha)= 23.84 Curve Number (CN)= 35.0
 Ia (mm)= 9.20 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.73

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.14	0.833	23.97	1.583	11.32	2.33	6.94
0.167	6.14	0.917	154.98	1.667	11.32	2.42	6.38
0.250	7.28	1.000	154.98	1.750	9.68	2.50	6.38
0.333	7.28	1.083	29.61	1.833	9.68	2.58	5.92
0.417	9.09	1.167	29.61	1.917	8.51	2.67	5.92
0.500	9.09	1.250	18.34	2.000	8.51	2.75	5.53
0.583	12.58	1.333	18.34	2.083	7.63	2.83	5.53
0.667	12.58	1.417	13.85	2.167	7.63	2.92	5.19
0.750	23.97	1.500	13.85	2.250	6.94	3.00	5.19

Unit Hyd Qpeak (cms)= 1.247

PEAK FLOW (cms)= 0.134 (i)
 TIME TO PEAK (hrs)= 2.000
 RUNOFF VOLUME (mm)= 4.425
 TOTAL RAINFALL (mm)= 57.153
 RUNOFF COEFFICIENT = 0.077

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

CALIB
 NASHYD (0002)
 ID= 1 DT= 5.0 min

Area (ha)= 20.64 Curve Number (CN)= 53.0
 Ia (mm)= 8.11 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.59

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.14	0.833	23.97	1.583	11.32	2.33	6.94
0.167	6.14	0.917	154.98	1.667	11.32	2.42	6.38
0.250	7.28	1.000	154.98	1.750	9.68	2.50	6.38
0.333	7.28	1.083	29.61	1.833	9.68	2.58	5.92
0.417	9.09	1.167	29.61	1.917	8.51	2.67	5.92
0.500	9.09	1.250	18.34	2.000	8.51	2.75	5.53
0.583	12.58	1.333	18.34	2.083	7.63	2.83	5.53
0.667	12.58	1.417	13.85	2.167	7.63	2.92	5.19
0.750	23.97	1.500	13.85	2.250	6.94	3.00	5.19

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.269 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 8.769

TOTAL RAINFALL (mm)= 57.153
 RUNOFF COEFFICIENT = 0.153

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

CALIB				
NASHYD (0002)	Area (ha)=	4.54	Curve Number (CN)=	41.0
ID= 1 DT= 5.0 min	Ia (mm)=	8.52	# of Linear Res.(N)=	3.00
	U.H. Tp(hrs)=	0.37		

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

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.14	0.833	23.97	1.583	11.32	2.33	6.94
0.167	6.14	0.917	154.98	1.667	11.32	2.42	6.38
0.250	7.28	1.000	154.98	1.750	9.68	2.50	6.38
0.333	7.28	1.083	29.61	1.833	9.68	2.58	5.92
0.417	9.09	1.167	29.61	1.917	8.51	2.67	5.92
0.500	9.09	1.250	18.34	2.000	8.51	2.75	5.53
0.583	12.58	1.333	18.34	2.083	7.63	2.83	5.53
0.667	12.58	1.417	13.85	2.167	7.63	2.92	5.19
0.750	23.97	1.500	13.85	2.250	6.94	3.00	5.19

Unit Hyd Qpeak (cms)= 0.469

PEAK FLOW (cms)= 0.051 (i)
 TIME TO PEAK (hrs)= 1.417
 RUNOFF VOLUME (mm)= 5.710
 TOTAL RAINFALL (mm)= 57.153
 RUNOFF COEFFICIENT = 0.100

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

ADD HYD (0042)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0002):	4.54	0.051	1.42	5.71
+ ID2= 2 (0001):	23.84	0.134	2.00	4.42
ID = 3 (0042):	28.38	0.170	1.83	4.63

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0042)				
3 + 2 = 1	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0042):	28.38	0.170	1.83	4.63
+ ID2= 2 (0002):	20.64	0.269	1.75	8.77
ID = 1 (0042):	49.02	0.437	1.75	6.37

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0048)
 IN= 2---> OUT= 1 | Routing time step (min)'= 5.00

<----- DATA FOR SECTION (1.1) ----->			
Distance	Elevation	Manning	
0.00	342.60	0.0350	
2.55	341.75	0.0350 / 0.0350	Main Channel
4.05	341.75	0.0350 / 0.0350	Main Channel
6.50	342.60	0.0350	

<----- TRAVEL TIME TABLE ----->					
DEPTH	ELEV	VOLUME	FLOW RATE	VELOCITY	TRAV.TIME
(m)	(m)	(cu.m.)	(cms)	(m/s)	(min)
0.04	341.79	.203E+02	0.0	0.35	13.28
0.09	341.84	.438E+02	0.1	0.54	8.60
0.13	341.88	.706E+02	0.2	0.69	6.73
0.18	341.93	.101E+03	0.3	0.81	5.68
0.22	341.97	.134E+03	0.4	0.93	4.99
0.27	342.02	.171E+03	0.6	1.03	4.50
0.31	342.06	.210E+03	0.8	1.12	4.13
0.36	342.11	.254E+03	1.1	1.21	3.83
0.40	342.15	.300E+03	1.4	1.29	3.59
0.45	342.20	.350E+03	1.7	1.36	3.39
0.49	342.24	.403E+03	2.1	1.44	3.22
0.54	342.29	.459E+03	2.5	1.51	3.07
0.58	342.33	.518E+03	2.9	1.57	2.94
0.63	342.38	.581E+03	3.4	1.64	2.82
0.67	342.42	.647E+03	4.0	1.70	2.72
0.72	342.47	.716E+03	4.5	1.76	2.63
0.76	342.51	.789E+03	5.2	1.82	2.54
0.81	342.55	.865E+03	5.8	1.88	2.46
0.85	342.60	.944E+03	6.6	1.93	2.39

<---- hydrograph ---->				<-pipe / channel-->	
AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)

INFLOW : ID= 2 (0042) 49.02 0.44 1.75 6.37 0.22 0.92
 OUTFLOW: ID= 1 (0048) 49.02 0.44 1.83 6.37 0.22 0.91

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

 CALIB
 NASHYD (0011) | Area (ha)= 6.87 Curve Number (CN)= 46.0
 ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.21

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.14	0.833	23.97	1.583	11.32	2.33	6.94
0.167	6.14	0.917	154.98	1.667	11.32	2.42	6.38
0.250	7.28	1.000	154.98	1.750	9.68	2.50	6.38
0.333	7.28	1.083	29.61	1.833	9.68	2.58	5.92
0.417	9.09	1.167	29.61	1.917	8.51	2.67	5.92
0.500	9.09	1.250	18.34	2.000	8.51	2.75	5.53
0.583	12.58	1.333	18.34	2.083	7.63	2.83	5.53
0.667	12.58	1.417	13.85	2.167	7.63	2.92	5.19
0.750	23.97	1.500	13.85	2.250	6.94	3.00	5.19

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.164 (i)
 TIME TO PEAK (hrs)= 1.167
 RUNOFF VOLUME (mm)= 7.920
 TOTAL RAINFALL (mm)= 57.153
 RUNOFF COEFFICIENT = 0.139

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

 CALIB
 STANDHYD (0053) | Area (ha)= 2.39
 ID= 1 DT= 5.0 min | Total Imp(%)= 35.60 Dir. Conn.(%)= 10.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.85	1.54
Dep. Storage (mm)=	2.00	5.00
Average Slope (%)=	0.50	2.00
Length (m)=	104.00	81.00
Mannings n =	0.013	0.250

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.14	0.833	23.97	1.583	11.32	2.33	6.94
0.167	6.14	0.917	154.98	1.667	11.32	2.42	6.38
0.250	7.28	1.000	154.98	1.750	9.68	2.50	6.38
0.333	7.28	1.083	29.61	1.833	9.68	2.58	5.92
0.417	9.09	1.167	29.61	1.917	8.51	2.67	5.92
0.500	9.09	1.250	18.34	2.000	8.51	2.75	5.53
0.583	12.58	1.333	18.34	2.083	7.63	2.83	5.53
0.667	12.58	1.417	13.85	2.167	7.63	2.92	5.19
0.750	23.97	1.500	13.85	2.250	6.94	3.00	5.19

Max.Eff.Inten.(mm/hr)= 154.98 12.87
 over (min) 5.00 30.00
 Storage Coeff. (min)= 2.70 (ii) 27.17 (ii)
 Unit Hyd. Tpeak (min)= 5.00 30.00
 Unit Hyd. peak (cms)= 0.29 0.04

TOTALS

PEAK FLOW (cms)= 0.10 0.03 0.106 (iii)
 TIME TO PEAK (hrs)= 1.00 1.42 1.00
 RUNOFF VOLUME (mm)= 55.15 7.34 12.11
 TOTAL RAINFALL (mm)= 57.15 57.15 57.15
 RUNOFF COEFFICIENT = 0.97 0.13 0.21

***** 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* = 35.0 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 (0034) |
1 + 2 = 3

	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0011):	6.87	0.164	1.17	7.92
+ ID2= 2 (0048):	49.02	0.436	1.83	6.37
=====				
ID = 3 (0034):	55.89	0.495	1.75	6.56

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0034) |
| 3 + 2 = 1 |
-----
      AREA   QPEAK   TPEAK   R.V.
      (ha)   (cms)   (hrs)   (mm)
ID1= 3 ( 0034):  55.89  0.495   1.75   6.56
+ ID2= 2 ( 0053):   2.39  0.106   1.00   12.11
=====
ID = 1 ( 0034):  58.28  0.527   1.75   6.79
-----

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| ROUTE CHN( 0049) |
| IN= 2--> OUT= 1 |
-----
      Routing time step (min)'= 5.00
-----

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<----- DATA FOR SECTION ( 1.1) ----->
Distance      Elevation      Manning
0.00          342.60          0.0350
2.55          341.75          0.0350 /0.0350  Main Channel
4.05          341.75          0.0350 /0.0350  Main Channel
6.50          342.60          0.0350

```

```

<----- TRAVEL TIME TABLE ----->
DEPTH   ELEV   VOLUME   FLOW RATE   VELOCITY   TRAV.TIME
(m)     (m)    (cu.m.)  (cms)       (m/s)     (min)
0.04    341.79 .323E+02  0.0         0.35      21.13
0.09    341.84 .697E+02  0.1         0.54      13.69
0.13    341.88 .112E+03  0.2         0.69      10.71
0.18    341.93 .160E+03  0.3         0.81      9.04
0.22    341.97 .213E+03  0.4         0.93      7.95
0.27    342.02 .272E+03  0.6         1.03      7.17
0.31    342.06 .335E+03  0.8         1.12      6.57
0.36    342.11 .404E+03  1.1         1.21      6.10
0.40    342.15 .477E+03  1.4         1.29      5.72
0.45    342.20 .557E+03  1.7         1.36      5.40
0.49    342.24 .641E+03  2.1         1.44      5.13
0.54    342.29 .730E+03  2.5         1.51      4.89
0.58    342.33 .825E+03  2.9         1.57      4.68
0.63    342.38 .925E+03  3.4         1.64      4.50
0.67    342.42 .103E+04  4.0         1.70      4.33
0.72    342.47 .114E+04  4.5         1.76      4.18
0.76    342.51 .126E+04  5.2         1.82      4.05
0.81    342.55 .138E+04  5.8         1.88      3.92
0.85    342.60 .150E+04  6.6         1.93      3.81

```

```

<---- hydrograph ----> <-pipe / channel->
AREA   QPEAK   TPEAK   R.V.   MAX DEPTH  MAX VEL

```

```

              (ha)   (cms)   (hrs)   (mm)   (m)   (m/s)
INFLOW : ID= 2 ( 0034)  58.28  0.53   1.75   6.79   0.24  0.97
OUTFLOW: ID= 1 ( 0049)  58.28  0.52   1.83   6.79   0.24  0.96

```

```

-----
| CALIB |
| NASHYD ( 0052) | Area (ha)= 1.35 Curve Number (CN)= 35.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
                          U.H. Tp(hrs)= 0.47
-----

```

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

```

----- TRANSFORMED HYETOGRAPH -----
      TIME   RAIN | TIME   RAIN | TIME   RAIN | TIME   RAIN
      hrs   mm/hr | hrs   mm/hr | hrs   mm/hr | hrs   mm/hr
0.083    6.14 | 0.833  23.97 | 1.583  11.32 | 2.33   6.94
0.167    6.14 | 0.917 154.98 | 1.667  11.32 | 2.42   6.38
0.250    7.28 | 1.000 154.98 | 1.750   9.68 | 2.50   6.38
0.333    7.28 | 1.083  29.61 | 1.833   9.68 | 2.58   5.92
0.417    9.09 | 1.167  29.61 | 1.917   8.51 | 2.67   5.92
0.500    9.09 | 1.250  18.34 | 2.000   8.51 | 2.75   5.53
0.583   12.58 | 1.333  18.34 | 2.083   7.63 | 2.83   5.53
0.667   12.58 | 1.417  13.85 | 2.167   7.63 | 2.92   5.19
0.750   23.97 | 1.500  13.85 | 2.250   6.94 | 3.00   5.19

```

Unit Hyd Qpeak (cms)= 0.110

```

PEAK FLOW (cms)= 0.010 (i)
TIME TO PEAK (hrs)= 1.583
RUNOFF VOLUME (mm)= 4.284
TOTAL RAINFALL (mm)= 57.153
RUNOFF COEFFICIENT = 0.075

```

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

```

-----
| CALIB |
| NASHYD ( 0054) | Area (ha)= 0.53 Curve Number (CN)= 35.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
                          U.H. Tp(hrs)= 0.25
-----

```

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.14	0.833	23.97	1.583	11.32	2.33	6.94
0.167	6.14	0.917	154.98	1.667	11.32	2.42	6.38
0.250	7.28	1.000	154.98	1.750	9.68	2.50	6.38
0.333	7.28	1.083	29.61	1.833	9.68	2.58	5.92
0.417	9.09	1.167	29.61	1.917	8.51	2.67	5.92
0.500	9.09	1.250	18.34	2.000	8.51	2.75	5.53
0.583	12.58	1.333	18.34	2.083	7.63	2.83	5.53
0.667	12.58	1.417	13.85	2.167	7.63	2.92	5.19
0.750	23.97	1.500	13.85	2.250	6.94	3.00	5.19

Unit Hyd Qpeak (cms)= 0.081

PEAK FLOW (cms)= 0.006 (i)
 TIME TO PEAK (hrs)= 1.250
 RUNOFF VOLUME (mm)= 4.281
 TOTAL RAINFALL (mm)= 57.153
 RUNOFF COEFFICIENT = 0.075

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

```

-----
| CALIB
| STANDHYD ( 0201) | Area (ha)= 10.55
| ID= 1 DT= 5.0 min | Total Imp(%)= 42.60 Dir. Conn.(%)= 23.50
-----

```

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	4.49	6.06
Dep. Storage (mm)=	2.00	5.00
Average Slope (%)=	0.50	2.00
Length (m)=	104.00	81.00
Mannings n =	0.013	0.250

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	6.14	0.833	23.97	1.583	11.32	2.33	6.94
0.167	6.14	0.917	154.98	1.667	11.32	2.42	6.38
0.250	7.28	1.000	154.98	1.750	9.68	2.50	6.38
0.333	7.28	1.083	29.61	1.833	9.68	2.58	5.92
0.417	9.09	1.167	29.61	1.917	8.51	2.67	5.92
0.500	9.09	1.250	18.34	2.000	8.51	2.75	5.53
0.583	12.58	1.333	18.34	2.083	7.63	2.83	5.53
0.667	12.58	1.417	13.85	2.167	7.63	2.92	5.19
0.750	23.97	1.500	13.85	2.250	6.94	3.00	5.19

Max.Eff.Inten.(mm/hr)=	154.98	10.51	
over (min)	5.00	30.00	
Storage Coeff. (min)=	2.70 (ii)	29.25 (ii)	
Unit Hyd. Tpeak (min)=	5.00	30.00	
Unit Hyd. peak (cms)=	0.29	0.04	
			TOTALS
PEAK FLOW (cms)=	1.04	0.10	1.064 (iii)
TIME TO PEAK (hrs)=	1.00	1.42	1.00
RUNOFF VOLUME (mm)=	55.15	7.00	18.31
TOTAL RAINFALL (mm)=	57.15	57.15	57.15
RUNOFF COEFFICIENT =	0.97	0.12	0.32

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 35.0 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 ( 0050) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
| | (ha) (cms) (hrs) (mm)
-----
ID1= 1 ( 0201): 10.55 1.064 1.00 18.31
+ ID2= 2 ( 0052): 1.35 0.010 1.58 4.28
=====
ID = 3 ( 0050): 11.90 1.065 1.00 16.72
-----

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0050) |
| 3 + 2 = 1 | AREA QPEAK TPEAK R.V.
| | (ha) (cms) (hrs) (mm)
-----
ID1= 3 ( 0050): 11.90 1.065 1.00 16.72
+ ID2= 2 ( 0054): 0.53 0.006 1.25 4.28
=====
ID = 1 ( 0050): 12.43 1.068 1.00 16.19
-----

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| RESERVOIR( 0011) | OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT= 5.0 min | OUTFLOW STORAGE | OUTFLOW STORAGE
-----

```

(cms)	(ha.m.)	(cms)	(ha.m.)
0.0000	0.0000	0.0290	0.1844
0.0070	0.0210	0.0310	0.2102
0.0120	0.0425	0.0330	0.2365
0.0160	0.0647	0.0340	0.2634
0.0200	0.0875	0.0360	0.2909
0.0220	0.1108	1.2930	0.3190
0.0250	0.1348	3.8000	0.3477
0.0270	0.1593	7.3300	0.3769

***** 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\voind.dat
Output filename:
C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\5b8caeb5-5cd6-4e2a-82a8-a5225e4a6aa8\sce
Summary filename:
C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\5b8caeb5-5cd6-4e2a-82a8-a5225e4a6aa8\sce

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0050)	12.430	1.068	1.00	16.19
OUTFLOW: ID= 1 (0011)	12.430	0.028	3.42	16.13

DATE: 01-15-2026 TIME: 04:40:13

USER:

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.63
TIME SHIFT OF PEAK FLOW (min)=145.00
MAXIMUM STORAGE USED (ha.m.)= 0.1735

COMMENTS: _____

ADD HYD (0023)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0011):	12.43	0.028	3.42	16.13
+ ID2= 2 (0049):	58.28	0.522	1.83	6.79
ID = 3 (0023):	70.71	0.547	1.83	8.43

** SIMULATION : 5 - 50yr 3hr 10min Chicago **

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

CHICAGO STORM
Ptotal= 64.05 mm

IDF curve parameters: A= 893.800
B= 0.000
C= 0.719

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	7.02	0.83	170.70	1.67	11.03	2.50	6.77
0.17	8.31	1.00	33.42	1.83	9.71	2.67	6.33
0.33	10.36	1.17	20.79	2.00	8.71	2.83	5.95
0.50	14.30	1.33	15.73	2.17	7.93		
0.67	27.09	1.50	12.89	2.33	7.29		

V V I SSSS U U A L (v 6.2.2015)
V V I SS U U A A L
V V I SS U U A A A A L
V V I SS U U A A L
VV I SSSS UUUU A A LLLL
000 TTTT TTTT H H Y Y M M 000 TM
O O T T H H Y Y M M O O
O O T T H H Y M M O O
000 T T H H Y M M 000

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CALIB

 | NASHYD (0001) | Area (ha)= 23.84 Curve Number (CN)= 35.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 9.20 # of Linear Res.(N)= 3.00

 U.H. Tp(hrs)= 0.73

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93
0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29
0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33
0.667	14.30	1.417	15.73	2.167	8.71	2.92	5.95
0.750	27.09	1.500	15.73	2.250	7.93	3.00	5.95

Unit Hyd Qpeak (cms)= 1.247

PEAK FLOW (cms)= 0.173 (i)
 TIME TO PEAK (hrs)= 2.000
 RUNOFF VOLUME (mm)= 5.714
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.089

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

 | CALIB |
 | NASHYD (0002) | Area (ha)= 20.64 Curve Number (CN)= 53.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00

 U.H. Tp(hrs)= 0.59

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93
0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29
0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33

0.667 14.30 | 1.417 15.73 | 2.167 8.71 | 2.92 5.95
 0.750 27.09 | 1.500 15.73 | 2.250 7.93 | 3.00 5.95

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.341 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 11.130
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.174

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

 | CALIB |
 | NASHYD (0002) | Area (ha)= 4.54 Curve Number (CN)= 41.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 8.52 # of Linear Res.(N)= 3.00

 U.H. Tp(hrs)= 0.37

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93
0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29
0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33
0.667	14.30	1.417	15.73	2.167	8.71	2.92	5.95
0.750	27.09	1.500	15.73	2.250	7.93	3.00	5.95

Unit Hyd Qpeak (cms)= 0.469

PEAK FLOW (cms)= 0.065 (i)
 TIME TO PEAK (hrs)= 1.417
 RUNOFF VOLUME (mm)= 7.323
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.114

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

 | ADD HYD (0042) |

```

| 1 + 2 = 3 |          AREA  QPEAK  TPEAK  R.V.
-----
          (ha)   (cms)   (hrs)   (mm)
ID1= 1 ( 0002):  4.54  0.065  1.42  7.32
+ ID2= 2 ( 0001): 23.84  0.173  2.00  5.71
=====
ID = 3 ( 0042):  28.38  0.219  1.83  5.97

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| ADD HYD ( 0042) |
| 3 + 2 = 1 |          AREA  QPEAK  TPEAK  R.V.
-----
          (ha)   (cms)   (hrs)   (mm)
ID1= 3 ( 0042):  28.38  0.219  1.83  5.97
+ ID2= 2 ( 0002): 20.64  0.341  1.75  11.13
=====
ID = 1 ( 0042):  49.02  0.559  1.75  8.14

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| ROUTE CHN( 0048) |
| IN= 2--> OUT= 1 | Routing time step (min)'= 5.00

```

```

<----- DATA FOR SECTION ( 1.1) ----->
Distance      Elevation      Manning
0.00          342.60         0.0350
2.55          341.75         0.0350 /0.0350 Main Channel
4.05          341.75         0.0350 /0.0350 Main Channel
6.50          342.60         0.0350

```

```

<----- TRAVEL TIME TABLE ----->
DEPTH  ELEV  VOLUME  FLOW RATE  VELOCITY  TRAV. TIME
(m)    (m)    (cu.m.) (cms)      (m/s)    (min)
0.04  341.79 .203E+02  0.0        0.35     13.28
0.09  341.84 .438E+02  0.1        0.54     8.60
0.13  341.88 .706E+02  0.2        0.69     6.73
0.18  341.93 .101E+03  0.3        0.81     5.68
0.22  341.97 .134E+03  0.4        0.93     4.99
0.27  342.02 .171E+03  0.6        1.03     4.50
0.31  342.06 .210E+03  0.8        1.12     4.13
0.36  342.11 .254E+03  1.1        1.21     3.83
0.40  342.15 .300E+03  1.4        1.29     3.59
0.45  342.20 .350E+03  1.7        1.36     3.39
0.49  342.24 .403E+03  2.1        1.44     3.22
0.54  342.29 .459E+03  2.5        1.51     3.07
0.58  342.33 .518E+03  2.9        1.57     2.94
0.63  342.38 .581E+03  3.4        1.64     2.82
0.67  342.42 .647E+03  4.0        1.70     2.72

```

```

0.72  342.47 .716E+03  4.5        1.76     2.63
0.76  342.51 .789E+03  5.2        1.82     2.54
0.81  342.55 .865E+03  5.8        1.88     2.46
0.85  342.60 .944E+03  6.6        1.93     2.39

```

```

<---- hydrograph ----> <-pipe / channel->
          AREA  QPEAK  TPEAK  R.V.  MAX DEPTH  MAX VEL
          (ha)   (cms)   (hrs)   (mm)   (m)        (m/s)
INFLOW : ID= 2 ( 0042) 49.02  0.56  1.75  8.14  0.25  0.99
OUTFLOW: ID= 1 ( 0048) 49.02  0.56  1.83  8.14  0.25  0.98

```

```

| CALIB |
| NASHYD ( 0011) | Area (ha)= 6.87 Curve Number (CN)= 46.0
| ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
|-----| U.H. Tp(hrs)= 0.21

```

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME  RAIN  TIME  RAIN  TIME  RAIN  TIME  RAIN
hrs   mm/hr | hrs   mm/hr | hrs   mm/hr | hrs   mm/hr
0.083 7.02 | 0.833 27.09 | 1.583 12.89 | 2.33  7.93
0.167 7.02 | 0.917 170.70 | 1.667 12.89 | 2.42  7.29
0.250 8.31 | 1.000 170.70 | 1.750 11.03 | 2.50  7.29
0.333 8.31 | 1.083 33.42 | 1.833 11.03 | 2.58  6.77
0.417 10.36 | 1.167 33.42 | 1.917 9.71 | 2.67  6.77
0.500 10.36 | 1.250 20.79 | 2.000 9.71 | 2.75  6.33
0.583 14.30 | 1.333 20.79 | 2.083 8.71 | 2.83  6.33
0.667 14.30 | 1.417 15.73 | 2.167 8.71 | 2.92  5.95
0.750 27.09 | 1.500 15.73 | 2.250 7.93 | 3.00  5.95

```

```

Unit Hyd Qpeak (cms)= 1.250
PEAK FLOW (cms)= 0.205 (i)
TIME TO PEAK (hrs)= 1.167
RUNOFF VOLUME (mm)= 9.932
TOTAL RAINFALL (mm)= 64.054
RUNOFF COEFFICIENT = 0.155

```

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

```

| CALIB |
| STANDHYD ( 0053) | Area (ha)= 2.39

```

|ID= 1 DT= 5.0 min | Total Imp(%)= 35.60 Dir. Conn.(%)= 10.00

```

-----
                IMPERVIOUS    PERVIOUS (i)
Surface Area   (ha)=      0.85      1.54
Dep. Storage   (mm)=      2.00      5.00
Average Slope  (%)=      0.50      2.00
Length        (m)=     104.00     81.00
Mannings n    =         0.013     0.250
  
```

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

```

-----
                ---- TRANSFORMED HYETOGRAPH ----
      TIME  RAIN | TIME  RAIN | TIME  RAIN | TIME  RAIN
      hrs  mm/hr | hrs  mm/hr | hrs  mm/hr | hrs  mm/hr
0.083  7.02 | 0.833 27.09 | 1.583 12.89 | 2.33  7.93
0.167  7.02 | 0.917 170.70 | 1.667 12.89 | 2.42  7.29
0.250  8.31 | 1.000 170.70 | 1.750 11.03 | 2.50  7.29
0.333  8.31 | 1.083 33.42 | 1.833 11.03 | 2.58  6.77
0.417 10.36 | 1.167 33.42 | 1.917  9.71 | 2.67  6.77
0.500 10.36 | 1.250 20.79 | 2.000  9.71 | 2.75  6.33
0.583 14.30 | 1.333 20.79 | 2.083  8.71 | 2.83  6.33
0.667 14.30 | 1.417 15.73 | 2.167  8.71 | 2.92  5.95
0.750 27.09 | 1.500 15.73 | 2.250  7.93 | 3.00  5.95
  
```

```

Max.Eff.Inten.(mm/hr)= 170.70      15.99
over (min)           = 5.00        30.00
Storage Coeff. (min)= 2.60 (ii)    25.04 (ii)
Unit Hyd. Tpeak (min)= 5.00        30.00
Unit Hyd. peak (cms)= 0.29         0.04
  
```

TOTALS

```

PEAK FLOW (cms)= 0.11      0.04      0.119 (iii)
TIME TO PEAK (hrs)= 1.00    1.42    1.00
RUNOFF VOLUME (mm)= 62.05   9.19   14.47
TOTAL RAINFALL (mm)= 64.05   64.05   64.05
RUNOFF COEFFICIENT = 0.97    0.14    0.23
  
```

***** 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* = 35.0 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 ( 0034) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
----- (ha) (cms) (hrs) (mm)
ID1= 1 ( 0011): 6.87 0.205 1.17 9.93
+ ID2= 2 ( 0048): 49.02 0.558 1.83 8.14
=====
ID = 3 ( 0034): 55.89 0.632 1.75 8.36
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| ADD HYD ( 0034) |
| 3 + 2 = 1 | AREA QPEAK TPEAK R.V.
----- (ha) (cms) (hrs) (mm)
ID1= 3 ( 0034): 55.89 0.632 1.75 8.36
+ ID2= 2 ( 0053): 2.39 0.119 1.00 14.47
=====
ID = 1 ( 0034): 58.28 0.671 1.75 8.61
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

| ROUTE CHN( 0049) |
| IN= 2--> OUT= 1 | Routing time step (min)'= 5.00
  
```

```

<----- DATA FOR SECTION ( 1.1) ----->
Distance Elevation Manning
0.00 342.60 0.0350
2.55 341.75 0.0350 /0.0350 Main Channel
4.05 341.75 0.0350 /0.0350 Main Channel
6.50 342.60 0.0350
  
```

```

<----- TRAVEL TIME TABLE ----->
DEPTH ELEV VOLUME FLOW RATE VELOCITY TRAV.TIME
(m) (m) (cu.m.) (cms) (m/s) (min)
0.04 341.79 .323E+02 0.0 0.35 21.13
0.09 341.84 .697E+02 0.1 0.54 13.69
0.13 341.88 .112E+03 0.2 0.69 10.71
0.18 341.93 .160E+03 0.3 0.81 9.04
0.22 341.97 .213E+03 0.4 0.93 7.95
0.27 342.02 .272E+03 0.6 1.03 7.17
0.31 342.06 .335E+03 0.8 1.12 6.57
0.36 342.11 .404E+03 1.1 1.21 6.10
0.40 342.15 .477E+03 1.4 1.29 5.72
0.45 342.20 .557E+03 1.7 1.36 5.40
0.49 342.24 .641E+03 2.1 1.44 5.13
0.54 342.29 .730E+03 2.5 1.51 4.89
0.58 342.33 .825E+03 2.9 1.57 4.68
0.63 342.38 .925E+03 3.4 1.64 4.50
  
```

0.67	342.42	.103E+04	4.0	1.70	4.33
0.72	342.47	.114E+04	4.5	1.76	4.18
0.76	342.51	.126E+04	5.2	1.82	4.05
0.81	342.55	.138E+04	5.8	1.88	3.92
0.85	342.60	.150E+04	6.6	1.93	3.81

| NASHYD (0054) | Area (ha)= 0.53 Curve Number (CN)= 35.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
 ----- U.H. Tp(hrs)= 0.25

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

	AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL
	(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)
INFLOW : ID= 2 (0034)	58.28	0.67	1.75	8.61	0.28	1.04
OUTFLOW: ID= 1 (0049)	58.28	0.67	1.83	8.61	0.28	1.04

 | CALIB |
 | NASHYD (0052) | Area (ha)= 1.35 Curve Number (CN)= 35.0
 | ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
 ----- U.H. Tp(hrs)= 0.47

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

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93
0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29
0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33
0.667	14.30	1.417	15.73	2.167	8.71	2.92	5.95
0.750	27.09	1.500	15.73	2.250	7.93	3.00	5.95

Unit Hyd Qpeak (cms)= 0.110

PEAK FLOW (cms)= 0.012 (i)
 TIME TO PEAK (hrs)= 1.583
 RUNOFF VOLUME (mm)= 5.556
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.087

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

 | CALIB |

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93
0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29
0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33
0.667	14.30	1.417	15.73	2.167	8.71	2.92	5.95
0.750	27.09	1.500	15.73	2.250	7.93	3.00	5.95

Unit Hyd Qpeak (cms)= 0.081

PEAK FLOW (cms)= 0.007 (i)
 TIME TO PEAK (hrs)= 1.250
 RUNOFF VOLUME (mm)= 5.552
 TOTAL RAINFALL (mm)= 64.054
 RUNOFF COEFFICIENT = 0.087

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

 | CALIB |
 | STANDHYD (0201) | Area (ha)= 10.55
 | ID= 1 DT= 5.0 min | Total Imp(%)= 42.60 Dir. Conn.(%)= 23.50

	IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)= 4.49	6.06
Dep. Storage	(mm)= 2.00	5.00
Average Slope	(%)= 0.50	2.00
Length	(m)= 104.00	81.00
Mannings n	= 0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	7.02	0.833	27.09	1.583	12.89	2.33	7.93

0.167	7.02	0.917	170.70	1.667	12.89	2.42	7.29
0.250	8.31	1.000	170.70	1.750	11.03	2.50	7.29
0.333	8.31	1.083	33.42	1.833	11.03	2.58	6.77
0.417	10.36	1.167	33.42	1.917	9.71	2.67	6.77
0.500	10.36	1.250	20.79	2.000	9.71	2.75	6.33
0.583	14.30	1.333	20.79	2.083	8.71	2.83	6.33
0.667	14.30	1.417	15.73	2.167	8.71	2.92	5.95
0.750	27.09	1.500	15.73	2.250	7.93	3.00	5.95

Max.Eff.Inten.(mm/hr)=	170.70	14.53		
over (min)	5.00	30.00		
Storage Coeff. (min)=	2.60 (ii)	25.91 (ii)		
Unit Hyd. Tpeak (min)=	5.00	30.00		
Unit Hyd. peak (cms)=	0.29	0.04		
			TOTALS	
PEAK FLOW (cms)=	1.15	0.14	1.181 (iii)	
TIME TO PEAK (hrs)=	1.00	1.42	1.00	
RUNOFF VOLUME (mm)=	62.05	8.78	21.30	
TOTAL RAINFALL (mm)=	64.05	64.05		
RUNOFF COEFFICIENT =	0.97	0.14	0.33	

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 35.0 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 (0050)				
1 + 2 = 3				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0201):	10.55	1.181	1.00	21.30
+ ID2= 2 (0052):	1.35	0.012	1.58	5.56
=====				
ID = 3 (0050):	11.90	1.183	1.00	19.51

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0050)				
3 + 2 = 1				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0050):	11.90	1.183	1.00	19.51
+ ID2= 2 (0054):	0.53	0.007	1.25	5.55
=====				

ID = 1 (0050): 12.43 1.186 1.00 18.92

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0011)					
IN= 2---> OUT= 1					
DT= 5.0 min					
OVERFLOW IS OFF					
	OUTFLOW	STORAGE	OUTFLOW	STORAGE	
	(cms)	(ha.m.)	(cms)	(ha.m.)	
	0.0000	0.0000	0.0290	0.1844	
	0.0070	0.0210	0.0310	0.2102	
	0.0120	0.0425	0.0330	0.2365	
	0.0160	0.0647	0.0340	0.2634	
	0.0200	0.0875	0.0360	0.2909	
	0.0220	0.1108	1.2930	0.3190	
	0.0250	0.1348	3.8000	0.3477	
	0.0270	0.1593	7.3300	0.3769	
		AREA	QPEAK	TPEAK	R.V.
		(ha)	(cms)	(hrs)	(mm)
INFLOW : ID= 2 (0050)	12.430	1.186	1.00	18.92	
OUTFLOW: ID= 1 (0011)	12.430	0.031	3.42	18.86	

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.58
 TIME SHIFT OF PEAK FLOW (min)=145.00
 MAXIMUM STORAGE USED (ha.m.)= 0.2051

ADD HYD (0023)				
1 + 2 = 3				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0011):	12.43	0.031	3.42	18.86
+ ID2= 2 (0049):	58.28	0.667	1.83	8.61
=====				
ID = 3 (0023):	70.71	0.693	1.83	10.41

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS 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 A A A A L
 V V I SS U U A A L
 VV I SSSSS UUUUU A A LLLLL
 000 TTTT TTTT H H Y Y M M 000 TM

O O T T H H Y Y M M M M O O
 O O T T H H Y M M O O
 000 T T H H Y M M 000

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0.33	11.77	1.17	23.45	2.00	9.92	2.83	6.80
0.50	16.19	1.33	17.80	2.17	9.04		
0.67	30.45	1.50	14.61	2.33	8.32		

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

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\V02\voin.dat

Output filename:

C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\6d2
 b18c8-cc94-42a3-a178-eb08c669e112\sce

Summary filename:

C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\6d2
 b18c8-cc94-42a3-a178-eb08c669e112\sce

DATE: 01-15-2026

TIME: 04:40:13

USER:

COMMENTS: _____

 ** SIMULATION : 6 - 100yr 3hr 10min Chicago **

CHICAGO STORM
 Ptotal= 71.21 mm

IDF curve parameters: A= 953.290
 B= 0.000
 C= 0.711

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	8.02	0.83	185.45	1.67	12.53	2.50	7.73
0.17	9.47	1.00	37.49	1.83	11.04	2.67	7.23

CALIB					
NASHYD (0001)	Area (ha)=	23.84	Curve Number (CN)=	35.0	
ID= 1 DT= 5.0 min	Ia (mm)=	9.20	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.73			

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

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32
0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Unit Hyd Qpeak (cms)= 1.247

PEAK FLOW (cms)= 0.218 (i)
 TIME TO PEAK (hrs)= 2.000
 RUNOFF VOLUME (mm)= 7.205
 TOTAL RAINFALL (mm)= 71.214
 RUNOFF COEFFICIENT = 0.101

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

CALIB					
NASHYD (0002)	Area (ha)=	20.64	Curve Number (CN)=	53.0	
ID= 1 DT= 5.0 min	Ia (mm)=	8.11	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.59			

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

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32
0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.423 (i)
 TIME TO PEAK (hrs)= 1.750
 RUNOFF VOLUME (mm)= 13.810
 TOTAL RAINFALL (mm)= 71.214
 RUNOFF COEFFICIENT = 0.194

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

CALIB
 NASHYD (0002) | Area (ha)= 4.54 Curve Number (CN)= 41.0
 ID= 1 DT= 5.0 min | Ia (mm)= 8.52 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.37

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32
0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Unit Hyd Qpeak (cms)= 0.469

PEAK FLOW (cms)= 0.081 (i)
 TIME TO PEAK (hrs)= 1.417
 RUNOFF VOLUME (mm)= 9.177
 TOTAL RAINFALL (mm)= 71.214

RUNOFF COEFFICIENT = 0.129

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

ADD HYD (0042)	AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0002):	4.54	0.081	1.42	9.18
+ ID2= 2 (0001):	23.84	0.218	2.00	7.21
ID = 3 (0042):	28.38	0.275	1.83	7.52

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0042)	AREA	QPEAK	TPEAK	R.V.
3 + 2 = 1	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0042):	28.38	0.275	1.83	7.52
+ ID2= 2 (0002):	20.64	0.423	1.75	13.81
ID = 1 (0042):	49.02	0.696	1.75	10.17

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0048)
 IN= 2---> OUT= 1 Routing time step (min)'= 5.00

<----- DATA FOR SECTION (1.1) ----->

Distance	Elevation	Manning	
0.00	342.60	0.0350	
2.55	341.75	0.0350 /0.0350	Main Channel
4.05	341.75	0.0350 /0.0350	Main Channel
6.50	342.60	0.0350	

<----- TRAVEL TIME TABLE ----->

DEPTH	ELEV	VOLUME	FLOW RATE	VELOCITY	TRAV.TIME
(m)	(m)	(cu.m.)	(cms)	(m/s)	(min)
0.04	341.79	.203E+02	0.0	0.35	13.28
0.09	341.84	.438E+02	0.1	0.54	8.60
0.13	341.88	.706E+02	0.2	0.69	6.73
0.18	341.93	.101E+03	0.3	0.81	5.68
0.22	341.97	.134E+03	0.4	0.93	4.99
0.27	342.02	.171E+03	0.6	1.03	4.50
0.31	342.06	.210E+03	0.8	1.12	4.13

0.36	342.11	.254E+03	1.1	1.21	3.83
0.40	342.15	.300E+03	1.4	1.29	3.59
0.45	342.20	.350E+03	1.7	1.36	3.39
0.49	342.24	.403E+03	2.1	1.44	3.22
0.54	342.29	.459E+03	2.5	1.51	3.07
0.58	342.33	.518E+03	2.9	1.57	2.94
0.63	342.38	.581E+03	3.4	1.64	2.82
0.67	342.42	.647E+03	4.0	1.70	2.72
0.72	342.47	.716E+03	4.5	1.76	2.63
0.76	342.51	.789E+03	5.2	1.82	2.54
0.81	342.55	.865E+03	5.8	1.88	2.46
0.85	342.60	.944E+03	6.6	1.93	2.39

RUNOFF COEFFICIENT = 0.172

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

CALIB			
STANDHYD (0053)			
ID= 1 DT= 5.0 min			
Area (ha)=	2.39		
Total Imp(%)=	35.60	Dir. Conn.(%)= 10.00	

			IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.85	1.54		
Dep. Storage (mm)=	2.00	5.00		
Average Slope (%)=	0.50	2.00		
Length (m)=	104.00	81.00		
Mannings n =	0.013	0.250		

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

<---- hydrograph ---->							<-pipe / channel-->	
AREA	QPEAK	TPEAK	R.V.	MAX DEPTH	MAX VEL			
(ha)	(cms)	(hrs)	(mm)	(m)	(m/s)			
INFLOW : ID= 2 (0042)	49.02	0.70	1.75	10.17	0.28	1.05		
OUTFLOW: ID= 1 (0048)	49.02	0.69	1.83	10.17	0.28	1.05		

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32
0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Max.Eff.Inten.(mm/hr)=	185.45	22.35		
over (min)	5.00	25.00		
Storage Coeff. (min)=	2.52 (ii)	22.14 (ii)		
Unit Hyd. Tpeak (min)=	5.00	25.00		
Unit Hyd. peak (cms)=	0.29	0.05		

TOTALS

PEAK FLOW (cms)=	0.12	0.05	0.134 (iii)
TIME TO PEAK (hrs)=	1.00	1.33	1.00
RUNOFF VOLUME (mm)=	69.21	11.29	17.08
TOTAL RAINFALL (mm)=	71.21	71.21	71.21
RUNOFF COEFFICIENT =	0.97	0.16	0.24

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

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20% YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CALIB			
NASHYD (0011)			
ID= 1 DT= 5.0 min			
Area (ha)=	6.87	Curve Number (CN)=	46.0
Ia (mm)=	4.39	# of Linear Res.(N)=	3.00
U.H. Tp(hrs)=	0.21		

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

----- TRANSFORMED HYETOGRAPH -----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32
0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)=	0.249 (i)
TIME TO PEAK (hrs)=	1.167
RUNOFF VOLUME (mm)=	12.215
TOTAL RAINFALL (mm)=	71.214

CN* = 35.0 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 ( 0034)|
| 1 + 2 = 3 |
-----
          AREA   QPEAK   TPEAK   R.V.
          (ha)   (cms)   (hrs)   (mm)
ID1= 1 ( 0011):  6.87  0.249  1.17  12.21
+ ID2= 2 ( 0048): 49.02  0.695  1.83  10.17
=====
ID = 3 ( 0034):  55.89  0.786  1.75  10.42

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0034)|
| 3 + 2 = 1 |
-----
          AREA   QPEAK   TPEAK   R.V.
          (ha)   (cms)   (hrs)   (mm)
ID1= 3 ( 0034):  55.89  0.786  1.75  10.42
+ ID2= 2 ( 0053):  2.39  0.134  1.00  17.08
=====
ID = 1 ( 0034):  58.28  0.833  1.67  10.69

```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ROUTE CHN( 0049)|
| IN= 2---> OUT= 1 | Routing time step (min)'= 5.00
-----

```

```

<----- DATA FOR SECTION ( 1.1) ----->
Distance   Elevation   Manning
0.00       342.60      0.0350
2.55       341.75      0.0350 /0.0350 Main Channel
4.05       341.75      0.0350 /0.0350 Main Channel
6.50       342.60      0.0350

```

```

<----- TRAVEL TIME TABLE ----->
DEPTH   ELEV   VOLUME   FLOW RATE   VELOCITY   TRAV.TIME
(m)     (m)    (cu.m.) (cms)       (m/s)      (min)
0.04   341.79  .323E+02  0.0         0.35       21.13
0.09   341.84  .697E+02  0.1         0.54       13.69
0.13   341.88  .112E+03  0.2         0.69       10.71
0.18   341.93  .160E+03  0.3         0.81       9.04
0.22   341.97  .213E+03  0.4         0.93       7.95
0.27   342.02  .272E+03  0.6         1.03       7.17

```

0.31	342.06	.335E+03	0.8	1.12	6.57
0.36	342.11	.404E+03	1.1	1.21	6.10
0.40	342.15	.477E+03	1.4	1.29	5.72
0.45	342.20	.557E+03	1.7	1.36	5.40
0.49	342.24	.641E+03	2.1	1.44	5.13
0.54	342.29	.730E+03	2.5	1.51	4.89
0.58	342.33	.825E+03	2.9	1.57	4.68
0.63	342.38	.925E+03	3.4	1.64	4.50
0.67	342.42	.103E+04	4.0	1.70	4.33
0.72	342.47	.114E+04	4.5	1.76	4.18
0.76	342.51	.126E+04	5.2	1.82	4.05
0.81	342.55	.138E+04	5.8	1.88	3.92
0.85	342.60	.150E+04	6.6	1.93	3.81

```

-----
<---- hydrograph ----> <-pipe / channel->
          AREA   QPEAK   TPEAK   R.V.   MAX DEPTH   MAX VEL
          (ha)   (cms)   (hrs)   (mm)   (m)         (m/s)
INFLOW : ID= 2 ( 0034) 58.28  0.83  1.67  10.69  0.31  1.11
OUTFLOW: ID= 1 ( 0049) 58.28  0.83  1.75  10.69  0.31  1.11

```

```

-----
| CALIB
| NASHYD ( 0052)| Area (ha)= 1.35 Curve Number (CN)= 35.0
|ID= 1 DT= 5.0 min| Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
U.H. Tp(hrs)= 0.47

```

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

```

----- TRANSFORMED HYETOGRAPH -----
TIME RAIN | TIME RAIN | TIME RAIN | TIME RAIN
hrs mm/hr | hrs mm/hr | hrs mm/hr | hrs mm/hr
0.083 8.02 | 0.833 30.45 | 1.583 14.61 | 2.33 9.04
0.167 8.02 | 0.917 185.45 | 1.667 14.61 | 2.42 8.32
0.250 9.47 | 1.000 185.45 | 1.750 12.53 | 2.50 8.32
0.333 9.47 | 1.083 37.49 | 1.833 12.53 | 2.58 7.73
0.417 11.77 | 1.167 37.49 | 1.917 11.04 | 2.67 7.73
0.500 11.77 | 1.250 23.45 | 2.000 11.04 | 2.75 7.23
0.583 16.19 | 1.333 23.45 | 2.083 9.92 | 2.83 7.23
0.667 16.19 | 1.417 17.80 | 2.167 9.92 | 2.92 6.80
0.750 30.45 | 1.500 17.80 | 2.250 9.04 | 3.00 6.80

```

```

Unit Hyd Qpeak (cms)= 0.110
PEAK FLOW (cms)= 0.016 (i)
TIME TO PEAK (hrs)= 1.583
RUNOFF VOLUME (mm)= 7.030

```

TOTAL RAINFALL (mm)= 71.214
 RUNOFF COEFFICIENT = 0.099

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

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

```

-----
| CALIB
| NASHYD ( 0054) | Area (ha)= 0.53 Curve Number (CN)= 35.0
| ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
|-----
| U.H. Tp(hrs)= 0.25
  
```

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

----- TRANSFORMED HYETOGRAPH -----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32
0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Unit Hyd Qpeak (cms)= 0.081

PEAK FLOW (cms)= 0.009 (i)
 TIME TO PEAK (hrs)= 1.250
 RUNOFF VOLUME (mm)= 7.025
 TOTAL RAINFALL (mm)= 71.214
 RUNOFF COEFFICIENT = 0.099

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

```

-----
| CALIB
| STANDHYD ( 0201) | Area (ha)= 10.55
| ID= 1 DT= 5.0 min | Total Imp(%)= 42.60 Dir. Conn.(%)= 23.50
|-----
| IMPERVIOUS PERVIOUS (i)
| Surface Area (ha)= 4.49 6.06
| Dep. Storage (mm)= 2.00 5.00
| Average Slope (%)= 0.50 2.00
| Length (m)= 104.00 81.00
| Mannings n = 0.013 0.250
  
```

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	8.02	0.833	30.45	1.583	14.61	2.33	9.04
0.167	8.02	0.917	185.45	1.667	14.61	2.42	8.32
0.250	9.47	1.000	185.45	1.750	12.53	2.50	8.32
0.333	9.47	1.083	37.49	1.833	12.53	2.58	7.73
0.417	11.77	1.167	37.49	1.917	11.04	2.67	7.73
0.500	11.77	1.250	23.45	2.000	11.04	2.75	7.23
0.583	16.19	1.333	23.45	2.083	9.92	2.83	7.23
0.667	16.19	1.417	17.80	2.167	9.92	2.92	6.80
0.750	30.45	1.500	17.80	2.250	9.04	3.00	6.80

Max.Eff.Inten.(mm/hr)= 185.45 17.64
 over (min) 5.00 25.00
 Storage Coeff. (min)= 2.52 (ii) 24.09 (ii)
 Unit Hyd. Tpeak (min)= 5.00 25.00
 Unit Hyd. peak (cms)= 0.29 0.05

TOTALS

PEAK FLOW (cms)= 1.26 0.18 1.301 (iii)
 TIME TO PEAK (hrs)= 1.00 1.33 1.00
 RUNOFF VOLUME (mm)= 69.21 10.80 24.53
 TOTAL RAINFALL (mm)= 71.21 71.21 71.21
 RUNOFF COEFFICIENT = 0.97 0.15 0.34

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

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
 CN* = 35.0 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 ( 0050) |
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
|-----| (ha) (cms) (hrs) (mm)
| ID1= 1 ( 0201): 10.55 1.301 1.00 24.53
| + ID2= 2 ( 0052): 1.35 0.016 1.58 7.03
|=====|
| ID = 3 ( 0050): 11.90 1.303 1.00 22.54
  
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-----
| ADD HYD ( 0050) |
| 3 + 2 = 1 |
|-----
```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0050):	11.90	1.303	1.00	22.54
+ ID2= 2 (0054):	0.53	0.009	1.25	7.02
=====				
ID = 1 (0050):	12.43	1.307	1.00	21.88

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
-----
| RESERVOIR( 0011) |
| IN= 2---> OUT= 1 |
| DT= 5.0 min |
|-----
```

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0290	0.1844
0.0070	0.0210	0.0310	0.2102
0.0120	0.0425	0.0330	0.2365
0.0160	0.0647	0.0340	0.2634
0.0200	0.0875	0.0360	0.2909
0.0220	0.1108	1.2930	0.3190
0.0250	0.1348	3.8000	0.3477
0.0270	0.1593	7.3300	0.3769

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0050)	12.430	1.307	1.00	21.88
OUTFLOW: ID= 1 (0011)	12.430	0.033	3.42	21.82

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.53
 TIME SHIFT OF PEAK FLOW (min)=145.00
 MAXIMUM STORAGE USED (ha.m.)= 0.2399

```
-----
| ADD HYD ( 0023) |
| 1 + 2 = 3 |
|-----
```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0011):	12.43	0.033	3.42	21.82
+ ID2= 2 (0049):	58.28	0.828	1.75	10.69
=====				
ID = 3 (0023):	70.71	0.857	1.75	12.65

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS 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 UUUU A A LLLLL
```

```
000 TTTT TTTT H H Y Y M M 000 TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
000 T T H H Y M M 000
```

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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\V02\voin.dat

Output filename:
 C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\7f07d98d-dd97-4770-bd76-82d4e910b62d\sce

Summary filename:
 C:\Users\noconnor\AppData\Local\Civica\XH5\ad5ffb59-cdbf-44b8-b93e-1def18aa052d\7f07d98d-dd97-4770-bd76-82d4e910b62d\sce

DATE: 01-15-2026

TIME: 04:40:13

USER:

COMMENTS: _____

```
*****
** SIMULATION : 7 - 25mm **
*****
```

```
-----
| READ STORM |
|-----
| Ptotal= 24.99 mm |
```

Filename: C:\Users\noconnor\AppData\Local\Temp\07d6ecb2-f0d3-45b3-b26b-47c96473cb42\1e3bc16b
 Comments: 25MM_S~1

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.00	0.44	6.00	0.77	12.00	1.20	18.00	0.60
0.17	0.44	6.17	0.77	12.17	1.20	18.17	0.60
0.33	0.44	6.33	0.77	12.33	1.20	18.33	0.60
0.50	0.44	6.50	0.77	12.50	1.05	18.50	0.60
0.67	0.44	6.67	0.78	12.67	1.05	18.67	0.60
0.83	0.44	6.83	0.77	12.83	1.05	18.83	0.60
1.00	0.44	7.00	0.95	13.00	1.05	19.00	0.60
1.17	0.44	7.17	0.95	13.17	1.05	19.17	0.60
1.33	0.44	7.33	0.95	13.33	1.05	19.33	0.60
1.50	0.44	7.50	0.95	13.50	0.95	19.50	0.60
1.67	0.44	7.67	0.95	13.67	0.95	19.67	0.60
1.83	0.44	7.83	0.95	13.83	0.95	19.83	0.60
2.00	0.51	8.00	1.25	14.00	0.79	20.00	0.46
2.17	0.51	8.17	1.25	14.17	0.79	20.17	0.46
2.33	0.51	8.33	1.25	14.33	0.79	20.33	0.46
2.50	0.51	8.50	1.75	14.50	0.79	20.50	0.46
2.67	0.51	8.67	1.75	14.67	0.79	20.67	0.46
2.83	0.51	8.83	1.75	14.83	0.79	20.83	0.46
3.00	0.51	9.00	2.45	15.00	0.79	21.00	0.46
3.17	0.51	9.17	2.45	15.17	0.79	21.17	0.46
3.33	0.51	9.33	2.45	15.33	0.79	21.33	0.46
3.50	0.51	9.50	5.90	15.50	0.79	21.50	0.46
3.67	0.51	9.67	10.60	15.67	0.79	21.67	0.46
3.83	0.51	9.83	15.30	15.83	0.79	21.83	0.46
4.00	0.61	10.00	3.40	16.00	0.60	22.00	0.46
4.17	0.61	10.17	3.40	16.17	0.60	22.17	0.46
4.33	0.61	10.33	3.40	16.33	0.60	22.33	0.46
4.50	0.61	10.50	2.05	16.50	0.60	22.50	0.46
4.67	0.61	10.67	2.05	16.67	0.60	22.67	0.46
4.83	0.61	10.83	2.05	16.83	0.60	22.83	0.46
5.00	0.61	11.00	1.50	17.00	0.60	23.00	0.46
5.17	0.61	11.17	1.50	17.17	0.60	23.17	0.46
5.33	0.61	11.33	1.50	17.33	0.60	23.33	0.46
5.50	0.61	11.50	1.50	17.50	0.60	23.50	0.46
5.67	0.61	11.67	1.40	17.67	0.60	23.67	0.46
5.83	0.61	11.83	1.30	17.83	0.60	23.83	0.46

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46

CALIB
NASHYD (0001) | Area (ha)= 23.84 | Curve Number (CN)= 35.0
ID= 1 DT= 5.0 min | Ia (mm)= 9.20 | # of Linear Res.(N)= 3.00

U.H. Tp(hrs)= 0.73

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

3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46

Unit Hyd Qpeak (cms)= 1.247

PEAK FLOW (cms)= 0.003 (i)
 TIME TO PEAK (hrs)= 11.333
 RUNOFF VOLUME (mm)= 0.511
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.020

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

 CALIB
 NASHYD (0002) | Area (ha)= 20.64 Curve Number (CN)= 53.0
 ID= 1 DT= 5.0 min | Ia (mm)= 8.11 # of Linear Res.(N)= 3.00

 U.H. Tp(hrs)= 0.59

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

4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46

Unit Hyd Qpeak (cms)= 1.336

PEAK FLOW (cms)= 0.009 (i)
 TIME TO PEAK (hrs)= 10.833
 RUNOFF VOLUME (mm)= 1.176
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.047

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

 CALIB
 NASHYD (0002) | Area (ha)= 4.54 Curve Number (CN)= 41.0
 ID= 1 DT= 5.0 min | Ia (mm)= 8.52 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.37

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60

4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Unit Hyd Qpeak (cms)= 0.469

PEAK FLOW (cms)= 0.001 (i)
 TIME TO PEAK (hrs)= 10.500
 RUNOFF VOLUME (mm)= 0.710
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.028

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

ID = 1 (0042): 49.02 0.013 11.00 0.81

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ROUTE CHN(0048)
 IN= 2---> OUT= 1 | Routing time step (min)'= 5.00

<----- DATA FOR SECTION (1.1) ----->

Distance	Elevation	Manning	
0.00	342.60	0.0350	
2.55	341.75	0.0350 /0.0350	Main Channel
4.05	341.75	0.0350 /0.0350	Main Channel
6.50	342.60	0.0350	

<----- TRAVEL TIME TABLE ----->

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.04	341.79	.203E+02	0.0	0.35	13.28
0.09	341.84	.438E+02	0.1	0.54	8.60
0.13	341.88	.706E+02	0.2	0.69	6.73
0.18	341.93	.101E+03	0.3	0.81	5.68
0.22	341.97	.134E+03	0.4	0.93	4.99
0.27	342.02	.171E+03	0.6	1.03	4.50
0.31	342.06	.210E+03	0.8	1.12	4.13
0.36	342.11	.254E+03	1.1	1.21	3.83
0.40	342.15	.300E+03	1.4	1.29	3.59
0.45	342.20	.350E+03	1.7	1.36	3.39
0.49	342.24	.403E+03	2.1	1.44	3.22
0.54	342.29	.459E+03	2.5	1.51	3.07
0.58	342.33	.518E+03	2.9	1.57	2.94
0.63	342.38	.581E+03	3.4	1.64	2.82
0.67	342.42	.647E+03	4.0	1.70	2.72
0.72	342.47	.716E+03	4.5	1.76	2.63
0.76	342.51	.789E+03	5.2	1.82	2.54
0.81	342.55	.865E+03	5.8	1.88	2.46
0.85	342.60	.944E+03	6.6	1.93	2.39

ADD HYD (0042)
 1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0002):	4.54	0.001	10.50	0.71
+ ID2= 2 (0001):	23.84	0.003	11.33	0.51
=====				
ID = 3 (0042):	28.38	0.004	11.17	0.54

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0042)
 3 + 2 = 1

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0042):	28.38	0.004	11.17	0.54
+ ID2= 2 (0002):	20.64	0.009	10.83	1.18

<---- hydrograph ----> <-pipe / channel->

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0042)	49.02	0.01	11.00	0.81	0.02	0.35
OUTFLOW: ID= 1 (0048)	49.02	0.01	11.25	0.81	0.02	0.35

CALIB |
 NASHYD (0011) | Area (ha)= 6.87 Curve Number (CN)= 46.0

|ID= 1 DT= 5.0 min | Ia (mm)= 4.39 # of Linear Res.(N)= 3.00
 ----- U.H. Tp(hrs)= 0.21

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46

3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Unit Hyd Qpeak (cms)= 1.250

PEAK FLOW (cms)= 0.008 (i)
 TIME TO PEAK (hrs)= 10.083
 RUNOFF VOLUME (mm)= 1.329
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.053

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

 | CALIB |
 | STANDHYD (0053) | Area (ha)= 2.39
 | ID= 1 DT= 5.0 min | Total Imp(%)= 35.60 Dir. Conn.(%)= 10.00

IMPERVIOUS PVIOUS (i)
 Surface Area (ha)= 0.85 1.54

Dep. Storage (mm)= 2.00 5.00
 Average Slope (%)= 0.50 2.00
 Length (m)= 104.00 81.00
 Mannings n = 0.013 0.250

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

---- TRANSFORMED HYETOGRAPH ----							
TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46

3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Max.Eff.Inten.(mm/hr)= 15.30 0.42
 over (min) 5.00 105.00
 Storage Coeff. (min)= 6.82 (ii) 103.12 (ii)
 Unit Hyd. Tpeak (min)= 5.00 105.00
 Unit Hyd. peak (cms)= 0.18 0.01

TOTALS
 PEAK FLOW (cms)= 0.01 0.00 0.009 (iii)
 TIME TO PEAK (hrs)= 10.00 11.92 10.00
 RUNOFF VOLUME (mm)= 22.99 1.28 3.42
 TOTAL RAINFALL (mm)= 24.99 24.99 24.99
 RUNOFF COEFFICIENT = 0.92 0.05 0.14

***** WARNING:FOR AREAS WITH IMPERVIOUS RATIOS BELOW 20%
 YOU SHOULD CONSIDER SPLITTING THE AREA.

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:

CN* = 35.0 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.

0.31	342.06	.335E+03	0.8	1.12	6.57
0.36	342.11	.404E+03	1.1	1.21	6.10
0.40	342.15	.477E+03	1.4	1.29	5.72
0.45	342.20	.557E+03	1.7	1.36	5.40
0.49	342.24	.641E+03	2.1	1.44	5.13
0.54	342.29	.730E+03	2.5	1.51	4.89
0.58	342.33	.825E+03	2.9	1.57	4.68
0.63	342.38	.925E+03	3.4	1.64	4.50
0.67	342.42	.103E+04	4.0	1.70	4.33
0.72	342.47	.114E+04	4.5	1.76	4.18
0.76	342.51	.126E+04	5.2	1.82	4.05
0.81	342.55	.138E+04	5.8	1.88	3.92
0.85	342.60	.150E+04	6.6	1.93	3.81

```

-----
| ADD HYD ( 0034)|
| 1 + 2 = 3 |
-----

```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0011):	6.87	0.008	10.08	1.33
+ ID2= 2 (0048):	49.02	0.013	11.25	0.81
=====				
ID = 3 (0034):	55.89	0.015	11.08	0.87

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```

-----
| ADD HYD ( 0034)|
| 3 + 2 = 1 |
-----

```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 3 (0034):	55.89	0.015	11.08	0.87
+ ID2= 2 (0053):	2.39	0.009	10.00	3.42
=====				
ID = 1 (0034):	58.28	0.017	10.00	0.98

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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-----
| ROUTE CHN( 0049)|
| IN= 2---> OUT= 1 | Routing time step (min)'= 5.00
-----

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<----- DATA FOR SECTION ( 1.1) ----->

```

Distance	Elevation	Manning	
0.00	342.60	0.0350	
2.55	341.75	0.0350 /0.0350	Main Channel
4.05	341.75	0.0350 /0.0350	Main Channel
6.50	342.60	0.0350	

```

<----- TRAVEL TIME TABLE ----->

```

DEPTH (m)	ELEV (m)	VOLUME (cu.m.)	FLOW RATE (cms)	VELOCITY (m/s)	TRAV.TIME (min)
0.04	341.79	.323E+02	0.0	0.35	21.13
0.09	341.84	.697E+02	0.1	0.54	13.69
0.13	341.88	.112E+03	0.2	0.69	10.71
0.18	341.93	.160E+03	0.3	0.81	9.04
0.22	341.97	.213E+03	0.4	0.93	7.95
0.27	342.02	.272E+03	0.6	1.03	7.17

```

-----
<---- hydrograph ----> <-pipe / channel->

```

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)	MAX DEPTH (m)	MAX VEL (m/s)
INFLOW : ID= 2 (0034)	58.28	0.02	10.00	0.98	0.03	0.35
OUTFLOW: ID= 1 (0049)	58.28	0.02	11.42	0.98	0.03	0.35

```

-----
| CALIB
| NASHYD ( 0052)| Area (ha)= 1.35 Curve Number (CN)= 35.0
|ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
-----
U.H. Tp(hrs)= 0.47

```

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

```

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

```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60

1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46

5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Unit Hyd Qpeak (cms)= 0.110

PEAK FLOW (cms)= 0.000 (i)
 TIME TO PEAK (hrs)= 11.000
 RUNOFF VOLUME (mm)= 0.461
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.018

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

 CALIB
 NASHYD (0054) | Area (ha)= 0.53 Curve Number (CN)= 35.0
 ID= 1 DT= 5.0 min | Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
 U.H. Tp(hrs)= 0.25

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

---- TRANSFORMED HYETOGRAPH ----

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60
1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60

1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46
5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46

5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Unit Hyd Qpeak (cms)= 0.081

PEAK FLOW (cms)= 0.000 (i)
 TIME TO PEAK (hrs)= 10.500
 RUNOFF VOLUME (mm)= 0.460
 TOTAL RAINFALL (mm)= 24.987
 RUNOFF COEFFICIENT = 0.018

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

 CALIB
 STANDHYD (0201) Area (ha)= 10.55
 ID= 1 DT= 5.0 min Total Imp(%)= 42.60 Dir. Conn.(%)= 23.50

IMPERVIOUS PERVIOUS (i)
 Surface Area (ha)= 4.49 6.06
 Dep. Storage (mm)= 2.00 5.00
 Average Slope (%)= 0.50 2.00
 Length (m)= 104.00 81.00
 Mannings n = 0.013 0.250

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

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

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN
hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.083	0.44	6.083	0.77	12.083	1.20	18.08	0.60
0.167	0.44	6.167	0.77	12.167	1.20	18.17	0.60
0.250	0.44	6.250	0.77	12.250	1.20	18.25	0.60
0.333	0.44	6.333	0.77	12.333	1.20	18.33	0.60
0.417	0.44	6.417	0.77	12.417	1.20	18.42	0.60
0.500	0.44	6.500	0.77	12.500	1.20	18.50	0.60
0.583	0.44	6.583	0.77	12.583	1.05	18.58	0.60
0.667	0.44	6.667	0.77	12.667	1.05	18.67	0.60
0.750	0.44	6.750	0.78	12.750	1.05	18.75	0.60
0.833	0.44	6.833	0.78	12.833	1.05	18.83	0.60
0.917	0.44	6.917	0.77	12.917	1.05	18.92	0.60
1.000	0.44	7.000	0.77	13.000	1.05	19.00	0.60
1.083	0.44	7.083	0.95	13.083	1.05	19.08	0.60
1.167	0.44	7.167	0.95	13.167	1.05	19.17	0.60
1.250	0.44	7.250	0.95	13.250	1.05	19.25	0.60
1.333	0.44	7.333	0.95	13.333	1.05	19.33	0.60
1.417	0.44	7.417	0.95	13.417	1.05	19.42	0.60

1.500	0.44	7.500	0.95	13.500	1.05	19.50	0.60
1.583	0.44	7.583	0.95	13.583	0.95	19.58	0.60
1.667	0.44	7.667	0.95	13.667	0.95	19.67	0.60
1.750	0.44	7.750	0.95	13.750	0.95	19.75	0.60
1.833	0.44	7.833	0.95	13.833	0.95	19.83	0.60
1.917	0.44	7.917	0.95	13.917	0.95	19.92	0.60
2.000	0.44	8.000	0.95	14.000	0.95	20.00	0.60
2.083	0.51	8.083	1.25	14.083	0.79	20.08	0.46
2.167	0.51	8.167	1.25	14.167	0.79	20.17	0.46
2.250	0.51	8.250	1.25	14.250	0.79	20.25	0.46
2.333	0.51	8.333	1.25	14.333	0.79	20.33	0.46
2.417	0.51	8.417	1.25	14.417	0.79	20.42	0.46
2.500	0.51	8.500	1.25	14.500	0.79	20.50	0.46
2.583	0.51	8.583	1.75	14.583	0.79	20.58	0.46
2.667	0.51	8.667	1.75	14.667	0.79	20.67	0.46
2.750	0.51	8.750	1.75	14.750	0.79	20.75	0.46
2.833	0.51	8.833	1.75	14.833	0.79	20.83	0.46
2.917	0.51	8.917	1.75	14.917	0.79	20.92	0.46
3.000	0.51	9.000	1.75	15.000	0.79	21.00	0.46
3.083	0.51	9.083	2.45	15.083	0.79	21.08	0.46
3.167	0.51	9.167	2.45	15.167	0.79	21.17	0.46
3.250	0.51	9.250	2.45	15.250	0.79	21.25	0.46
3.333	0.51	9.333	2.45	15.333	0.79	21.33	0.46
3.417	0.51	9.417	2.45	15.417	0.79	21.42	0.46
3.500	0.51	9.500	2.45	15.500	0.79	21.50	0.46
3.583	0.51	9.583	5.90	15.583	0.79	21.58	0.46
3.667	0.51	9.667	5.90	15.667	0.79	21.67	0.46
3.750	0.51	9.750	10.60	15.750	0.79	21.75	0.46
3.833	0.51	9.833	10.60	15.833	0.79	21.83	0.46
3.917	0.51	9.917	15.30	15.917	0.79	21.92	0.46
4.000	0.51	10.000	15.30	16.000	0.79	22.00	0.46
4.083	0.61	10.083	3.40	16.083	0.60	22.08	0.46
4.167	0.61	10.167	3.40	16.167	0.60	22.17	0.46
4.250	0.61	10.250	3.40	16.250	0.60	22.25	0.46
4.333	0.61	10.333	3.40	16.333	0.60	22.33	0.46
4.417	0.61	10.417	3.40	16.417	0.60	22.42	0.46
4.500	0.61	10.500	3.40	16.500	0.60	22.50	0.46
4.583	0.61	10.583	2.05	16.583	0.60	22.58	0.46
4.667	0.61	10.667	2.05	16.667	0.60	22.67	0.46
4.750	0.61	10.750	2.05	16.750	0.60	22.75	0.46
4.833	0.61	10.833	2.05	16.833	0.60	22.83	0.46
4.917	0.61	10.917	2.05	16.917	0.60	22.92	0.46
5.000	0.61	11.000	2.05	17.000	0.60	23.00	0.46
5.083	0.61	11.083	1.50	17.083	0.60	23.08	0.46
5.167	0.61	11.167	1.50	17.167	0.60	23.17	0.46
5.250	0.61	11.250	1.50	17.250	0.60	23.25	0.46
5.333	0.61	11.333	1.50	17.333	0.60	23.33	0.46
5.417	0.61	11.417	1.50	17.417	0.60	23.42	0.46
5.500	0.61	11.500	1.50	17.500	0.60	23.50	0.46
5.583	0.61	11.583	1.50	17.583	0.60	23.58	0.46

5.667	0.61	11.667	1.50	17.667	0.60	23.67	0.46
5.750	0.61	11.750	1.40	17.750	0.60	23.75	0.46
5.833	0.61	11.833	1.40	17.833	0.60	23.83	0.46
5.917	0.61	11.917	1.30	17.917	0.60	23.92	0.46
6.000	0.61	12.000	1.30	18.000	0.60	24.00	0.46

Max.Eff.Inten.(mm/hr)=	15.30	0.37	
over (min)	5.00	110.00	
Storage Coeff. (min)=	6.82 (ii)	107.69 (ii)	
Unit Hyd. Tpeak (min)=	5.00	110.00	
Unit Hyd. peak (cms)=	0.18	0.01	
			TOTALS
PEAK FLOW (cms)=	0.10	0.00	0.096 (iii)
TIME TO PEAK (hrs)=	10.00	12.08	10.00
RUNOFF VOLUME (mm)=	22.99	1.20	6.32
TOTAL RAINFALL (mm)=	24.99	24.99	24.99
RUNOFF COEFFICIENT =	0.92	0.05	0.25

- (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 35.0 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 (0050)				
1 + 2 = 3				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 1 (0201):	10.55	0.096	10.00	6.32
+ ID2= 2 (0052):	1.35	0.000	11.00	0.46
=====				
ID = 3 (0050):	11.90	0.096	10.00	5.65

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

ADD HYD (0050)				
3 + 2 = 1				
	AREA	QPEAK	TPEAK	R.V.
	(ha)	(cms)	(hrs)	(mm)
ID1= 3 (0050):	11.90	0.096	10.00	5.65
+ ID2= 2 (0054):	0.53	0.000	10.50	0.46
=====				
ID = 1 (0050):	12.43	0.096	10.00	5.43

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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| RESERVOIR( 0011)|
| IN= 2---> OUT= 1 |
| DT= 5.0 min      |
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OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0290	0.1844
0.0070	0.0210	0.0310	0.2102
0.0120	0.0425	0.0330	0.2365
0.0160	0.0647	0.0340	0.2634
0.0200	0.0875	0.0360	0.2909
0.0220	0.1108	1.2930	0.3190
0.0250	0.1348	3.8000	0.3477
0.0270	0.1593	7.3300	0.3769

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0050)	12.430	0.096	10.00	5.43
OUTFLOW: ID= 1 (0011)	12.430	0.009	13.92	5.37

PEAK FLOW REDUCTION [Qout/Qin](%)= 9.40
 TIME SHIFT OF PEAK FLOW (min)=235.00
 MAXIMUM STORAGE USED (ha.m.)= 0.0298

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-----
| ADD HYD ( 0023)|
| 1 + 2 = 3      |
-----

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	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0011):	12.43	0.009	13.92	5.37
+ ID2= 2 (0049):	58.28	0.016	11.42	0.98
=====				
ID = 3 (0023):	70.71	0.025	11.50	1.75

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

FINISH

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APPENDIX B5

OGS Sizing Reports

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/07/2026

Province:	Ontario
City:	Township of Puslinch
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Project Name:	Arkell Road Developments
Project Number:	2433-6646
Designer Name:	Cole Martin
Designer Company:	C.F. Crozier & Associates Inc.
Designer Email:	cmartin@cfcrozier.ca
Designer Phone:	289-204-8239
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	Arkell - OGS #1
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Drainage Area (ha):	1.74
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% Imperviousness:	35.00
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Runoff Coefficient 'c': 0.51

Particle Size Distribution:	Fine
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Target TSS Removal (%):	80.0
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Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	27.60
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):	606
Estimated Average Annual Sediment Volume (L/yr):	492

Net Annual Sediment (TSS) Load Reduction Sizing Summary	
Stormceptor Model	TSS Removal Provided (%)
EFO4	74
EFO5	81
EFO6	86
EFO8	92
EFO10	95
EFO12	97

Recommended Stormceptor EFO Model: EFO5

Estimated Net Annual Sediment (TSS) Load Reduction (%): 81

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.

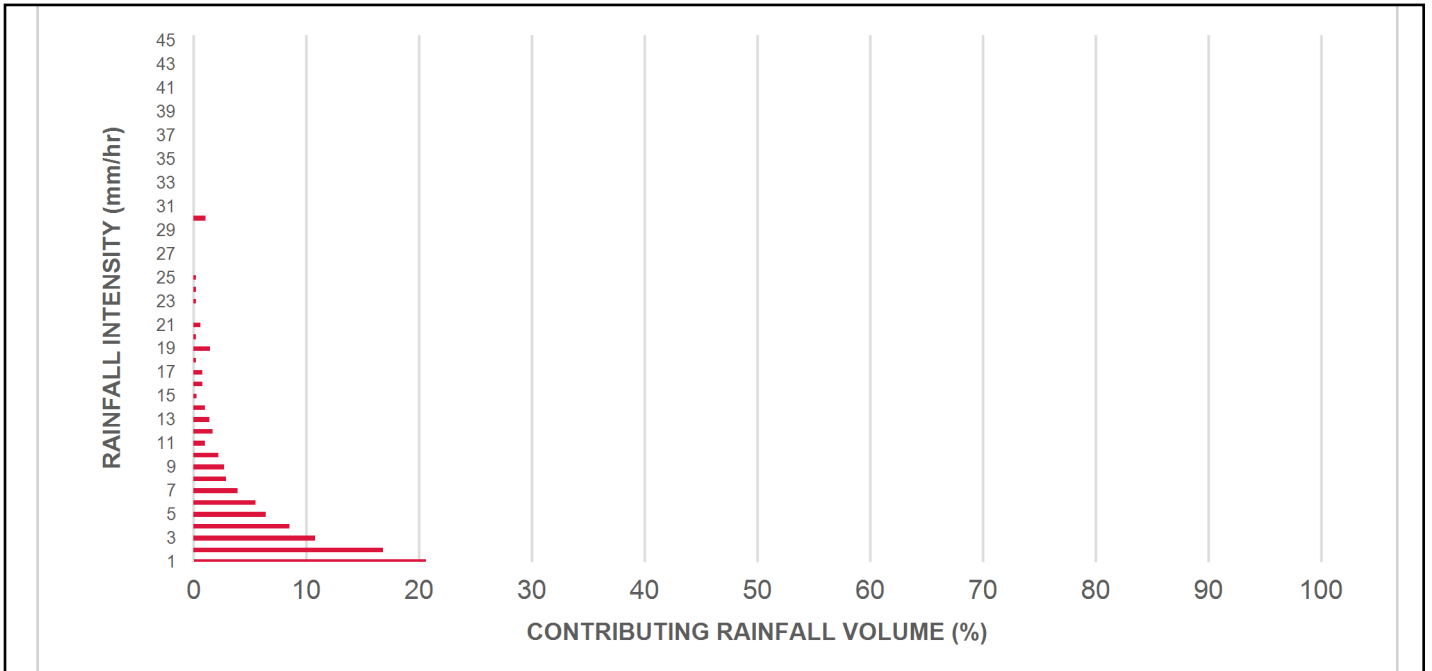
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m ²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.5	8.5	1.23	74.0	41.0	100	8.5	8.5
1.00	20.6	29.1	2.47	148.0	81.0	98	20.3	28.8
2.00	16.8	45.9	4.93	296.0	163.0	88	14.8	43.7
3.00	10.8	56.7	7.40	444.0	244.0	81	8.7	52.4
4.00	8.5	65.2	9.87	592.0	325.0	78	6.6	58.9
5.00	6.4	71.6	12.33	740.0	407.0	74	4.7	63.7
6.00	5.5	77.0	14.80	888.0	488.0	70	3.8	67.5
7.00	3.9	81.0	17.27	1036.0	569.0	66	2.6	70.1
8.00	2.9	83.9	19.74	1184.0	651.0	64	1.9	72.0
9.00	2.7	86.5	22.20	1332.0	732.0	64	1.7	73.7
10.00	2.2	88.7	24.67	1480.0	813.0	63	1.4	75.0
11.00	1.0	89.7	27.14	1628.0	895.0	62	0.6	75.6
12.00	1.7	91.3	29.60	1776.0	976.0	62	1.0	76.7
13.00	1.4	92.8	32.07	1924.0	1057.0	60	0.9	77.5
14.00	1.0	93.7	34.54	2072.0	1139.0	59	0.6	78.1
15.00	0.3	94.0	37.00	2220.0	1220.0	56	0.2	78.3
16.00	0.8	94.8	39.47	2368.0	1301.0	55	0.4	78.7
17.00	0.8	95.7	41.94	2516.0	1383.0	53	0.4	79.1
18.00	0.2	95.8	44.41	2664.0	1464.0	50	0.1	79.2
19.00	1.5	97.3	46.87	2812.0	1545.0	48	0.7	79.9
20.00	0.2	97.5	49.34	2960.0	1627.0	45	0.1	80.0
21.00	0.6	98.2	51.81	3108.0	1708.0	43	0.3	80.3
22.00	0.0	98.2	54.27	3256.0	1789.0	41	0.0	80.3
23.00	0.2	98.4	56.74	3404.0	1871.0	39	0.1	80.4
24.00	0.2	98.6	59.21	3552.0	1952.0	38	0.1	80.5
25.00	0.2	98.9	61.67	3700.0	2033.0	36	0.1	80.6
30.00	1.1	100.0	74.01	4441.0	2440.0	30	0.3	80.9
35.00	0.0	100.0	86.34	5181.0	2847.0	26	0.0	80.9
40.00	0.0	100.0	98.68	5921.0	3253.0	23	0.0	80.9
45.00	0.0	100.0	111.01	6661.0	3660.0	20	0.0	80.9
Estimated Net Annual Sediment (TSS) Load Reduction =								81 %

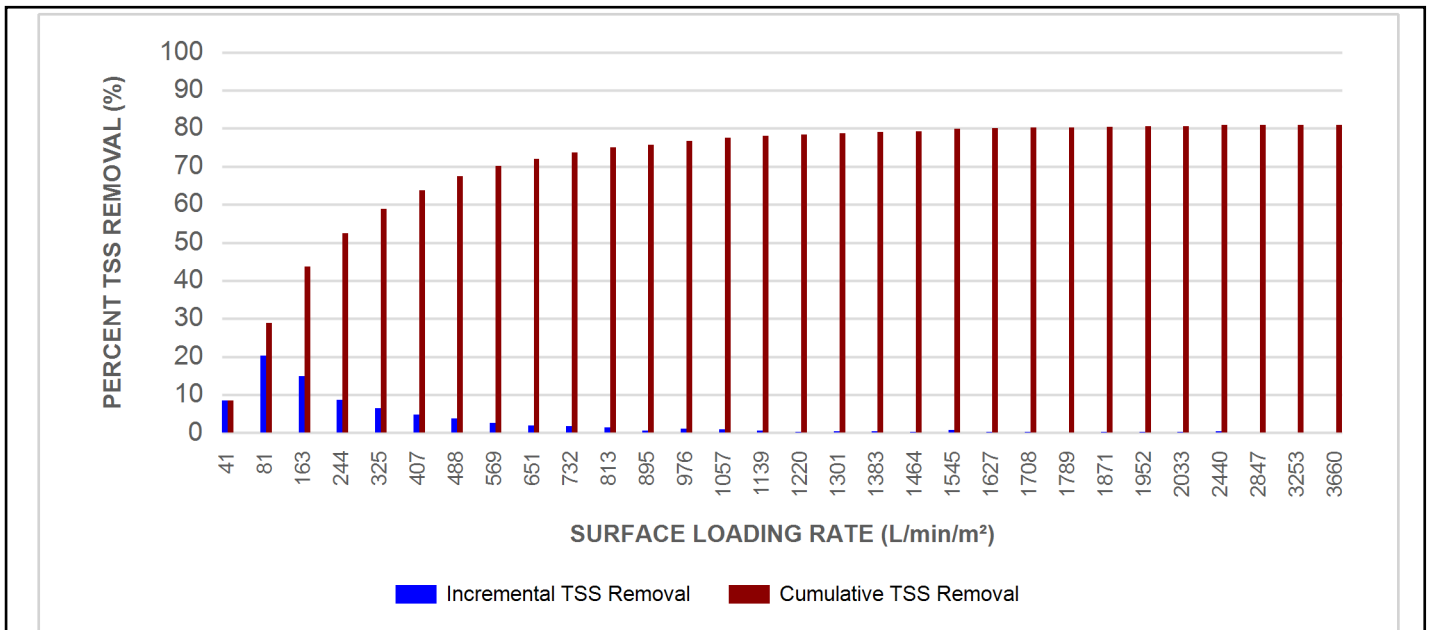
Climate Station ID: 6158731 Years of Rainfall Data: 20



RAINFALL DATA FROM TORONTO INTL 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
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
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

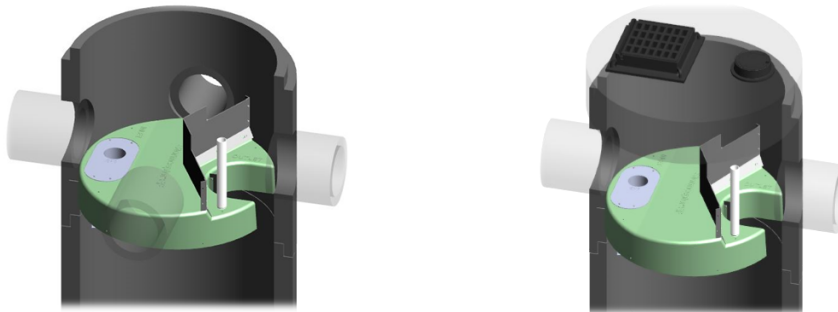
► Stormceptor® EF and EFO feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV Procedure for Laboratory Testing of Oil-Grit Separators, and the exceptional scour test performance 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.

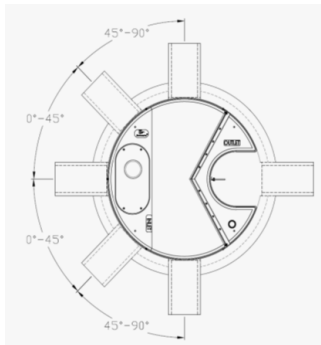
DESIGN FLEXIBILITY

► 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
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
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
	5 ft (1524 mm) Diameter OGS Units:	1.95 m ³ sediment / 420 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/m² to 1400 L/min/m², 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/m² and 1400 L/min/m² 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/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² 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/m².

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/m².

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/m² to 2600 L/min/m²) 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.

Imbrium® Systems

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/07/2026

Province:	Ontario
City:	Township of Puslinch
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Project Name:	Arkell Road Developments
Project Number:	2433-6646
Designer Name:	Cole Martin
Designer Company:	C.F. Crozier & Associates Inc.
Designer Email:	cmartin@cfcrozier.ca
Designer Phone:	289-204-8239
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	Arkell - OGS #2
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Drainage Area (ha):	2.04
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% Imperviousness:	29.00
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Runoff Coefficient 'c': 0.47

Particle Size Distribution:	Fine
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Target TSS Removal (%):	80.0
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Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	30.07
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):	581
Estimated Average Annual Sediment Volume (L/yr):	472

Net Annual Sediment (TSS) Load Reduction Sizing Summary	
Stormceptor Model	TSS Removal Provided (%)
EFO4	73
EFO5	80
EFO6	85
EFO8	91
EFO10	95
EFO12	97

Recommended Stormceptor EFO Model: EFO5

Estimated Net Annual Sediment (TSS) Load Reduction (%): 80

Water Quality Runoff Volume Capture (%): > 90



THIRD-PARTY TESTING AND VERIFICATION

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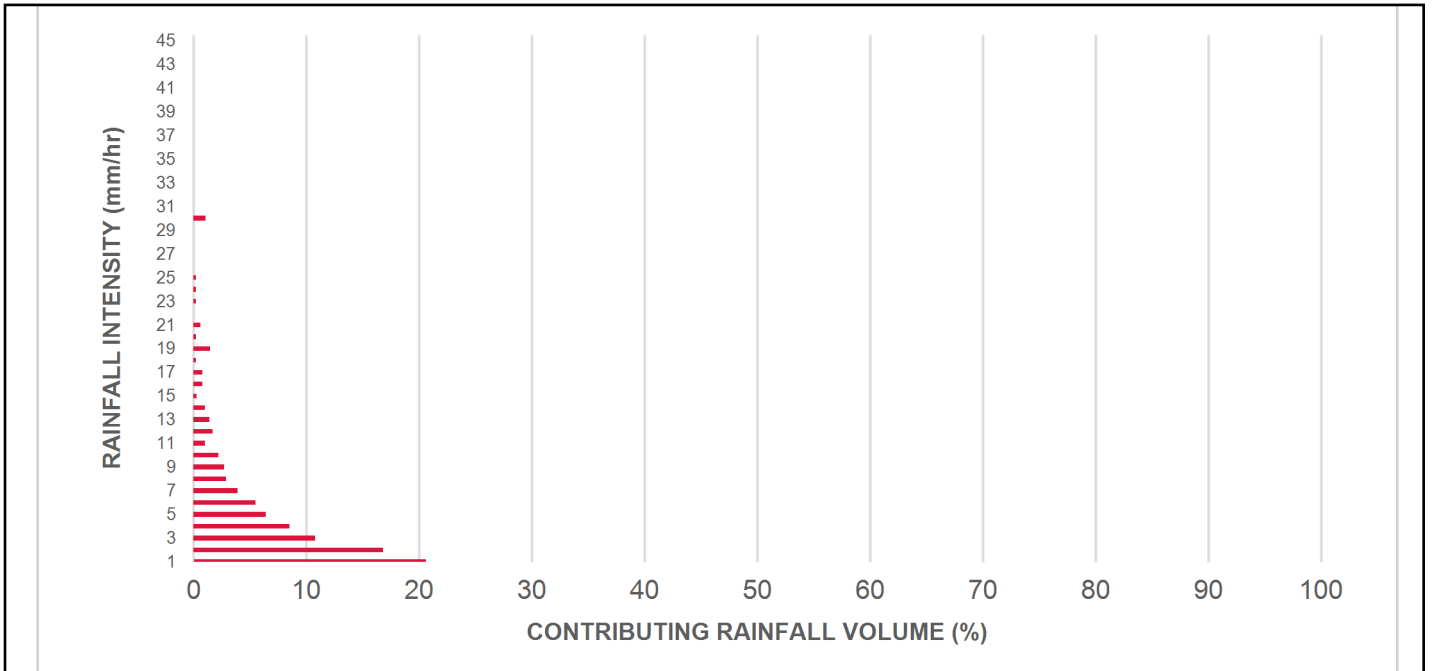
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m ²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.5	8.5	1.34	81.0	44.0	100	8.5	8.5
1.00	20.6	29.1	2.69	161.0	89.0	98	20.3	28.8
2.00	16.8	45.9	5.38	323.0	177.0	87	14.6	43.4
3.00	10.8	56.7	8.06	484.0	266.0	80	8.6	52.1
4.00	8.5	65.2	10.75	645.0	354.0	76	6.4	58.5
5.00	6.4	71.6	13.44	806.0	443.0	72	4.6	63.1
6.00	5.5	77.0	16.13	968.0	532.0	68	3.7	66.8
7.00	3.9	81.0	18.82	1129.0	620.0	64	2.5	69.4
8.00	2.9	83.9	21.51	1290.0	709.0	64	1.8	71.2
9.00	2.7	86.5	24.19	1452.0	798.0	63	1.7	72.9
10.00	2.2	88.7	26.88	1613.0	886.0	62	1.4	74.3
11.00	1.0	89.7	29.57	1774.0	975.0	62	0.6	74.9
12.00	1.7	91.3	32.26	1935.0	1063.0	60	1.0	75.9
13.00	1.4	92.8	34.95	2097.0	1152.0	58	0.8	76.7
14.00	1.0	93.7	37.63	2258.0	1241.0	56	0.5	77.2
15.00	0.3	94.0	40.32	2419.0	1329.0	54	0.2	77.4
16.00	0.8	94.8	43.01	2581.0	1418.0	52	0.4	77.8
17.00	0.8	95.7	45.70	2742.0	1507.0	49	0.4	78.2
18.00	0.2	95.8	48.39	2903.0	1595.0	46	0.1	78.3
19.00	1.5	97.3	51.07	3064.0	1684.0	44	0.7	78.9
20.00	0.2	97.5	53.76	3226.0	1772.0	41	0.1	79.0
21.00	0.6	98.2	56.45	3387.0	1861.0	39	0.2	79.3
22.00	0.0	98.2	59.14	3548.0	1950.0	38	0.0	79.3
23.00	0.2	98.4	61.83	3710.0	2038.0	36	0.1	79.4
24.00	0.2	98.6	64.52	3871.0	2127.0	35	0.1	79.4
25.00	0.2	98.9	67.20	4032.0	2216.0	33	0.1	79.5
30.00	1.1	100.0	80.64	4839.0	2659.0	28	0.3	79.8
35.00	0.0	100.0	94.09	5645.0	3102.0	24	0.0	79.8
40.00	0.0	100.0	107.53	6452.0	3545.0	21	0.0	79.8
45.00	0.0	100.0	120.97	7258.0	3988.0	19	0.0	79.8
Estimated Net Annual Sediment (TSS) Load Reduction =								80 %

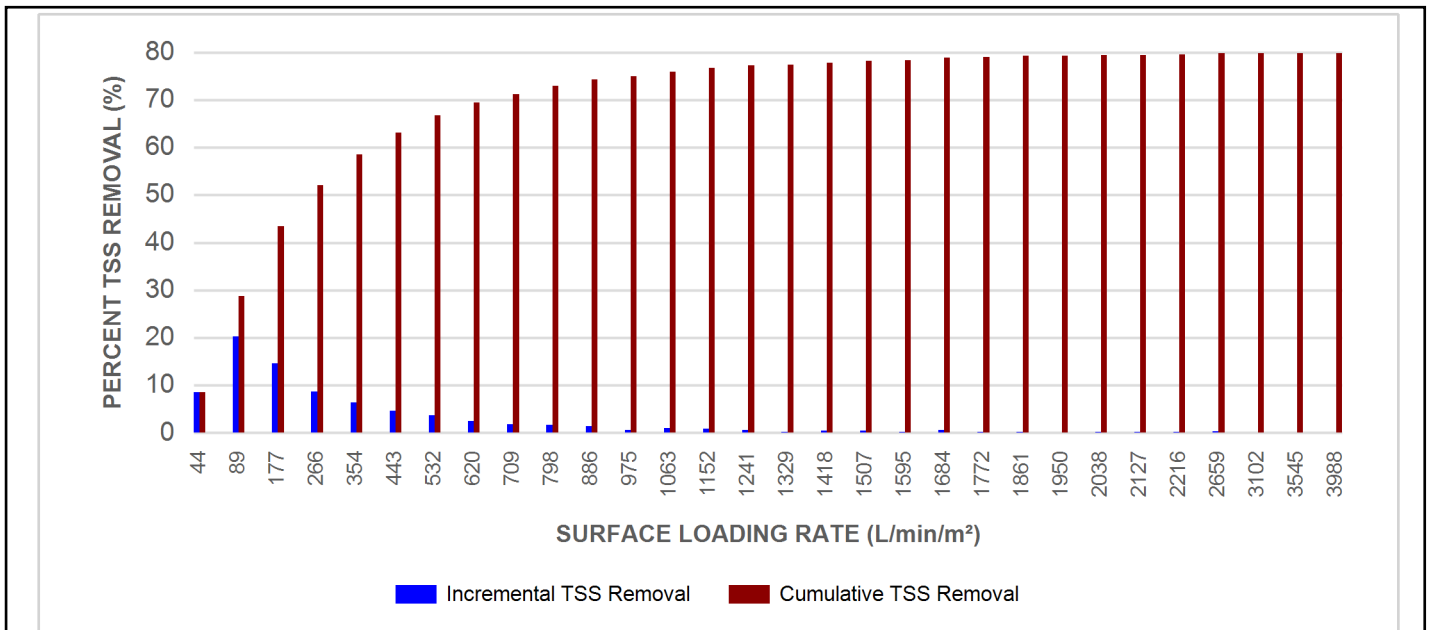
Climate Station ID: 6158731 Years of Rainfall Data: 20



RAINFALL DATA FROM TORONTO INTL 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
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
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

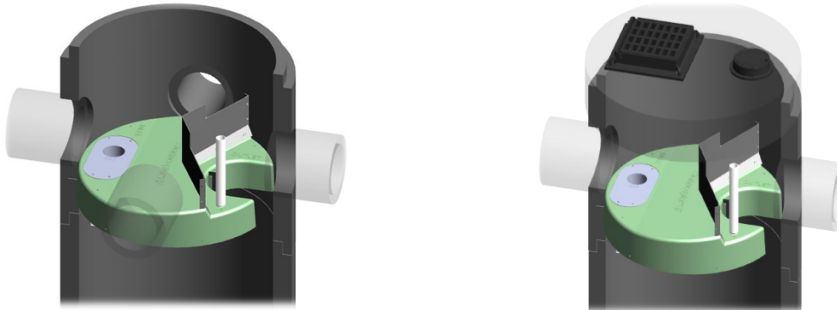
► Stormceptor® EF and EFO feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV Procedure for Laboratory Testing of Oil-Grit Separators, and the exceptional scour test performance 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.

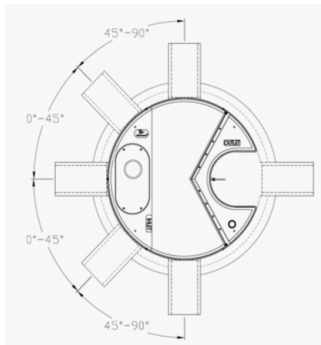
DESIGN FLEXIBILITY

► 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
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
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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

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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
	5 ft (1524 mm) Diameter OGS Units:	1.95 m ³ sediment / 420 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m ³ sediment / 609 L oil
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	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/m² to 1400 L/min/m², 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/m² and 1400 L/min/m² 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/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² 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/m².

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/m².

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/m² to 2600 L/min/m²) 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.

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/07/2026

Province:	Ontario
City:	Township of Puslinch
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Project Name:	Arkell Road Developments
Project Number:	2433-6646
Designer Name:	Cole Martin
Designer Company:	C.F. Crozier & Associates Inc.
Designer Email:	cmartin@cfcrozier.ca
Designer Phone:	289-204-8239
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	Arkell - OGS #3
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Drainage Area (ha):	1.33
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% Imperviousness:	22.00
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Runoff Coefficient 'c': 0.43

Particle Size Distribution:	Fine
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Target TSS Removal (%):	80.0
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Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	17.87
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):	291
Estimated Average Annual Sediment Volume (L/yr):	237

Net Annual Sediment (TSS) Load Reduction Sizing Summary	
Stormceptor Model	TSS Removal Provided (%)
EFO4	81
EFO5	87
EFO6	91
EFO8	95
EFO10	98
EFO12	99

Recommended Stormceptor EFO Model: EFO4

Estimated Net Annual Sediment (TSS) Load Reduction (%): 81

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.

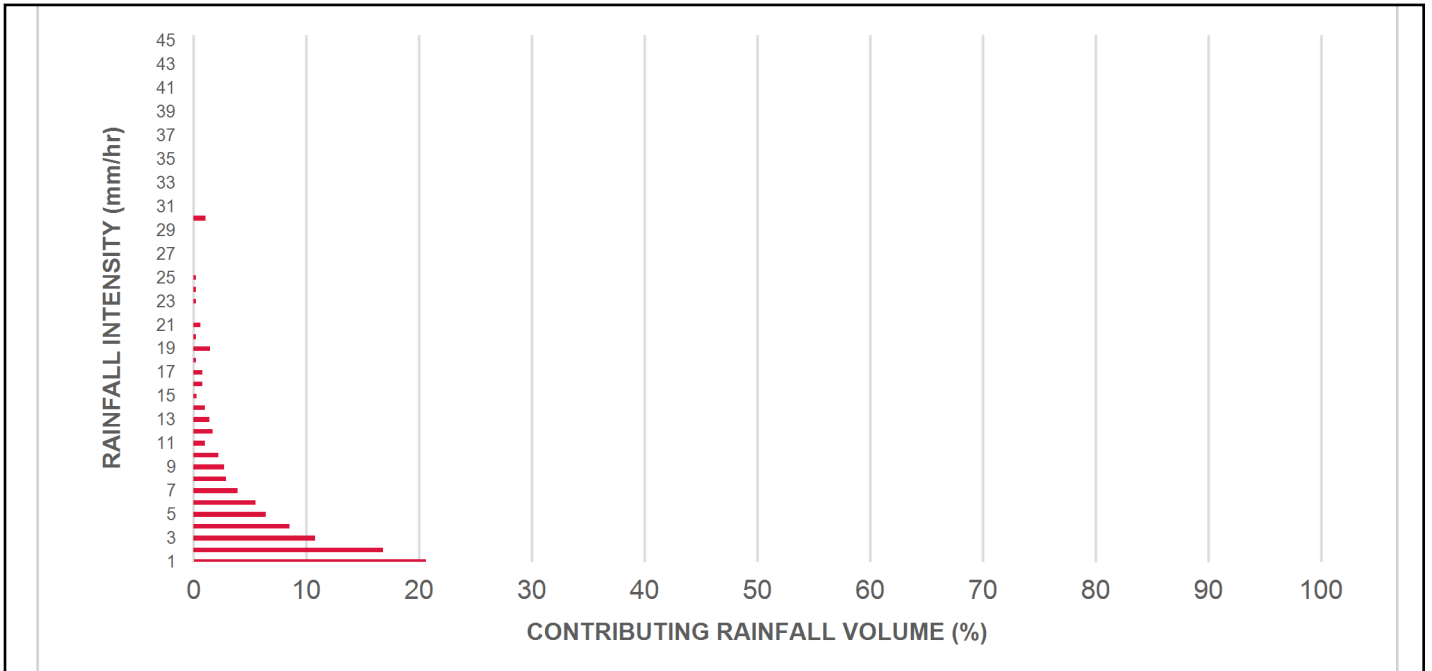
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m ²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.5	8.5	0.80	48.0	40.0	100	8.5	8.5
1.00	20.6	29.1	1.60	96.0	80.0	98	20.3	28.8
2.00	16.8	45.9	3.19	192.0	160.0	88	14.8	43.7
3.00	10.8	56.7	4.79	288.0	240.0	81	8.7	52.4
4.00	8.5	65.2	6.39	383.0	319.0	78	6.6	58.9
5.00	6.4	71.6	7.99	479.0	399.0	74	4.7	63.7
6.00	5.5	77.0	9.58	575.0	479.0	70	3.8	67.5
7.00	3.9	81.0	11.18	671.0	559.0	66	2.6	70.1
8.00	2.9	83.9	12.78	767.0	639.0	64	1.9	72.0
9.00	2.7	86.5	14.38	863.0	719.0	64	1.7	73.7
10.00	2.2	88.7	15.97	958.0	799.0	63	1.4	75.1
11.00	1.0	89.7	17.57	1054.0	879.0	63	0.6	75.7
12.00	1.7	91.3	19.17	1150.0	958.0	62	1.0	76.7
13.00	1.4	92.8	20.76	1246.0	1038.0	61	0.9	77.6
14.00	1.0	93.7	22.36	1342.0	1118.0	59	0.6	78.1
15.00	0.3	94.0	23.96	1438.0	1198.0	57	0.2	78.3
16.00	0.8	94.8	25.56	1533.0	1278.0	55	0.4	78.7
17.00	0.8	95.7	27.15	1629.0	1358.0	53	0.4	79.2
18.00	0.2	95.8	28.75	1725.0	1438.0	51	0.1	79.3
19.00	1.5	97.3	30.35	1821.0	1517.0	48	0.7	80.0
20.00	0.2	97.5	31.95	1917.0	1597.0	46	0.1	80.1
21.00	0.6	98.2	33.54	2013.0	1677.0	44	0.3	80.4
22.00	0.0	98.2	35.14	2108.0	1757.0	42	0.0	80.4
23.00	0.2	98.4	36.74	2204.0	1837.0	40	0.1	80.5
24.00	0.2	98.6	38.33	2300.0	1917.0	38	0.1	80.6
25.00	0.2	98.9	39.93	2396.0	1997.0	37	0.1	80.6
30.00	1.1	100.0	47.92	2875.0	2396.0	31	0.4	81.0
35.00	0.0	100.0	55.90	3354.0	2795.0	27	0.0	81.0
40.00	0.0	100.0	63.89	3833.0	3195.0	24	0.0	81.0
45.00	0.0	100.0	71.88	4313.0	3594.0	21	0.0	81.0
Estimated Net Annual Sediment (TSS) Load Reduction =								81 %

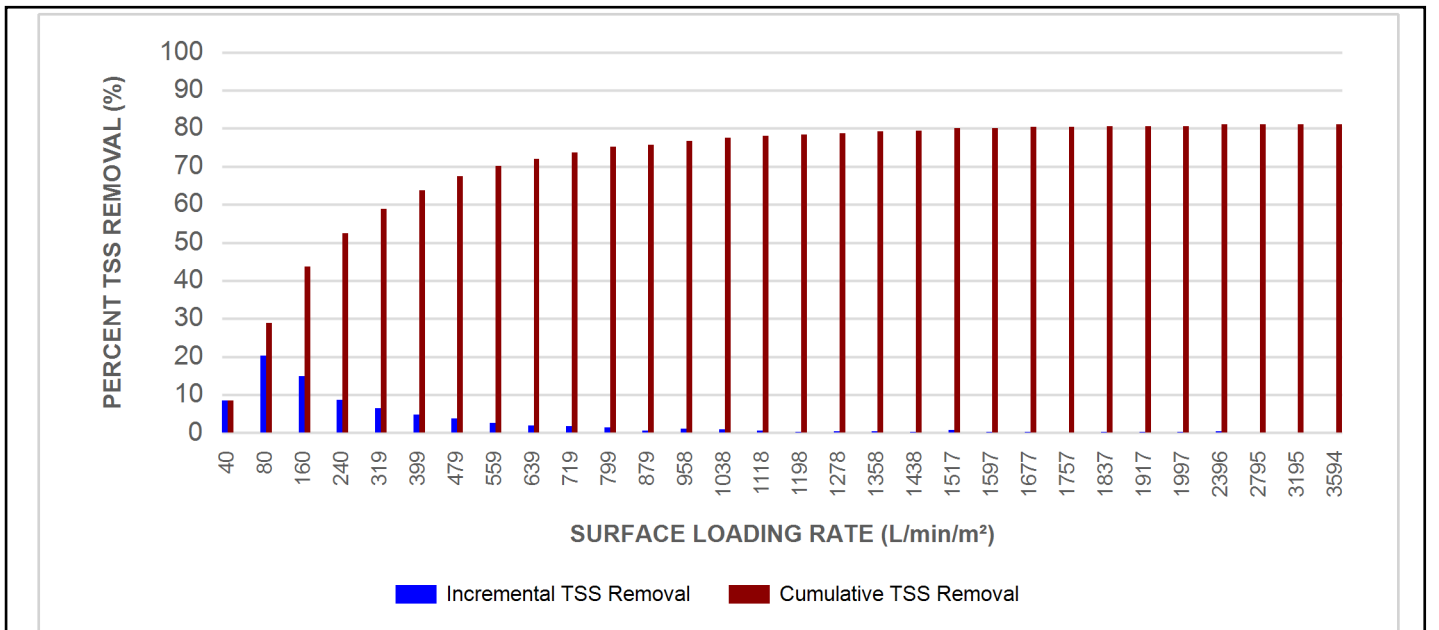
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RAINFALL DATA FROM TORONTO INTL AP RAINFALL STATION



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	
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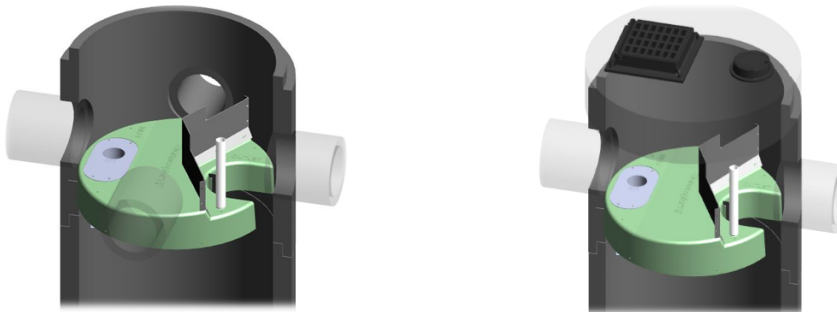
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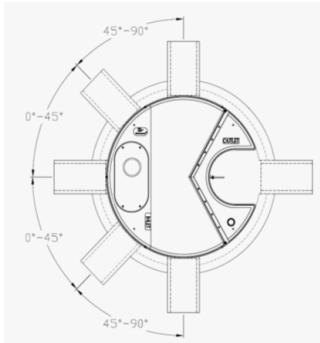
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Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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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/m² to 1400 L/min/m², 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/m² and 1400 L/min/m² 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/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² 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/m².

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/m².

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/m² to 2600 L/min/m²) 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.

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

01/07/2026

Province:	Ontario
City:	Township of Puslinch
Nearest Rainfall Station:	TORONTO INTL AP
Climate Station Id:	6158731
Years of Rainfall Data:	20

Project Name:	Arkell Road Developments
Project Number:	2433-6646
Designer Name:	Cole Martin
Designer Company:	C.F. Crozier & Associates Inc.
Designer Email:	cmartin@cfcrozier.ca
Designer Phone:	289-204-8239
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	Arkell - OGS #4
------------	-----------------

Drainage Area (ha):	1.01
% Imperviousness:	86.00

Runoff Coefficient 'c': 0.81

Particle Size Distribution:	Fine
-----------------------------	------

Target TSS Removal (%):	80.0
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Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	25.63
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):	874
Estimated Average Annual Sediment Volume (L/yr):	711

Net Annual Sediment (TSS) Load Reduction Sizing Summary	
Stormceptor Model	TSS Removal Provided (%)
EFO4	76
EFO5	82
EFO6	87
EFO8	93
EFO10	96
EFO12	98

Recommended Stormceptor EFO Model: EFO5
Estimated Net Annual Sediment (TSS) Load Reduction (%): 82
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.

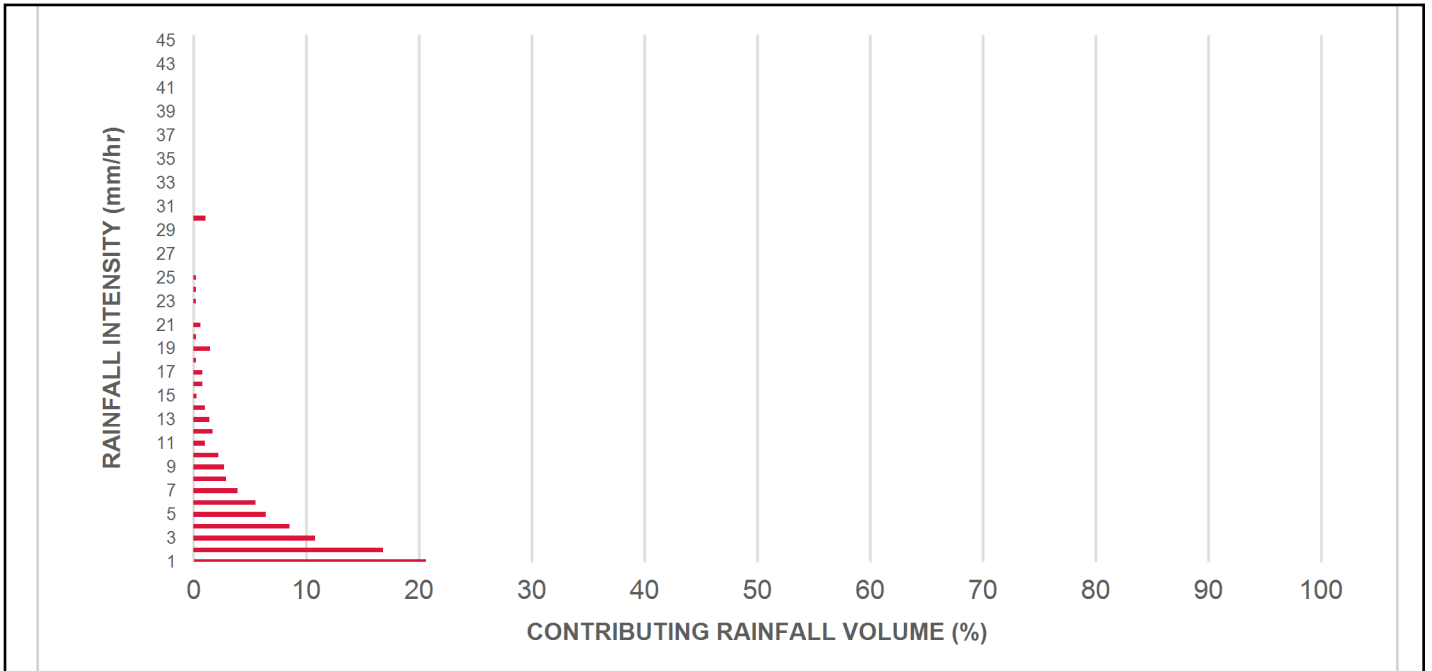
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

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	1.15	69.0	38.0	100	8.5	8.5
1.00	20.6	29.1	2.29	137.0	76.0	100	20.6	29.1
2.00	16.8	45.9	4.58	275.0	151.0	89	15.0	44.2
3.00	10.8	56.7	6.87	412.0	227.0	82	8.8	53.0
4.00	8.5	65.2	9.16	550.0	302.0	78	6.6	59.6
5.00	6.4	71.6	11.46	687.0	378.0	75	4.8	64.5
6.00	5.5	77.0	13.75	825.0	453.0	72	3.9	68.4
7.00	3.9	81.0	16.04	962.0	529.0	68	2.7	71.1
8.00	2.9	83.9	18.33	1100.0	604.0	65	1.9	72.9
9.00	2.7	86.5	20.62	1237.0	680.0	64	1.7	74.6
10.00	2.2	88.7	22.91	1375.0	755.0	63	1.4	76.0
11.00	1.0	89.7	25.20	1512.0	831.0	63	0.6	76.6
12.00	1.7	91.3	27.49	1650.0	906.0	62	1.0	77.7
13.00	1.4	92.8	29.79	1787.0	982.0	62	0.9	78.6
14.00	1.0	93.7	32.08	1925.0	1057.0	60	0.6	79.1
15.00	0.3	94.0	34.37	2062.0	1133.0	59	0.2	79.3
16.00	0.8	94.8	36.66	2200.0	1209.0	57	0.4	79.8
17.00	0.8	95.7	38.95	2337.0	1284.0	55	0.5	80.2
18.00	0.2	95.8	41.24	2474.0	1360.0	53	0.1	80.3
19.00	1.5	97.3	43.53	2612.0	1435.0	51	0.8	81.1
20.00	0.2	97.5	45.82	2749.0	1511.0	48	0.1	81.2
21.00	0.6	98.2	48.11	2887.0	1586.0	46	0.3	81.5
22.00	0.0	98.2	50.41	3024.0	1662.0	44	0.0	81.5
23.00	0.2	98.4	52.70	3162.0	1737.0	42	0.1	81.6
24.00	0.2	98.6	54.99	3299.0	1813.0	40	0.1	81.7
25.00	0.2	98.9	57.28	3437.0	1888.0	39	0.1	81.8
30.00	1.1	100.0	68.73	4124.0	2266.0	32	0.4	82.1
35.00	0.0	100.0	80.19	4811.0	2644.0	28	0.0	82.1
40.00	0.0	100.0	91.65	5499.0	3021.0	24	0.0	82.1
45.00	0.0	100.0	103.10	6186.0	3399.0	22	0.0	82.1
Estimated Net Annual Sediment (TSS) Load Reduction =								82 %

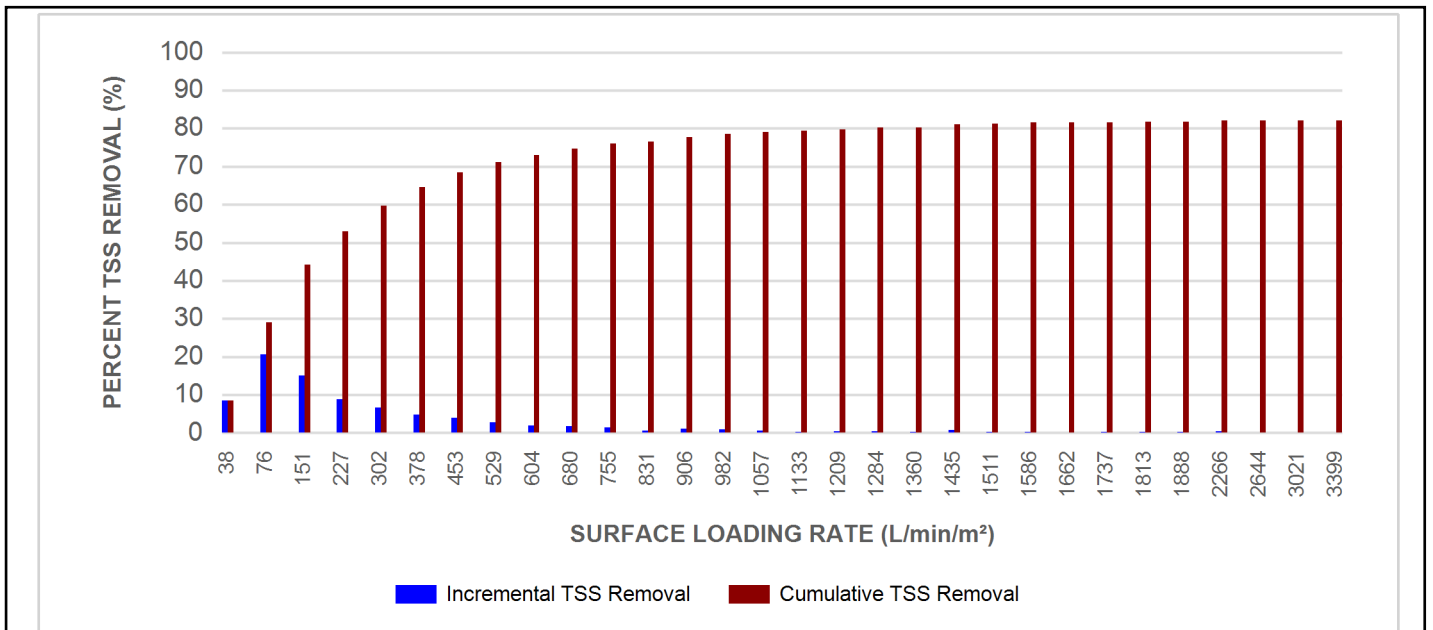
Climate Station ID: 6158731 Years of Rainfall Data: 20



RAINFALL DATA FROM TORONTO INTL 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
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
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

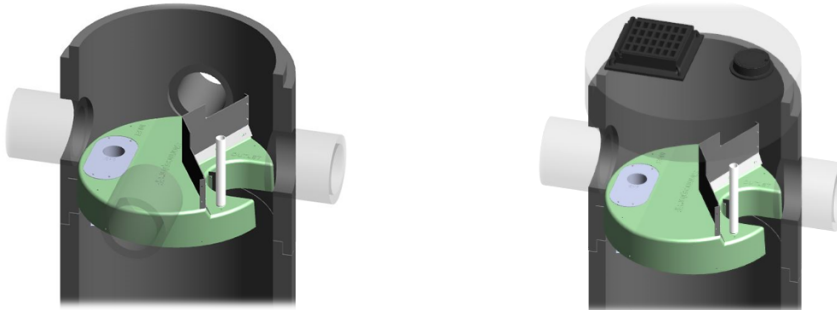
► Stormceptor® EF and EFO feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV Procedure for Laboratory Testing of Oil-Grit Separators, and the exceptional scour test performance 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.

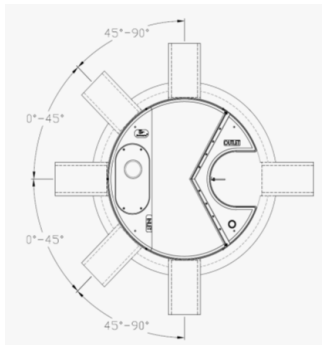
DESIGN FLEXIBILITY

► 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
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
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
	5 ft (1524 mm) Diameter OGS Units:	1.95 m ³ sediment / 420 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/m² to 1400 L/min/m², 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/m² and 1400 L/min/m² 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/m² shall be assumed to be identical to the sediment removal efficiency at 40 L/min/m². No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 L/min/m².

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² 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/m².

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/m².

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/m² to 2600 L/min/m²) 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.

DRAWINGS & FIGURES

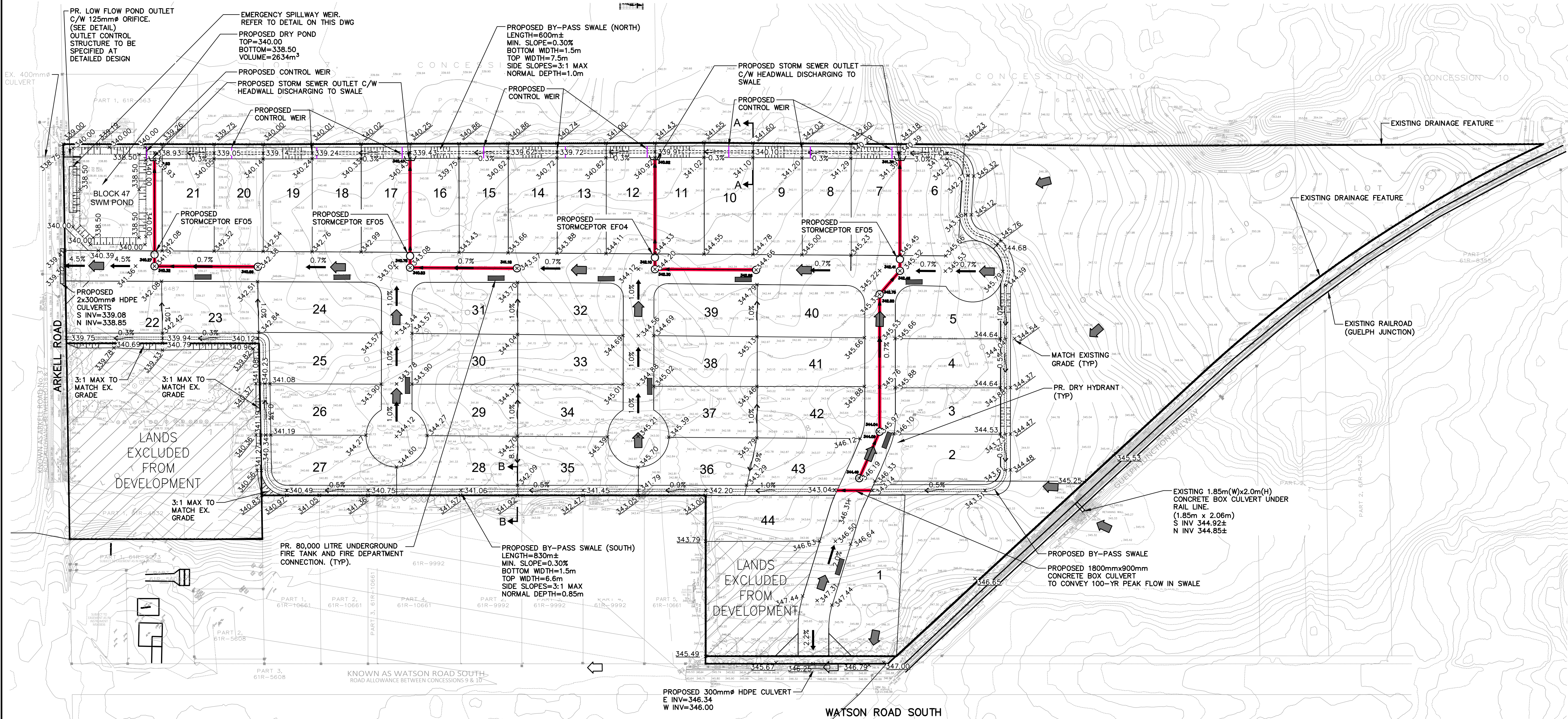
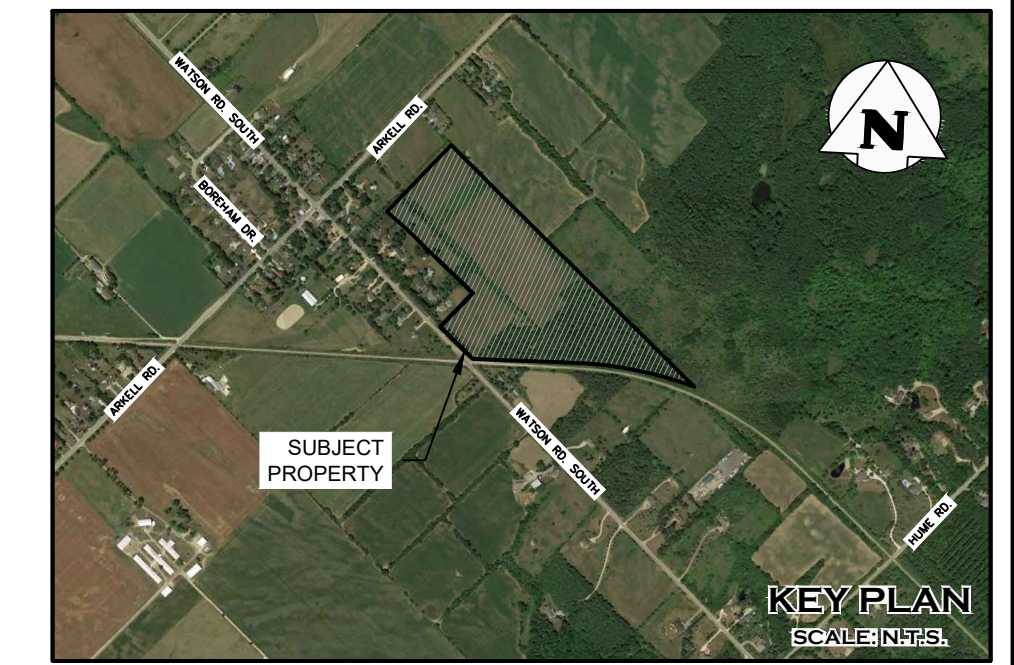
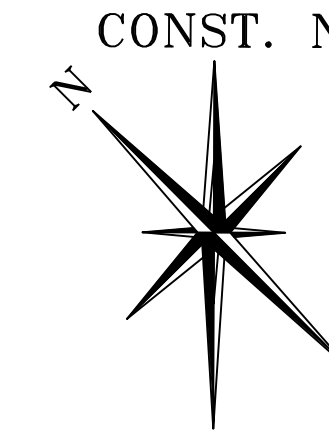
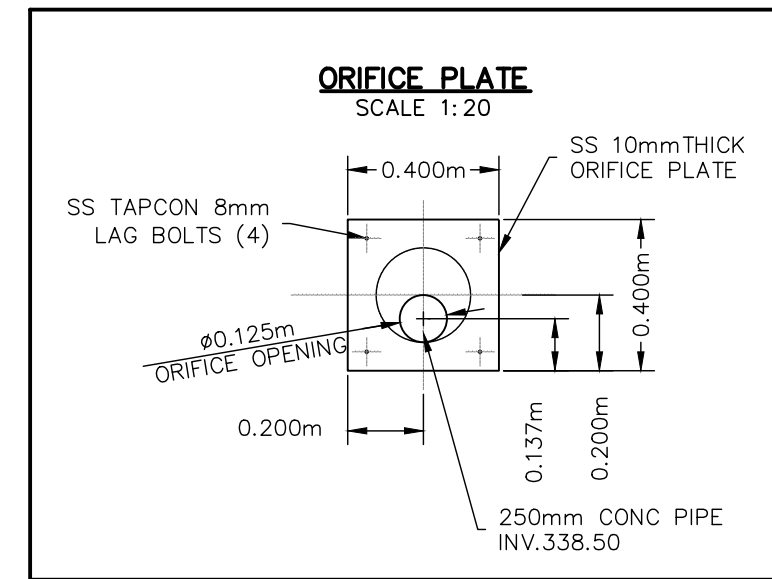
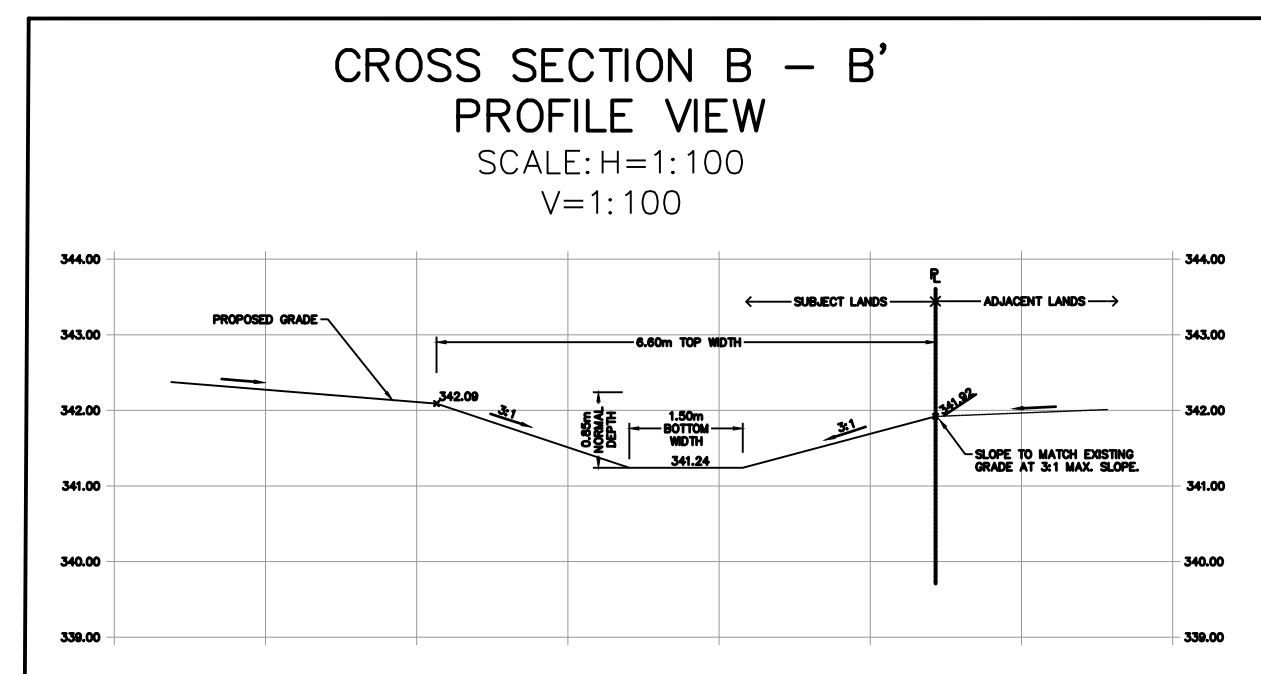
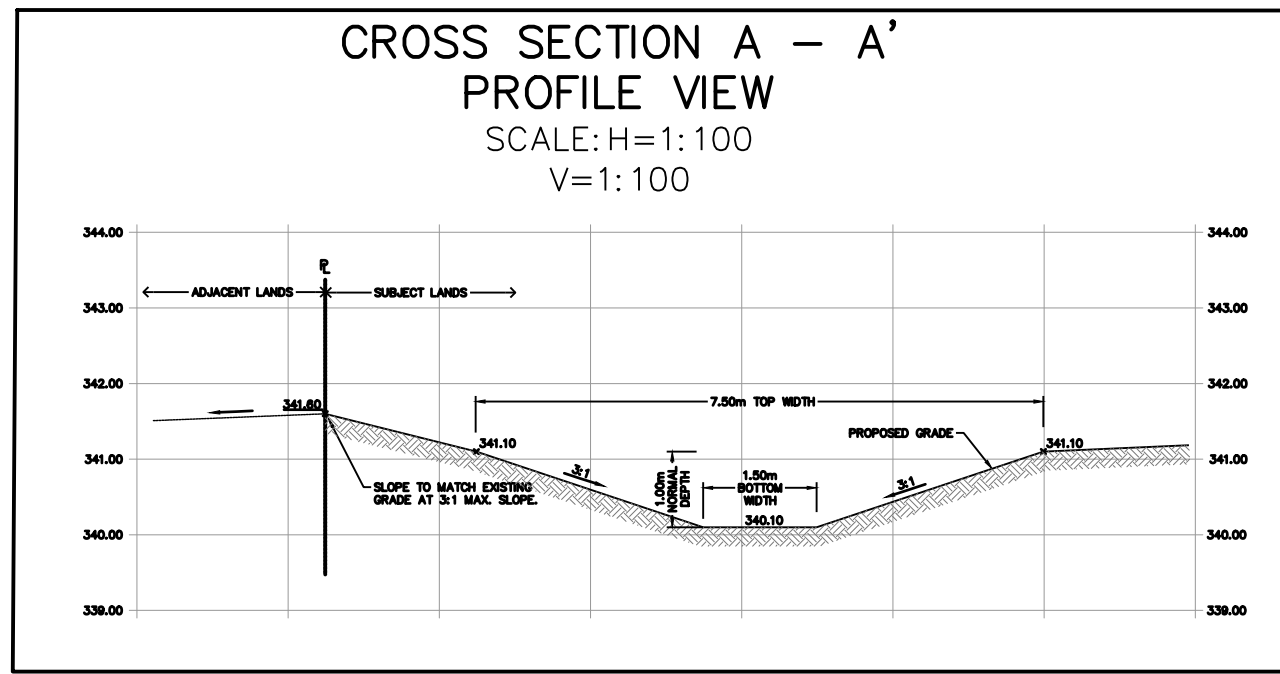
Drawing C101: Preliminary Grading and Servicing Plan

Drawing C102: Onsite Sewage Servicing Schematic

Figure 1: Study Area

Figure 2: Pre-development Drainage Plan

Figure 3: Post-development Drainage Plan



LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING GRADE
- PROPOSED GRADE
- PROPOSED GRADE (TO MATCH EXISTING)
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED SLOPE (3:1 MAX.)
- PROPOSED CONTROL WEIR
- EXISTING OVERLAND FLOW DIRECTION
- PROPOSED OVERLAND FLOW DIRECTION
- PROPOSED SWALE FLOW DIRECTION
- PROPOSED LOT-LINE
- PROPOSED 80,000 LITRE UNDERGROUND FIRE TANK WITH FIRE DEPARTMENT CONNECTION
- PROPOSED CATCHBASIN
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED SINGLE / DOUBLE CATCHBASIN

REFER TO TOWNSHIP OF PUSLINCH STANDARD DRAWING STD-102 "TYPICAL URBAN CROSS-SECTION" FOR DIMENSIONS AND DETAILS OF PROPOSED ROAD CROSS-SECTION.

No.	ISSUE / REVISION	DATE
2	ISSUED FOR 3rd DRAFT PLAN SUBMISSION	2026/JAN/16
1	ISSUED FOR 2nd DRAFT PLAN SUBMISSION	2025/AUG/01
0	ISSUED FOR PRE-CONSULTATION	2023/AUG/31

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON DRAFT SITE PLAN BY STOVEL AND ASSOCIATES INC. PROJECT No. XXX DRAWING No. XXX DATE RECEIVED 2025/JUL/29

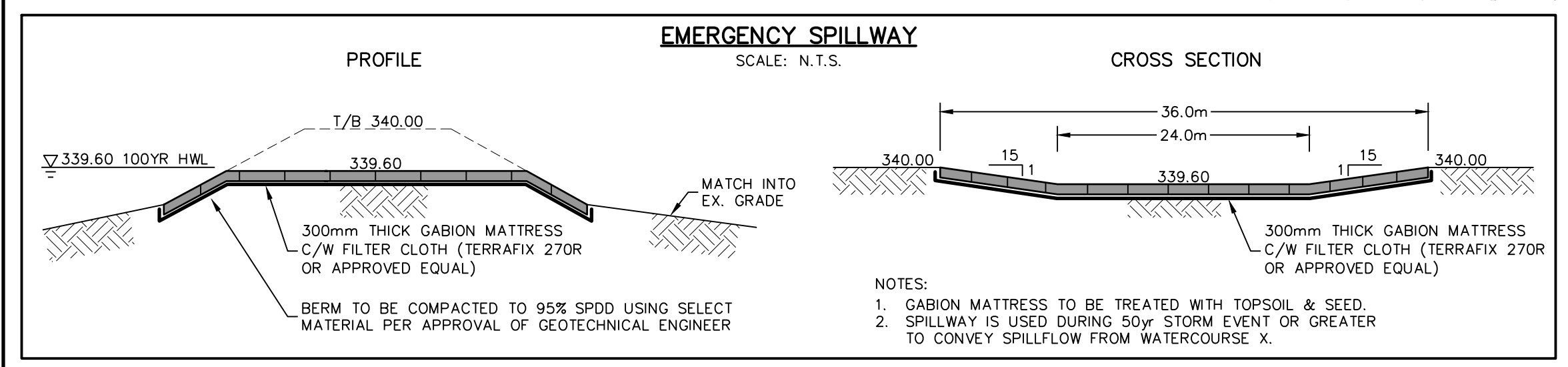
DRAWING NOTES:

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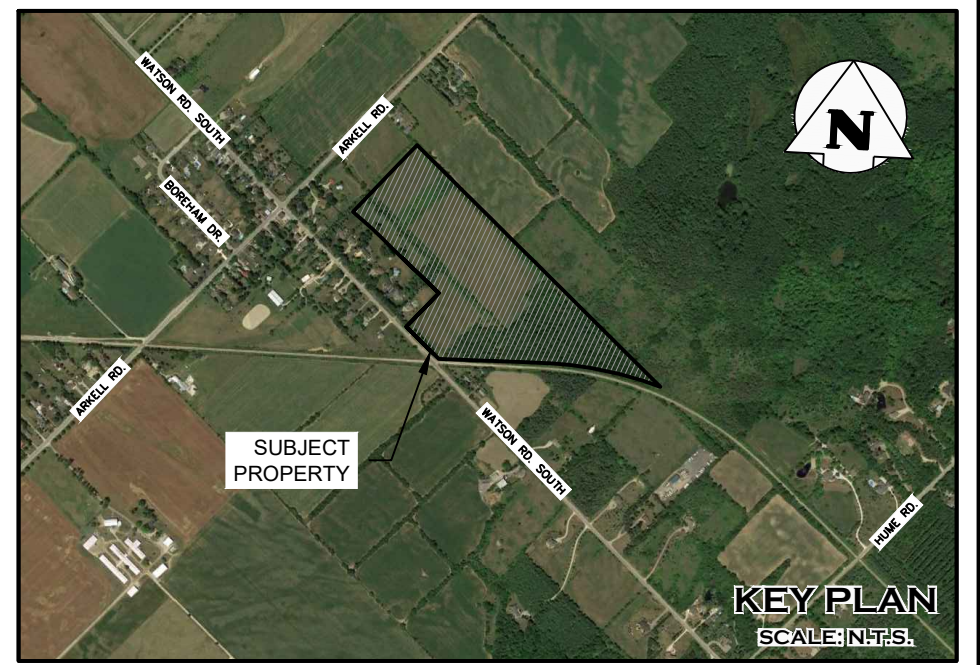
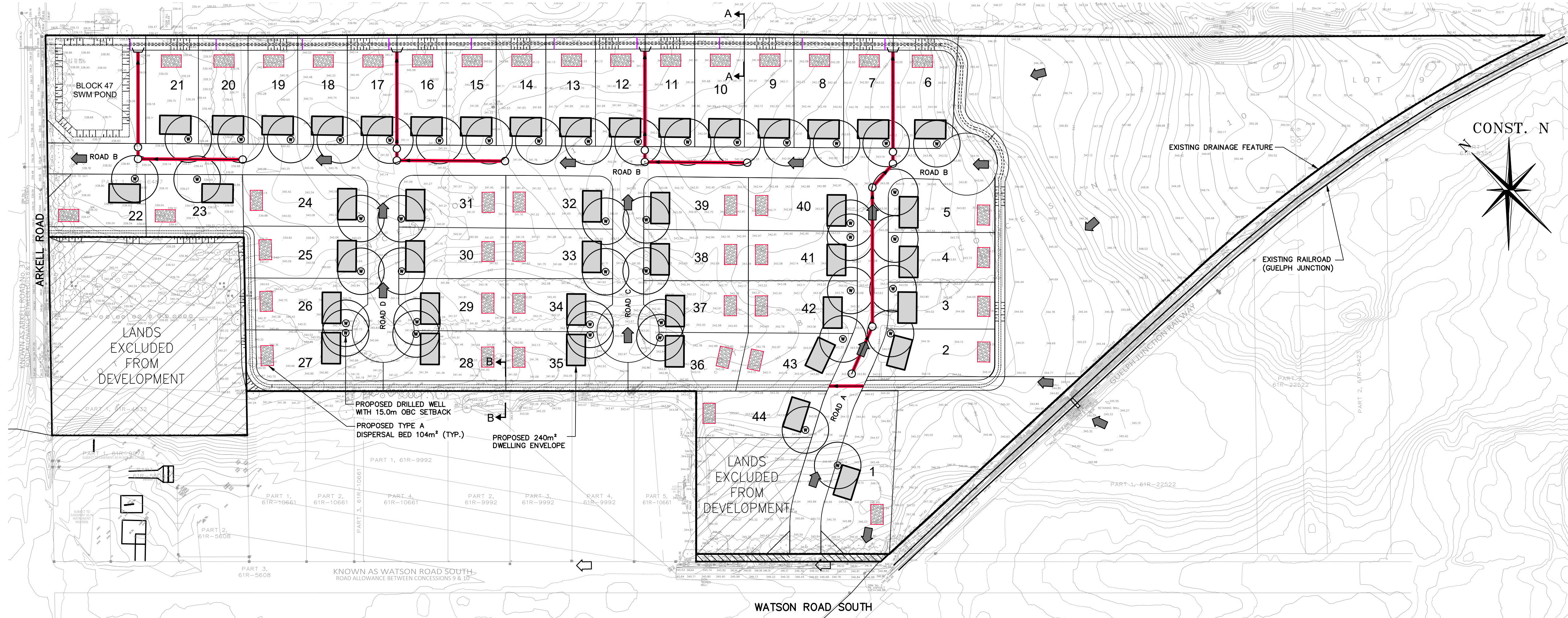


Project: **WATSON ROAD SOUTH TOWN OF PUSLINCH**

Drawing: **PRELIMINARY GRADING AND SERVICING PLAN**

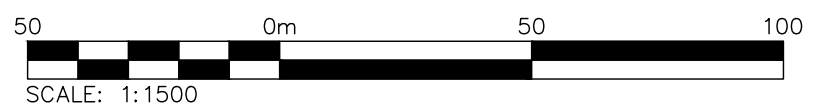
Drawn: A.O. Design: A.O. Project No: **2433-6646**

Check: J.B. Check: J.B. Scale: 1:1500 Dwg: **C101**



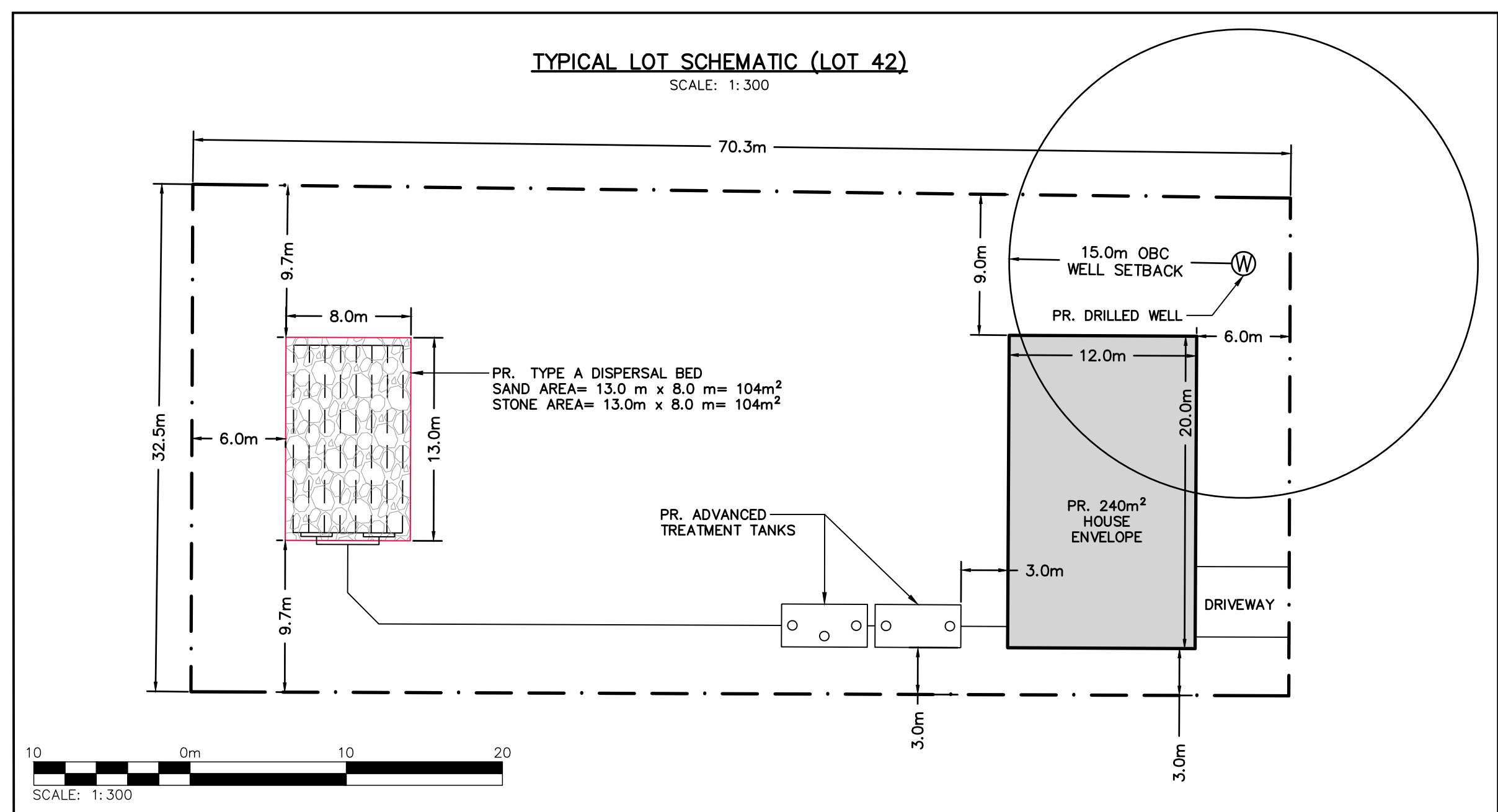
LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- LOT NUMBER
- EXISTING GRADE
- PROPOSED GRADE
- PROPOSED GRADE (TO MATCH EXISTING)
- PROPOSED SLOPE (3:1 MAX.)
- PROPOSED LOT-LINE
- CONCEPTUAL 240 m² BUILDING ENVELOPE
- PROPOSED TYPE A DISPERSAL BED 104 m²
- CONCEPTUAL PROPOSED DRILLED WELL LOCATION C/W 15.0m OBC SETBACK



ONSITE SEWAGE SYSTEM DESIGN TYPICAL LOT NOTES

PROPOSED 6 BEDROOM, 240 m ² HOME WITH SIXTY-TWO (62) FIXTURE UNITS	BASE FLOW (6 BEDROOMS)= 2,500 L/DAY ADDITIONAL FLOOR AREA (40 m ²)= 400 L/DAY ADDITIONAL FIXTURE UNITS (42)= 2,075 L/DAY Q TOTAL (2,500+2,075)= 4,575 L/DAY
SOIL PERCOLATION RATE	T = 15 min/cm (ESTIMATED BY C.F. CROZIER)
PROPOSED TREATMENT UNIT	WATERLOO BIOFILTER AD-BA50
TYPE A DISPERSAL BED STONE AREA	MINIMUM SIZE=Q/50=4,575/50 = 91.5m ² PROVIDED 13m x 8m = 104m ²
TYPE A DISPERSAL BED SAND AREA	MINIMUM SIZE=QT/850 = 4,575*15/850 = 80.7m ² PROVIDED 13m x 8m = 104m ²



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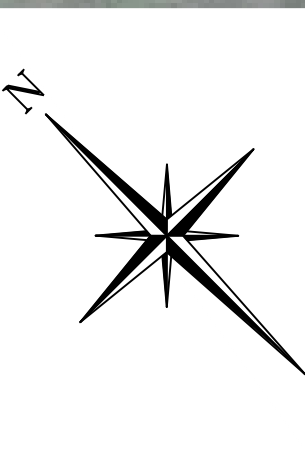
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Project
**WATSON ROAD SOUTH
TOWN OF PUSLINCH**

Drawing
ONSITE SEWAGE SERVICING SCHEMATIC



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Check	M.B.	Check	M.B.	Scale	1:1500 Dwg. C102



ARKELL ROAD

WATSON ROAD SOUTH

GUELPH JUNCTION RAILROAD

LEGEND

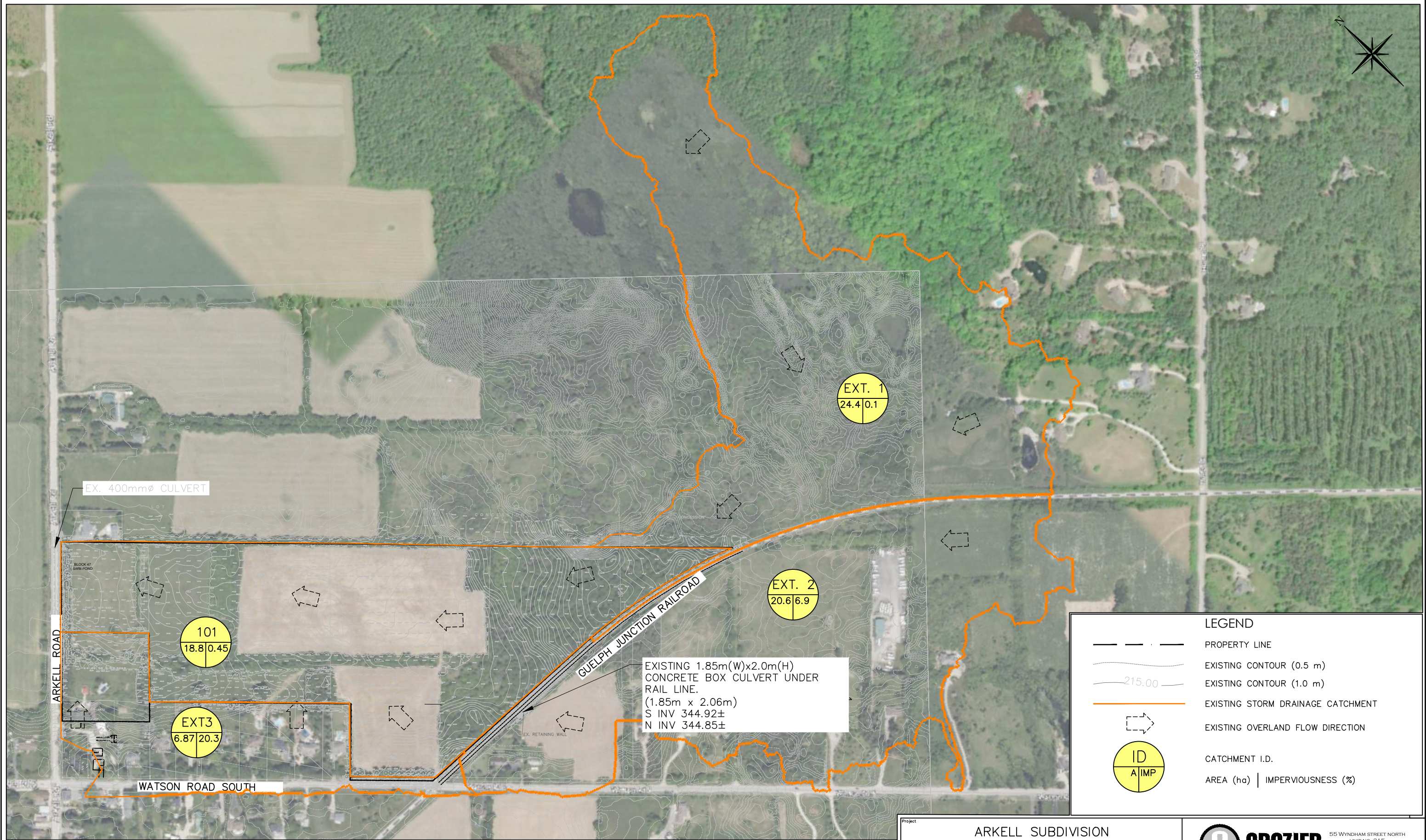
- PROPERTY LINE
- ==== GUELPH JUNCTION RAILROAD



ARKELL SUBDIVISION
STUDY AREA

SCALE: 1:1000

FIGURE 1



EX. 400mmØ CULVERT

ARKELL ROAD

101
18.8 | 0.45

EXT. 3
6.87 | 20.3

WATSON ROAD SOUTH

GUELPH JUNCTION RAILROAD

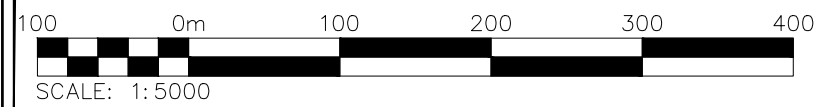
EXT. 1
24.4 | 0.1

EXT. 2
20.6 | 6.9

EXISTING 1.85m(W)x2.0m(H)
CONCRETE BOX CULVERT UNDER
RAIL LINE.
(1.85m x 2.06m)
S INV 344.92±
N INV 344.85±

LEGEND

- PROPERTY LINE
- ~ EXISTING CONTOUR (0.5 m)
- ~215.00~ EXISTING CONTOUR (1.0 m)
- EXISTING STORM DRAINAGE CATCHMENT
- ⇨ EXISTING OVERLAND FLOW DIRECTION
- ⊙ ID
A|IMP CATCHMENT I.D.
AREA (ha) | IMPERVIOUSNESS (%)



Project
**ARKELL SUBDIVISION
TOWNSHIP OF PUSLINCH**

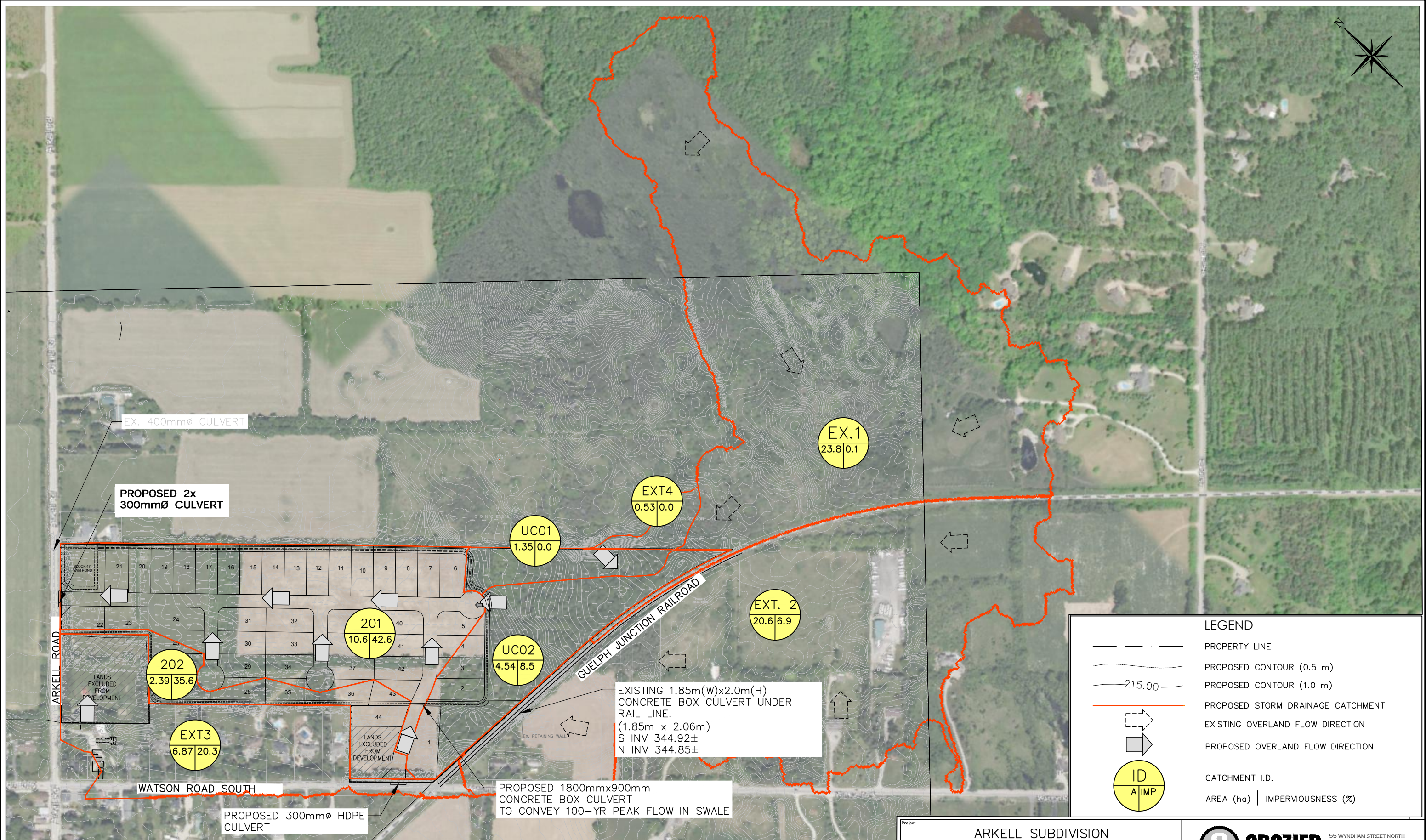
Drawing
PRE-DEVELOPMENT DRAINAGE PLAN

CROZIER
CONSULTING ENGINEERS

55 WYNDHAM STREET NORTH
UNIT NO. 215
GUELPH, ON N1H 7T8
548-708-0022
WWW.CFCROZIER.CA

Drawn By	A.O.	Design By	A.O.	Project	2433-6646
Scale	1:5000	Date	FEB/20/2024	Check By	T.E.

FIG. 2



LEGEND	
	PROPERTY LINE
	PROPOSED CONTOUR (0.5 m)
	PROPOSED CONTOUR (1.0 m)
	PROPOSED STORM DRAINAGE CATCHMENT
	EXISTING OVERLAND FLOW DIRECTION
	PROPOSED OVERLAND FLOW DIRECTION
	CATCHMENT I.D. AREA (ha) IMPERVIOUSNESS (%)

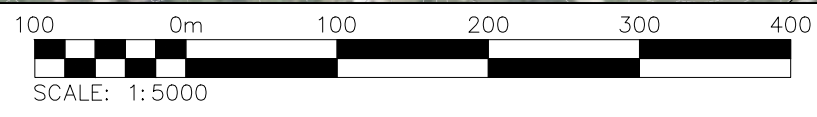
EXISTING 1.85m(W)x2.0m(H)
CONCRETE BOX CULVERT UNDER
RAIL LINE.
(1.85m x 2.06m)
S INV 344.92±
N INV 344.85±

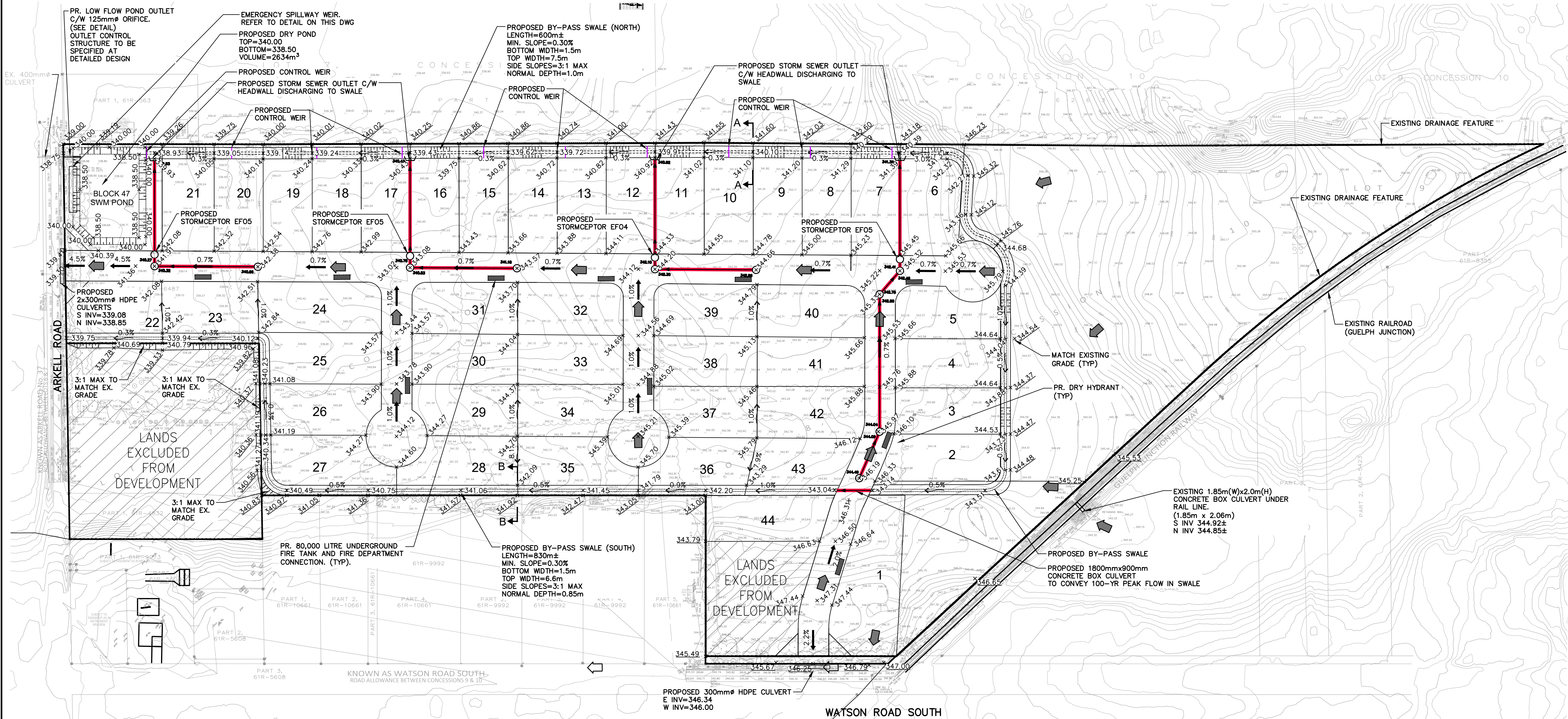
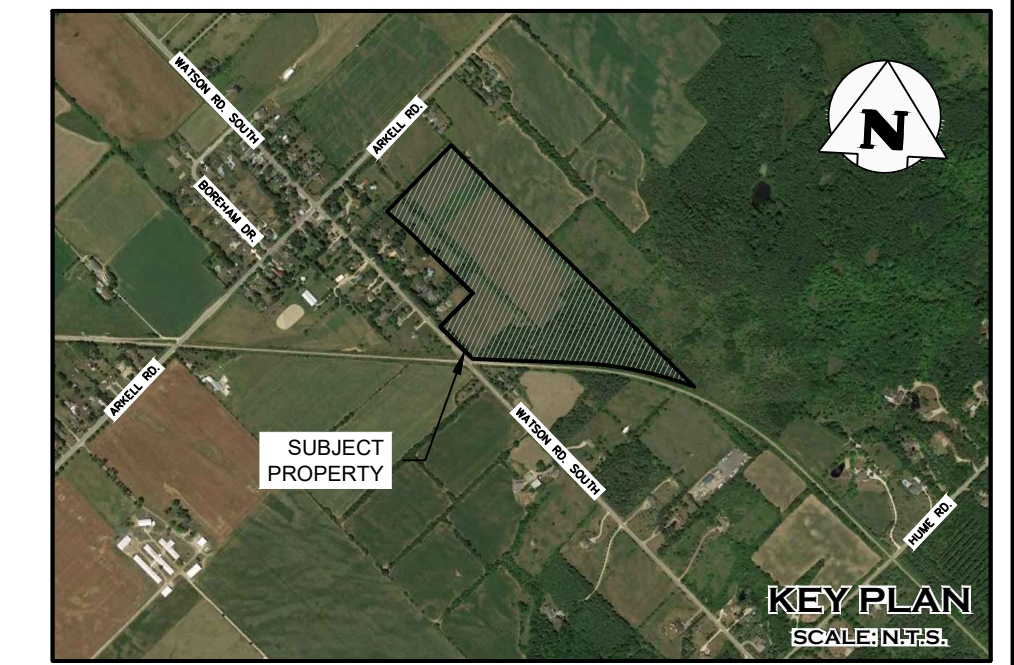
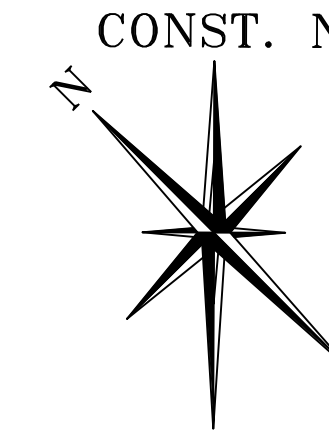
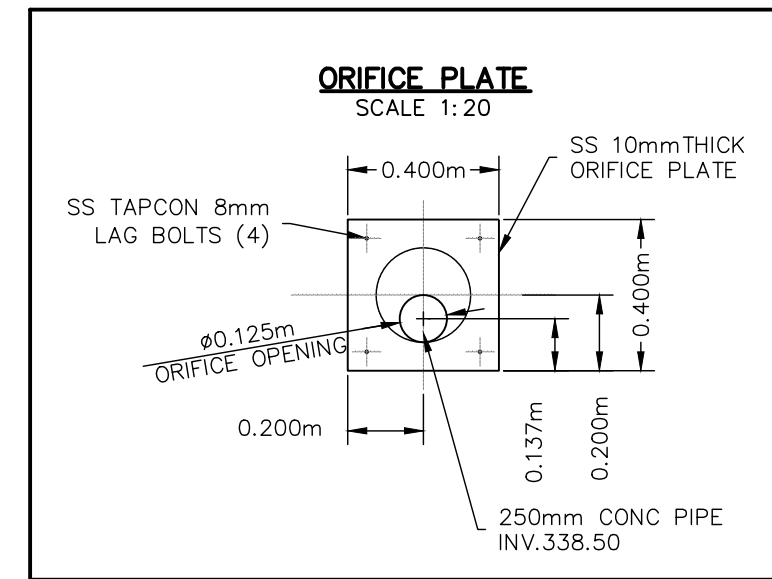
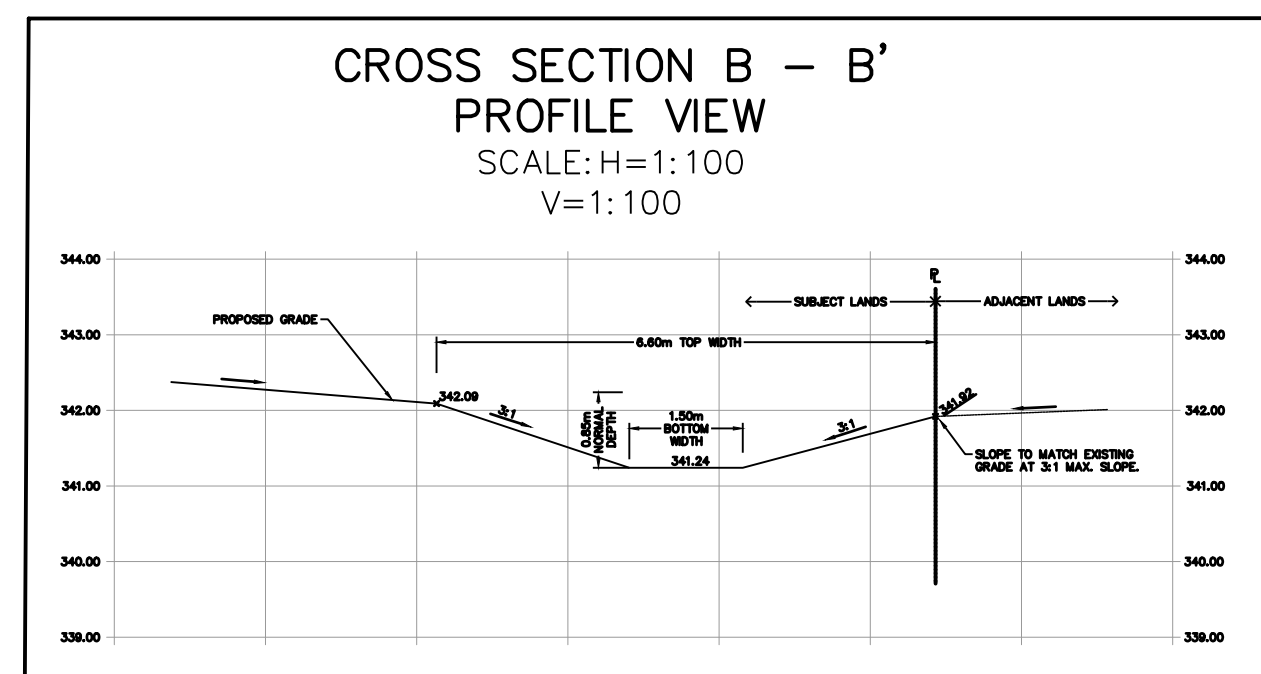
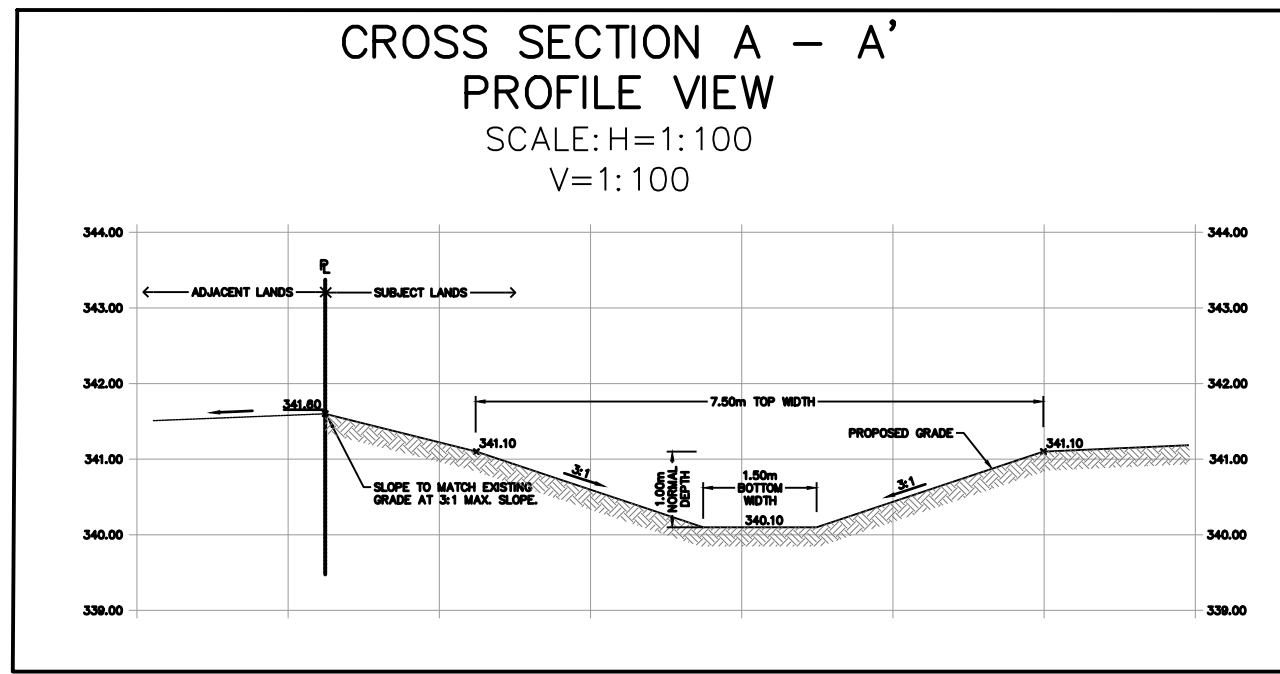
PROPOSED 1800mmx900mm
CONCRETE BOX CULVERT
TO CONVEY 100-YR PEAK FLOW IN SWALE

Project
**ARKELL SUBDIVISION
TOWNSHIP OF PUSLINCH**

Drawing
POST-DEVELOPMENT DRAINAGE PLAN

	55 WYNDHAM STREET NORTH UNIT NO. 215 GUELPH, ON N1H 7T8 548-708-0022 WWW.CFCROZIER.CA	
	Drawn By	Design By
Scale	Date	Check By
1:5000	FEB/20/2024	T.E.
Project		2433-6646
Drawing		FIG. 3





LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING GRADE
- PROPOSED GRADE
- PROPOSED GRADE (TO MATCH EXISTING)
- PROPOSED MINOR FLOW DIRECTION
- PROPOSED SLOPE (3:1 MAX.)
- PROPOSED CONTROL WEIR
- EXISTING OVERLAND FLOW DIRECTION
- PROPOSED OVERLAND FLOW DIRECTION
- PROPOSED SWALE FLOW DIRECTION
- PROPOSED LOT-LINE
- PROPOSED 80,000 LITRE UNDERGROUND FIRE TANK WITH FIRE DEPARTMENT CONNECTION
- PROPOSED CATCHBASIN
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED SINGLE / DOUBLE CATCHBASIN

REFER TO TOWNSHIP OF PUSLINCH STANDARD DRAWING STD-102 "TYPICAL URBAN CROSS-SECTION" FOR DIMENSIONS AND DETAILS OF PROPOSED ROAD CROSS-SECTION.

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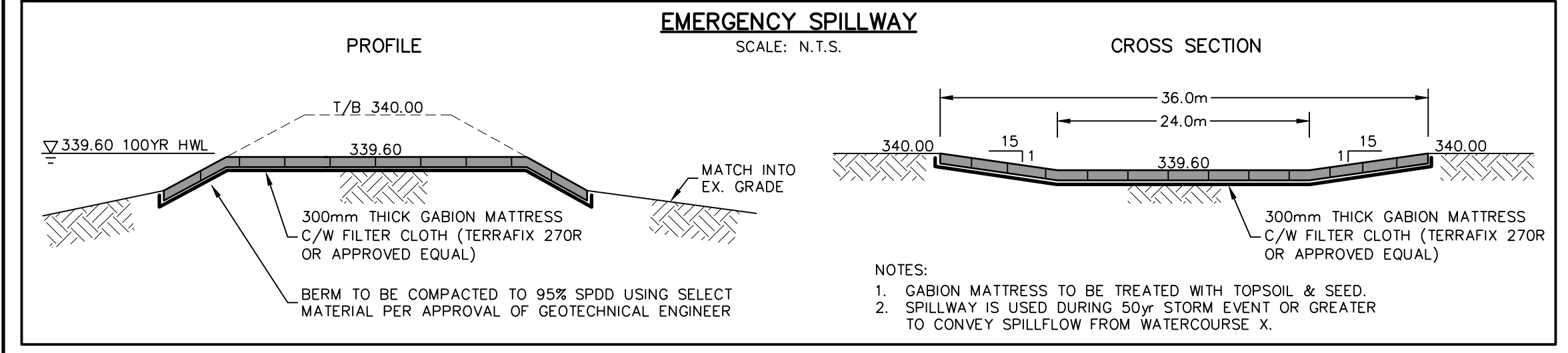
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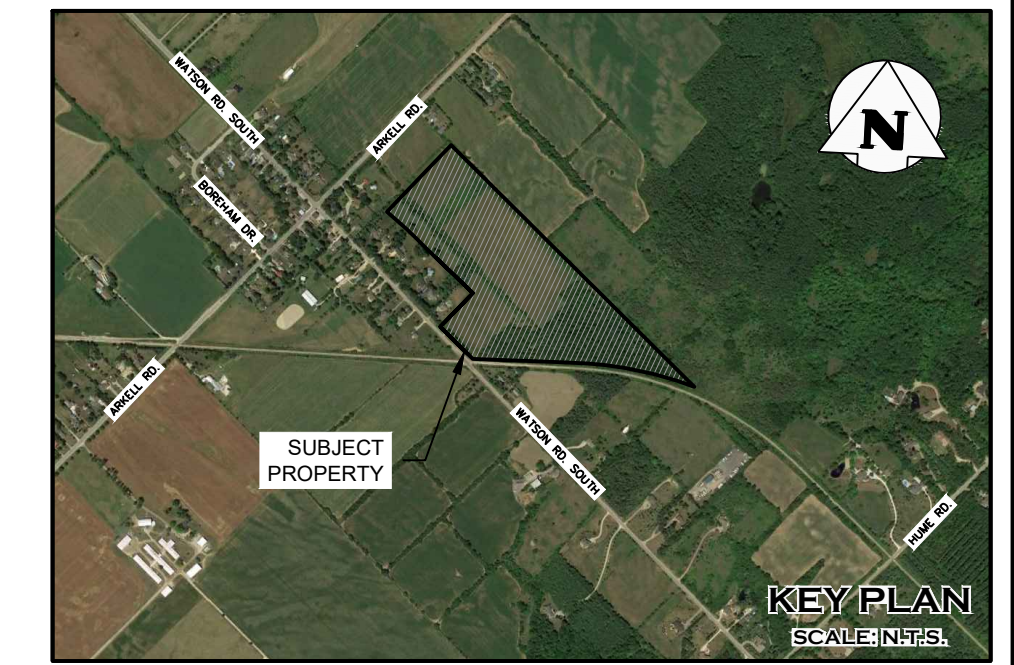
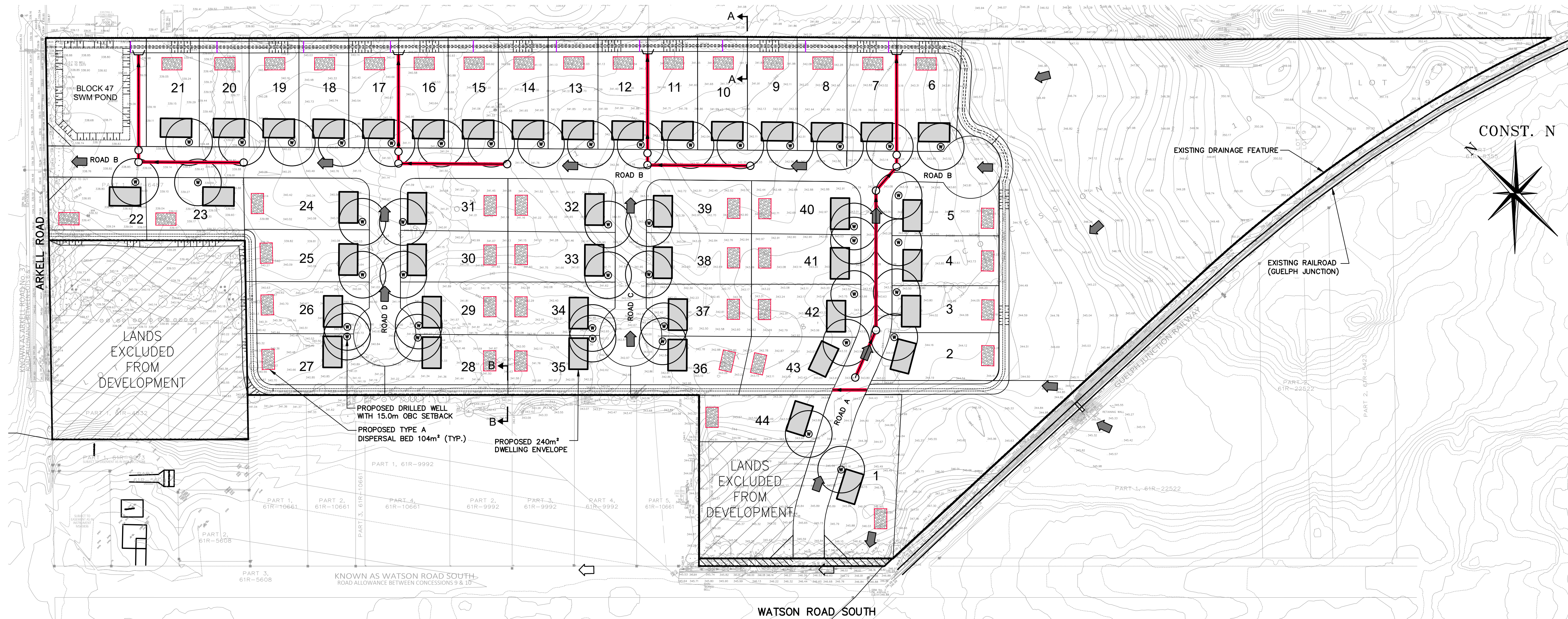


Project
WATSON ROAD SOUTH
TOWN OF PUSLINCH

Drawing
PRELIMINARY GRADING AND
SERVICING PLAN



Drawn	A.O.	Design	A.O.	Project No.	2433-6646
Check	J.B.	Check	J.B.	Scale	1:1500
				Dwg.	C101



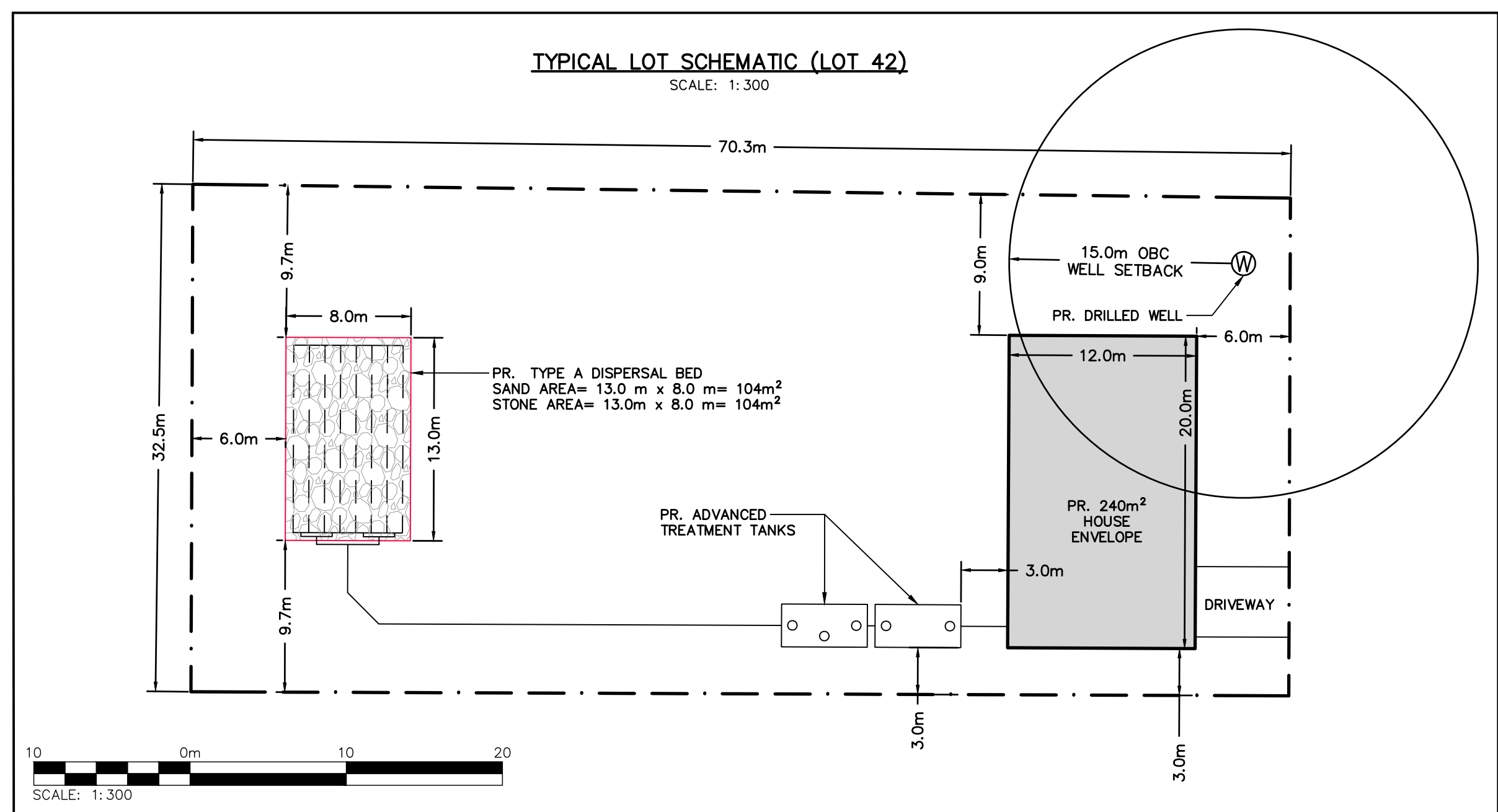
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Project
**WATSON ROAD SOUTH
TOWN OF PUSLINCH**

Drawing
ONSITE SEWAGE SERVICING SCHEMATIC

Drawn: E.G. Design: E.G. Project No. **2433-6646**
Check: M.B. Check: M.B. Scale: 1:1500 Dwg. **C102**

**AGRICULTURAL IMPACT ASSESSMENT
FOR ARKELL SUBDIVISION**

PREPARED FOR:

Timberworx Custom Homes Inc.
376 Maltby Rd. E,
Guelph, ON
&
Sloot Construction Ltd.
661 Watson Road S
Puslinch ON
&
John Sloot Investments Ltd.

PREPARED BY:



STOVEL AND ASSOCIATES INC.

651 Orangeville Road
Fergus, ON
N1M 1T9

January 2026

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1.0 INTRODUCTION

1.1 Site Location and Purpose

Stovel and Associates Inc. (“SAI”) was retained by Timberworx Custom Homes Inc. (Timberworx), Slood Construction Ltd. (Slood), and John Slood Investments Ltd. to complete an Agricultural Impact Assessment (“AIA”) of a proposed residential subdivision in the Township of Puslinch (Arkell). Additional lands have been conditionally purchased by the ownership group to provide for an entrance onto Arkell Road. These additional lands are approximately 1.6 ha in size and are owned by Victor Satzewich and Linda Mahood. The project is referred to as Arkell Subdivision. The lands in question (including the Satzewich/Mahood parcel) are approximately 18.8 ha in size and are located on Part of Lots 7, 8 and 9, Concession 10.

Watson Road abuts the property on the southeastern limits of the site and Wellington County Road 37 (also known as Arkell Road) is located on the west/northwestern limits of the site (see Figure 1).

In the context of this report, the lands in question are referred to as the site, subject lands or subject property.

The purpose of this AIA is to evaluate potential impacts on agriculture from the proposed residential subdivision and identify mitigation measures to abate these impacts to the extent feasible.

This report generally follows the direction provided with the Province’s *Draft Agricultural Impact Assessment Guidance Document*, released in March 2018 by the Ministry of Agriculture, Food, and Rural Affairs (“OMAFRA”), *Agricultural Impact Assessment (AIA) Guidance Document (Publication 861)* by the Ontario Ministry of Agriculture, Food and Agribusiness and the AIA direction set out in the County of Wellington Official Plan (“County OP”). The report also addresses the planning policies related to the consideration and protection of agricultural resources, as set out in the Provincial Planning Statement, 2024, and the County of Wellington Official Plan.

1.2 History

In 2006, Mr. Tom Kukovica (the owner of the subject property at the time) applied for Draft Plan of Subdivision, Official Plan Amendment and Zoning Bylaw Amendment. The applications were deemed complete in September 2006. The proposal included 35 residential lots (minimum 1 acre in size) serviced by private individual wells and septic systems. The application was circulated to public agencies for comment and to landowners within 120m of the site. Following the receipt of the comments, replies were prepared by the Kukovica consulting team.

Astrid J. Clos Planning Consultants (“AJC Planning”) conducted a review of the Municipal Comprehensive Review from The County of Wellington – Progress Report #3. The letter prepared by Astrid Clos. requests that the Proposed Kukovica Subdivision be considered as a Hamlet Expansion (March 19, 2021). The following excerpt from AJC Planning summarizes the proposal:

“JOHN SLOOD INVESTMENTS LIMITED and SLOOD CONSTRUCTION LTD. is the owner of the property abutting the Arkell Hamlet and is legally described as Part of Lots 7, 8 and 9, Concession 10, Township of Puslinch. County Official Plan Amendment, Zone Change and Draft Plan of Subdivision applications were deemed to be complete in September 2006 for this property.

Please find this documentation attached for your reference.

These applications propose to expand the Arkell Hamlet to the east by approximately 18.2 hectares and change the zoning to implement a proposed residential Draft Plan of Subdivision to permit 35 residential lots. The area breakdown is provided below:

1.65 hectares (area of 3 severed lots)

1.83 hectares (area within the Hamlet)

18.2 hectares (area of Hamlet expansion)

21.68 hectares (Total Draft Plan Area)”

In 2021, the current ownership group engaged with the Township of Puslinch and County of Wellington to resolve technical issues associated with the proposed development. Updated technical analysis was submitted to the municipality for technical peer review. The findings of these updated reports are summarized in this document. The updated reports include the following:

- *Planning Justification Report (SAI, 2026).*
- *Nitrate Impact Assessment (Crozier, 2024).*
- *Functional Servicing and Stormwater Management Report (Crozier, 2025).*
- *Groundwater Supply Assessment (ARL Groundwater Resources Ltd, 2023).*
- *Water Balance Assessment (Crozier, 2025).*
- *Traffic Impact Study (Crozier, 2025).*

This AIA incorporates relevant information from these aforementioned reports.

1.3 Data Collection and Review

In addition to the plans and reports that were specifically prepared for the submission of the planning applications, the following background materials were also reviewed:

- Soil data resource information which includes Ontario Soil Survey reports and mapping, the provincial digital soil resource database, Canada Land Inventory Agricultural Capability mapping, and information from on-site investigations;
- Aerial photography (historic and recent drone survey) with scale of 1:10,000 or smaller;
- OMAFRA's Agricultural System Portal for information on specialty crops, drainage, surrounding crops and livestock, etc.;
- OMAFRA's constructed and agricultural Artificial Drainage Mapping; and
- Parcel mapping/fabric of the area.

An agricultural land use survey was also conducted (2023 and 2024), with additional information gathered from Google Satellite Imagery. Aerial photographic mapping and roadside images have been utilized to gain a better understanding of the agricultural operations and activities in both the primary and secondary study areas (see Section 2.0). Farm Data Sheets were also delivered to all potential livestock operations in the Secondary Study area (Appendix A). A summary of the results of the agricultural land use survey is provided in Section 2.0 of this report.

1.4 Overview of Subdivision Proposal

The subject land is designated Hamlet, Prime Agricultural and Secondary Agricultural (Figure 2). The subject land is zoned Agriculture (Figure 3).

The proposed development is comprised of 44 lots suitable for the construction of single detached dwellings (See Figure 4 below). The lots are proposed to be created through a Plan of Subdivision. The residential lots will be serviced utilizing advanced tertiary septic systems and private, drilled individual wells. Proposed lot sizes range from approximately 0.2 to 0.4 ha in size (with one Block +/- 4.5 ha). Lot frontages range from 30-43 m, not including the lots on curves or cul de sacs. Each home is expected to have a double-car garage with additional parking for a minimum of two cars within each driveway.

The proposed development will have two entrances; one access onto Watson Road and one access onto Arkell Road. The road cross-section utilizes a urban section with pavement, curb, and gutter. The road section has been designed using a standard 20m right of way.

The internal road network sets out the following:

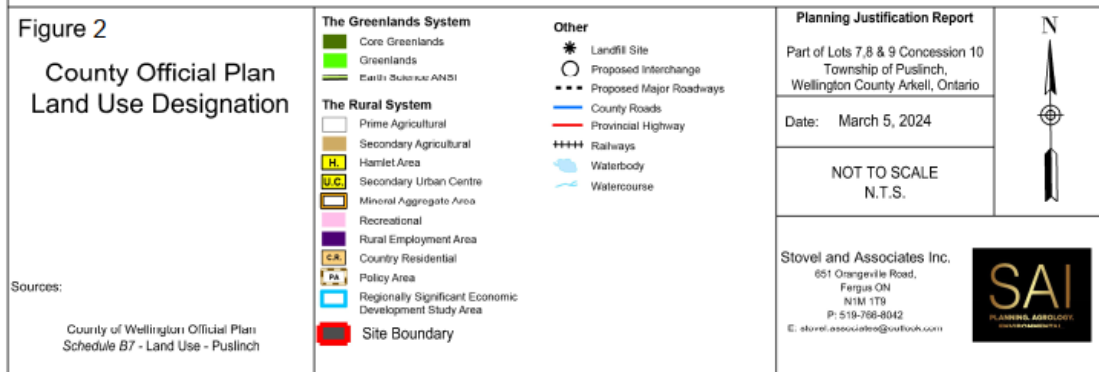
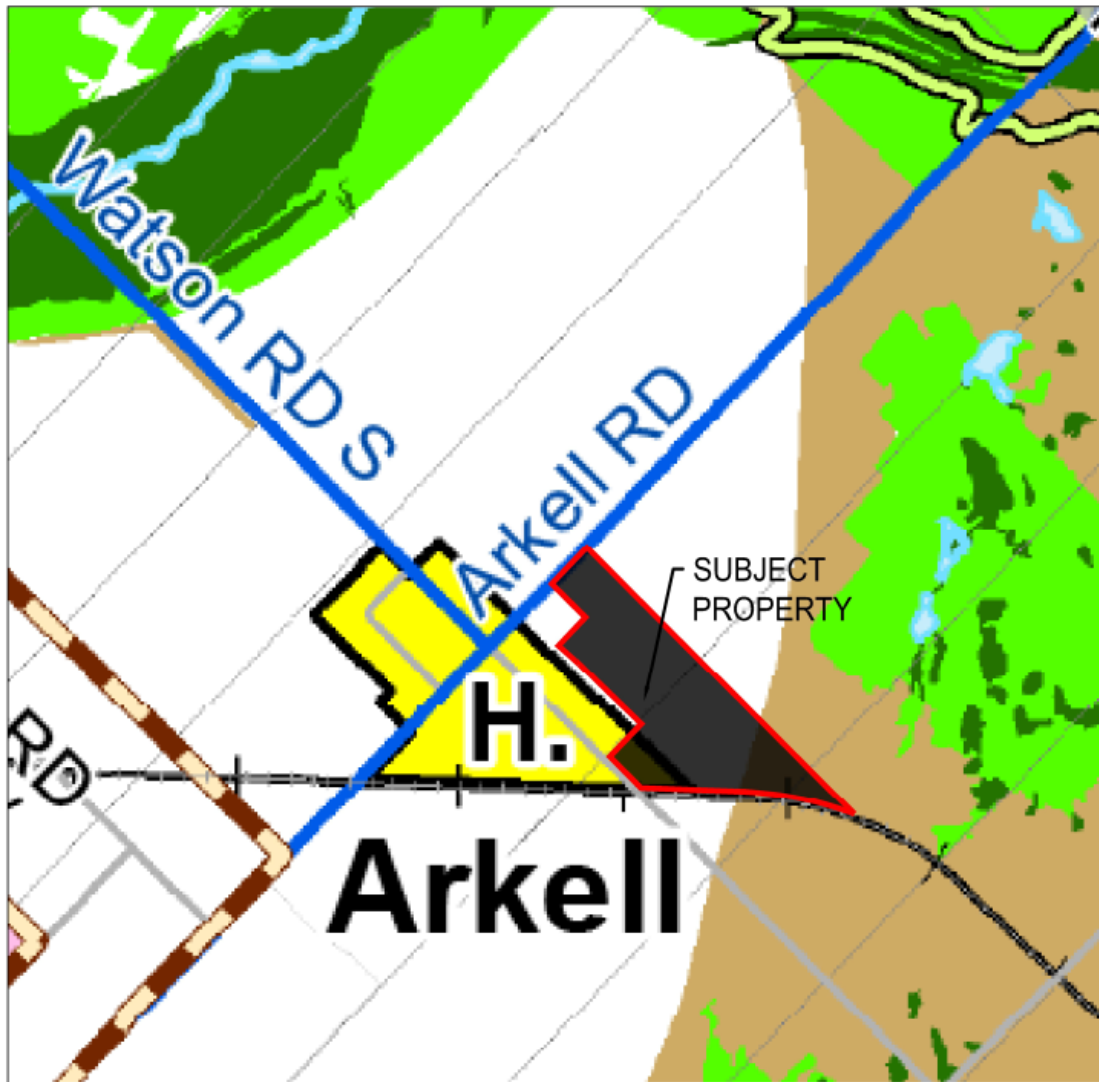
- There is approximately 1200m of road in the proposed subdivision;
- The roads are mainly double-loaded.
- Three cul de sacs are proposed.

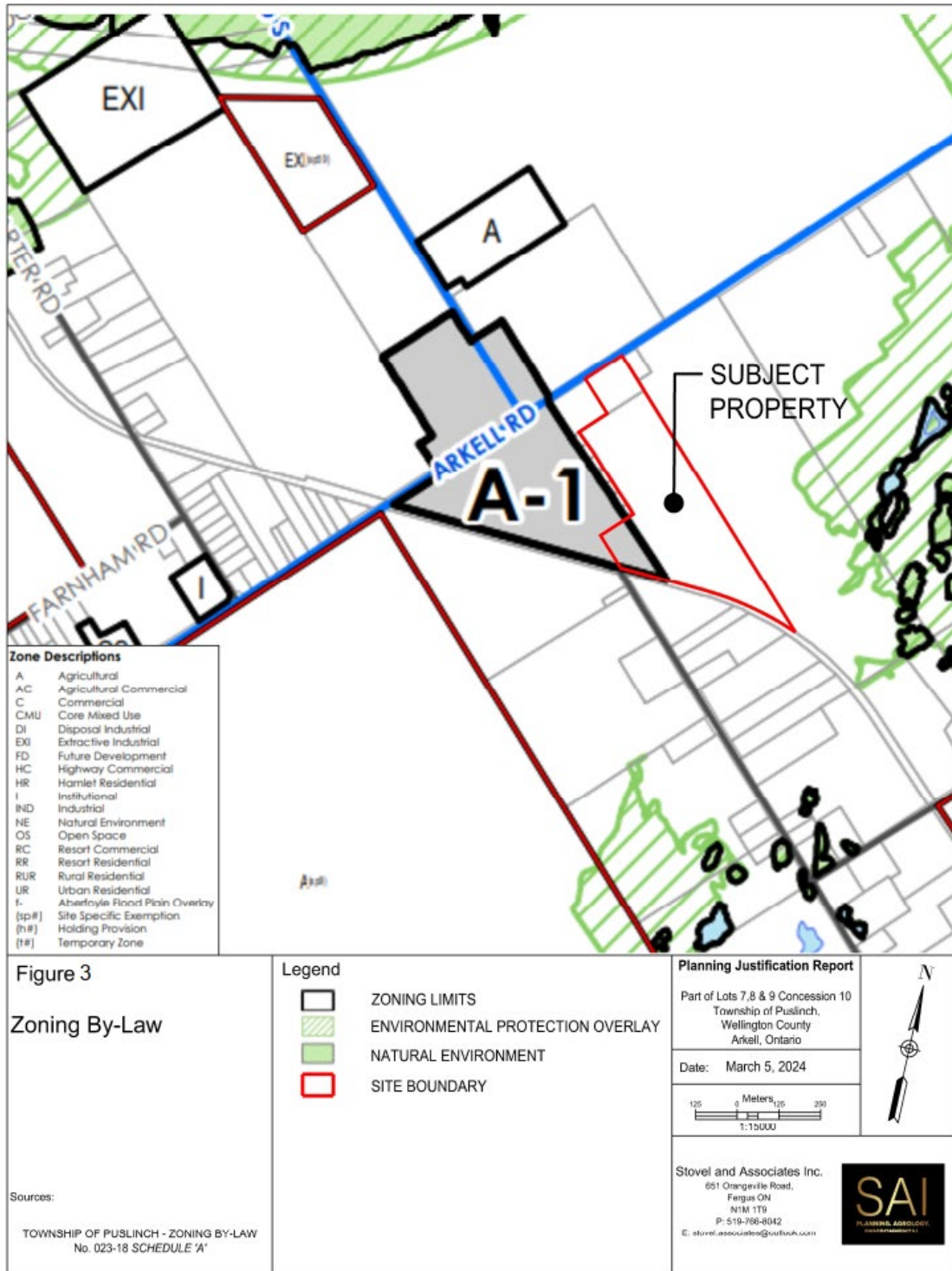
The engineering proposal includes design elements to capture additional runoff water and to promote infiltration. A stormwater management pond is proposed at the northeast portion of the site.

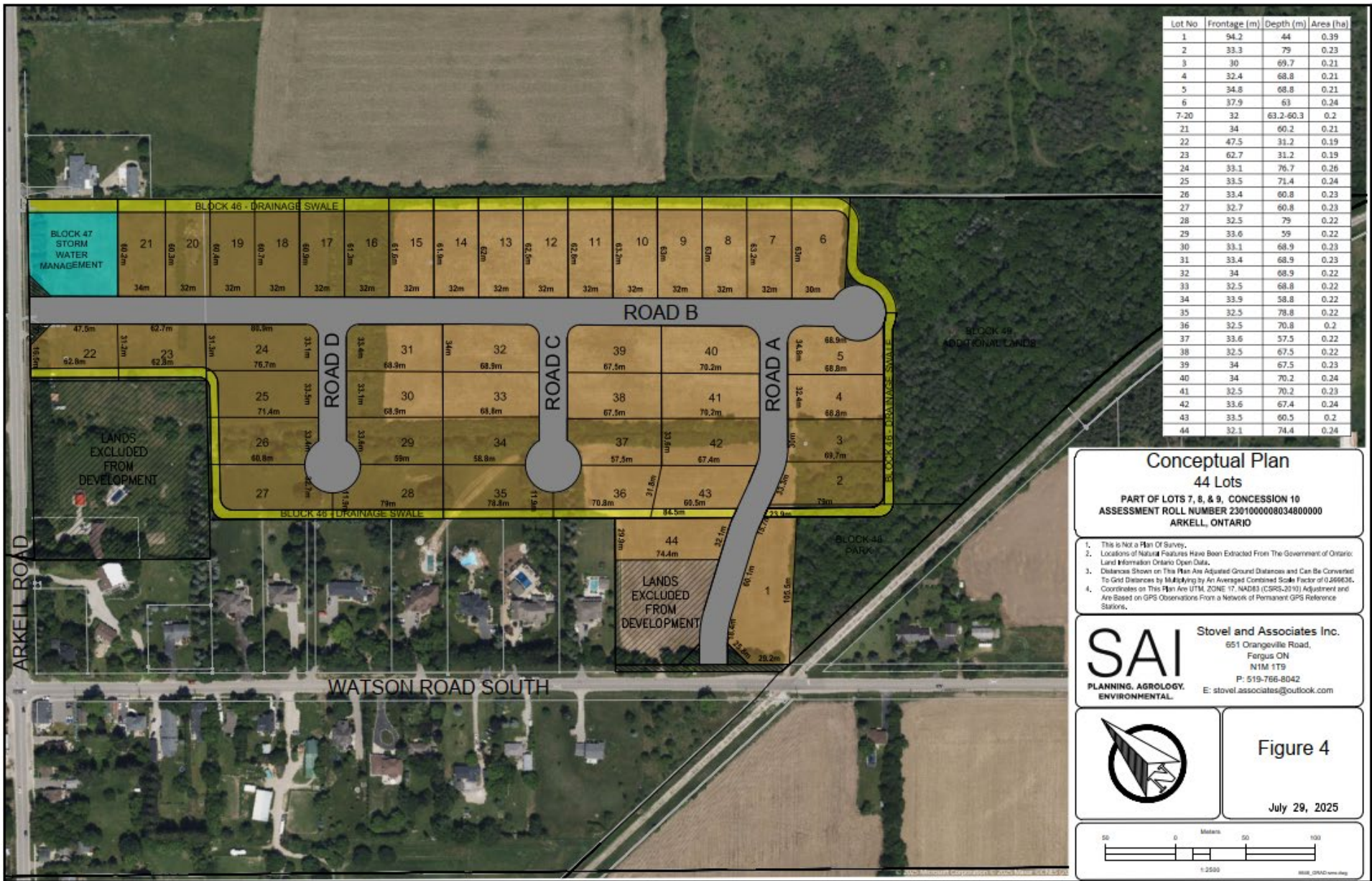
The current conceptual layout for the proposed development includes a Park in the southwestern portion of the site. Discussions with the municipality will be required to determine if a Park is required or if the municipality will require cash in lieu for parkland dedication.



<p>Figure 1</p> <p>Site Location</p> <p>Sources:</p> <p>Aerial Imagery Provided By Microsoft Corporation @ 2024 Maxar CNES (2024) Distribution Airbus DS.</p>	<p>Legend</p> <p> Site Boundary</p> <p> Hamlet of Arkell Limits</p>	<p>Planning Justification Report</p> <p>Part of Lots 7,8 & 9 Concession 10 Township of Puslinch, Wellington County Arkell, Ontario</p> <p>Date: March 5, 2024</p> <p>0 50 100 Meters 1:5000</p>	<p>N</p>
<p>Stovel and Associates Inc. 651 Orangeville Road, Fergus ON N1M 1T9 P: 519-766-8042 E: stovel.associates@outlook.com</p>			







2.0 DESCRIPTION OF AGRICULTURAL RESOURCE BASE

The following paragraphs describe the agricultural resource base on the site and surrounding area. The description is divided into the following categories:

- Agricultural land uses and agricultural operations.
- Parcel size.
- Soils and soil capability for agriculture.
- Microclimate; and
- Agricultural drainage.

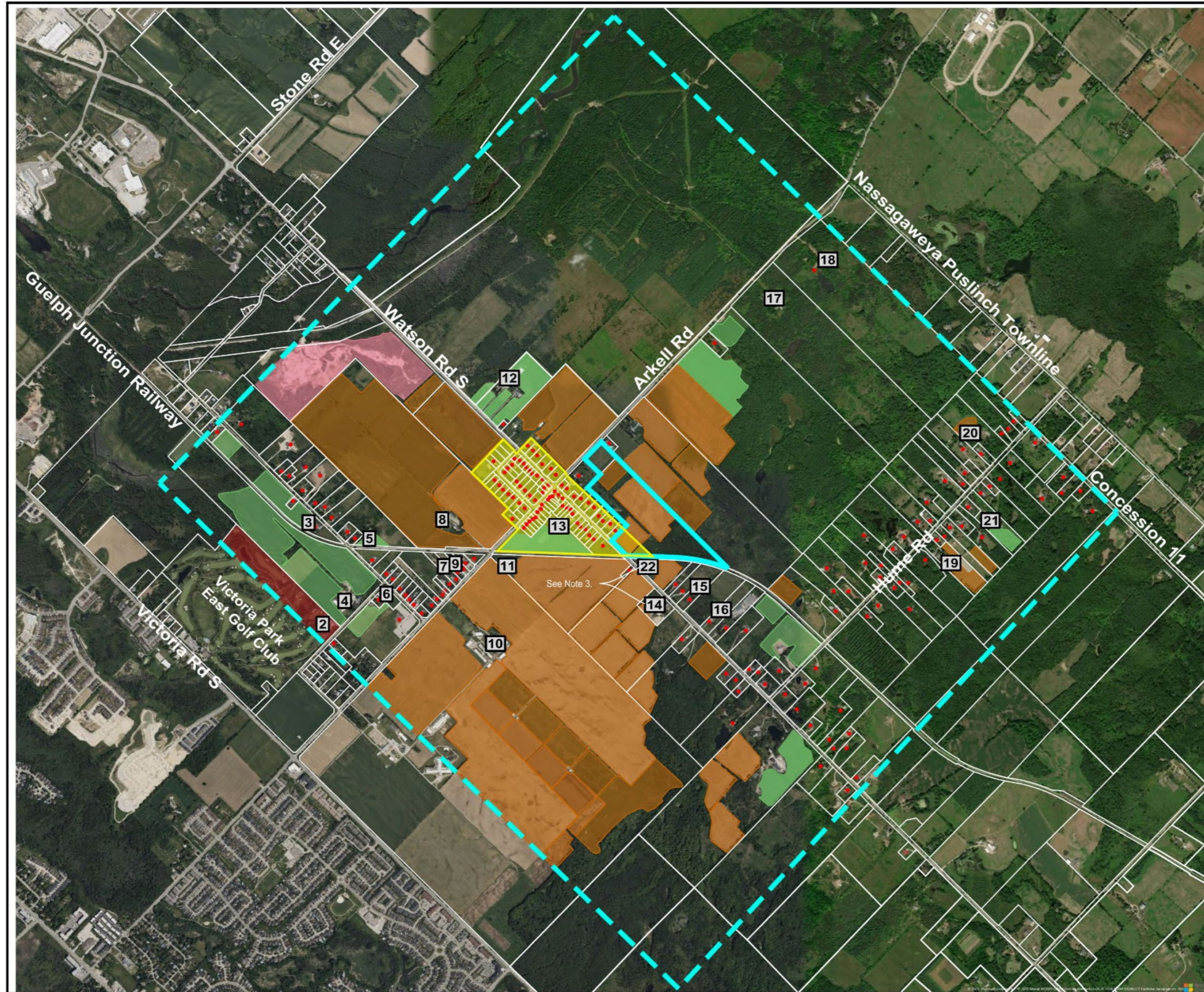
The examination is based on a study area comprised of a 'Primary Study Area' and a 'Secondary Study Area'. The Primary Study Area ("PSA") is the area for consideration for redesignation to a settlement area, or in this case, the PSA is the subject lands.

The Secondary Study Area ("SSA") includes a larger area surrounding the Primary Study Area. For this assessment, a SSA of approximately 1.5 km from the subject lands was established.

Figure 5 provides the Agricultural Land Use Map. Figure 5 identifies the adjacent properties, existing crops, barns, other forms of agricultural infrastructure, non-farm land uses, and residential structures within the SSA. The inventory of existing agricultural land uses, cropping patterns, and structures is based on observations made during reconnaissance surveys in 2023 and 2024. A review of historic aerial photography was also undertaken to confirm that the agricultural production patterns and livestock types in the Primary and Secondary Study Areas remain relatively consistent over the last two decades.

It is noted that a significant portion of the SSA is included in the settlement boundaries of Arkell. Approximately 30 Hectares of the SSA is included in the settlement boundary. Residential land uses predominate in this area. Over the past two decades, several residential units have been added to Arkell, including a subdivision in the northwestern portion of Arkell.

Accompanying the Agricultural Land Use Map is an Agricultural Operations Summary. Each agricultural operation that was observed in the field was summarized. The description of these operations includes the following: type of operation, associated crop type, a brief description of onsite infrastructure, and other related notes about the agricultural operation. Appendix B provides a photograph of the agricultural operation noted on the Agricultural Land Use Map.



Agricultural Land Use Map Figure 5

Agricultural Impact Assessment
Part of Lots 7, 8 & 9 Concession 10
Township of Puslinch,
Wellington County
Arkell, Ontario

Legend

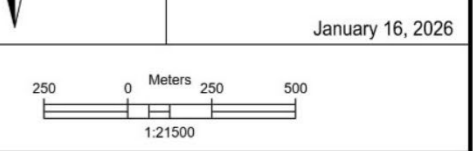
- Subject Lands (Primary Study Area)
- Secondary Study Area
- Hamlet
- Agricultural Operation Number
- Non-Agricultural Uses**
 - Aggregate Extraction
 - Non-farm Residence
 - Woodland / Old Field / Scrubland
 - Victoria Park East Golf Course
- Cropping Pattern**
 - Row Crop
 - Pasture/Forage
 - Cultivated

Notes

1. PROPERTY BOUNDARIES AND DELINEATION OF THE ARKELL HAMLET BOUNDARY HAVE BEEN EXTRACTED FROM WELLINGTON COUNTY BASE DATA.
2. AIRPHOTO - 2026 MICROSOFT CORPORATION & MAXAR CNES AIR DISTRIBUTION AIRBUS.
3. AGRICULTURAL OPERATIONS NO. 22 AND 14 HAVE BEEN REMOVED SINCE THE INITIAL FIELD VISIT.
4. CITY OF GUELPH, MAXAR, CITY OF GUELPH, PROVINCE OF ONTARIO, ESRI CANADA, ESRI, TOMTOM, GARMIN, SAFEGRAPH, GEOTECHNOLOGIES, INC, METI/NASA, USGS, EPA, NPS, USDA, NRCAN, PARKS CANADA.

SAI
PLANNING. AGROLOGY.
ENVIRONMENTAL.

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January 16, 2026

2.1.1 Primary Study Area – Agricultural Land Use

The Primary Study Area (PSA) includes the subject lands. No active agricultural buildings or other forms of capital investment related to agriculture are located onsite.

There are no agricultural operations in the PSA.

Agricultural land uses comprise approximately 7.1 ha or 41 % of the PSA. The agricultural uses within the PSA are primarily cash crop land. Additional land uses on the PSA include old fields, hedgerows, and a plantation.

The land uses immediately adjacent to the PSA include:

- Residential lots in Arkell,
- Non-farm residential units,
- Guelph-Junction Railway corridor,
- Old fields,
- Plantation/Woodlands/Scrublands, and
- Common Field Croplands.

2.1.2 Secondary Study Area – Agricultural Land Use

The Secondary Study Area (SSA) includes a portion of the Hamlet of Arkell and several non-agricultural land uses (i.e. rural residential lands, recreational lands associated with the GRCA-operated Starkey's Hill (37 ha), a gravel pit and old field/reforestation area managed by the City of Guelph). Several active agricultural or agricultural-related operations, including agricultural research station associated with the University of Guelph. This operation is described as follows:

- 700 Acres
- Horses:
 - 60 Medium-framed
 - Manure Type: V1 (Very Low Storage Odour Potential, Solid, inside, bedded pack) + V2 (Very Low Storage Odour Potential, Solid, outside, covered).
- Swine:
 - 350 Sows with litter
 - 120 Breeder gilts
 - 1000 Weaners
 - 500 Feeders
 - Manure Type: V5 (Very Low Storage Odour Potential, Liquid, inside, underneath slatted floor) + M1 (Medium Storage Odour Potential, Liquid, outside, no cover, straight walled storage)
- Chickens:
 - 6000 Layer Hens
 - 3000 Layer Pullets
 - 1000 Broiler breeder growers
 - 1000 Broiler breeder layers
 - 3000 Broilers on any length of cycle
 - Manure Type: V2
- Turkeys
 - 500 Broilers
 - 500 Hens
 - 500 Toms

- Manure Type: V2
- Unoccupied Livestock Barn:
 - 1000 Housing Capacity
 - Manure Type: V1 + V2

The residential and commercial/institutional uses associated with the settlement of Arkell exist west and north of the site.

Table 1 provides a summary of agricultural cropping systems in the Secondary Study Area. There are no speciality crop lands on the subject property or in the Secondary Study Area. The area estimates associated with this Table are derived from field investigations conducted by SAI and supplemented by background mapping and aerial photography.

Table 1 - Summary of Agricultural Cropping Systems

Crop Type	Subject Lands (ha)	%	Subject Lands Within Hamlet (ha)	%	Secondary Study Area (ha)	%	Totals (ha)	%
ROW CROP	7.1	41.0%	1.1	73.0%	281.2	20.6%	289.4	21.0%
PASTURE/FORAGE	0.0	0.0%	0.0	0.0%	56.4	4.2%	56.4	4.1%
SMALL GRAINS	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
SPECIALTY CROP	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
REMAINING AREA	10.2	59.0%	0.4	27.0%	1023.0	75.2%	1034	75.0%
TOTAL	17.3	100.0%	1.5	100.0%	1361.0	100.0%	1379.8	100.0%

The Agricultural Land Use mapping and aerial breakdown in Table 2 illustrates that this portion of the Township of Puslinch is representative of a non-prime agricultural area. The extent of non-agricultural land uses is significant. Overall, both the Primary and Secondary Study Areas are not representative of normal agricultural production land uses in the Township of Puslinch and County of Wellington.

The University of Guelph research facility (which is approximately 800 m south west of the subject property) represents the most significant agricultural use and agricultural-related use in the Secondary Study Area.

Background information (OMAF. Ontario Agricultural Systems – Dairy Cattle and Milk Production Heat Map) indicates a dairy farm at 86 Farnham Road. However, a recently obtained Farm Data Sheet (October 17, 2022 – Appendix A) for this property indicates that there is no livestock at the property and all structures are used for hay and equipment storage purposes.

A review of environmental approvals for agricultural purposes indicates that there are no Permits to Take Water for agricultural use in the SSA and there is a Pesticides Operator at 142 Hume Road.

2.2 Parcel Size

Parcel size mapping was reviewed for the PSA and SSA. The PPSA and SSA are highly fragmented due to historic severance activity in the area. In addition, both the PSA and SSA are included in the Hamlet of Arkell. In addition, the GJR has also resulted in a severed (and oddly shaped) parcel fabric for a portion of the PSA and SSA.

The two largest parcels in the SSA are owned by government institutions, not farmers. The largest parcel in the SSA is owned by the City of Guelph and is not used for agricultural production (310.4 ha). The University of Guelph Research facility is set on a land base of 245.83 ha.

The minimum farm parcel size in the Prime Agricultural Area (as set out in the County of Wellington Official Plan) is 34.4 ha. The average parcel size in the SSA is 6.1 ha and the average size of agricultural parcels in the SSA is 28.1 ha.

Based on an analysis of the property fabric data, it is concluded that the PSA and SSA is fragmented with a significant proportion of non-local ownership. The parcel size and land ownership characteristics of the PSA and SSA are not consistent with a prime agricultural area.

2.3 Soil and CLI – Soil Capability for Agriculture

Soils in the Secondary Study Area consist of three soil series: Dumfries sandy loam, Burford loam, and Guelph loam. The following description of these soils has been taken from the Soil Survey of Wellington County. Report No. 35. of the Ontario Soil Survey (1963). Figure 6 illustrates the soils mapped in the Secondary Study Area, and the associated Canada Land Inventory – Soil Capability for Agriculture classification for these soil series. Based on this background mapping, approximately 53.6% of the Secondary Study Area is mapped as prime agricultural lands. The PPS defines prime agricultural land as *specialty crop areas and/or Canada Land Inventory (CLI) Class 1, 2, and 3 lands, as amended from time to time, in this order of priority for protection*. This estimate does not exclude lands that have been removed from agricultural production, such as residential lots associated with the Hamlet of Arkell or rural residential lots.

Dumfries loam

“The Dumfries soils have developed from stony soil material derived mainly from limestone. The material is therefore calcareous and free carbonates can be found at depths of 18 to 24 inches except in places of severe erosion where they occur at the soil surface.

The topography is hilly; slopes are steep, irregular and short; depressions or "potholes" are common. Since water runs rapidly off the steep slopes or readily percolates through the stony materials the Dumfries soils are well drained. However, within the areas shown on the soil map there are often areas of poorly drained soils too small to be delineated. These potholes contain water during a large part of the year, cannot be easily drained and therefore are not arable.

Surface erosion has occurred on most of the cultivated slopes. Indeed, the soil loss has been so great on many of the knolls that the whole profile has been removed and only the light grey parent materials remain. Erosion is slight where the land has been kept under grass or tree cover. Stones and boulders are numerous both on the surface and throughout the soil mass. As a result, stone removal becomes an annual chore and the presence of frequent stone piles interferes with cultivation.” (Pages 23-24).

Within the Secondary Study Area, background mapping illustrates the location of the Dumfries loam in the southern and eastern portion. Mapping of Canada Land Inventory (“CLI”) – Soil Capability for Agriculture illustrates these soils as Class 6T and Class 3FM (50%)/Class 5PT (50%) (AgMaps, 2024). The southern portion of the subject lands is mapped as Dumfries sandy loam with a complex polygon unit of Class 3FM/Class 5PT.

The Burford loam soils occur over much of the Secondary Study Area, including the subject lands.

“Burford loam soils are well-drained, consisting of loam surface horizons on gravel deposits. The gravel was deposited by glacial meltwaters in the form of spillways that are most common in the southern part of the County the largest of which occurs on the terraces that border the Speed River. The deposits are stratified with a considerable range in the size of the material from one stratum to another. The materials vary in size from fine sand to cobbles and where these deposits occur adjacent to the stony till of the Dumfries soils, strata consisting of large stones are found.

The topography is gently undulating except along the edge of the terraces where slopes are often steep. Gravel, stones, and cobbles are usually present on the soil surface and throughout the soil profile but they usually do not interfere with cultivation. Where the loam surface is thin stones are more numerous and may interfere with cultivation, especially in those areas associated with the Dumfries soils.

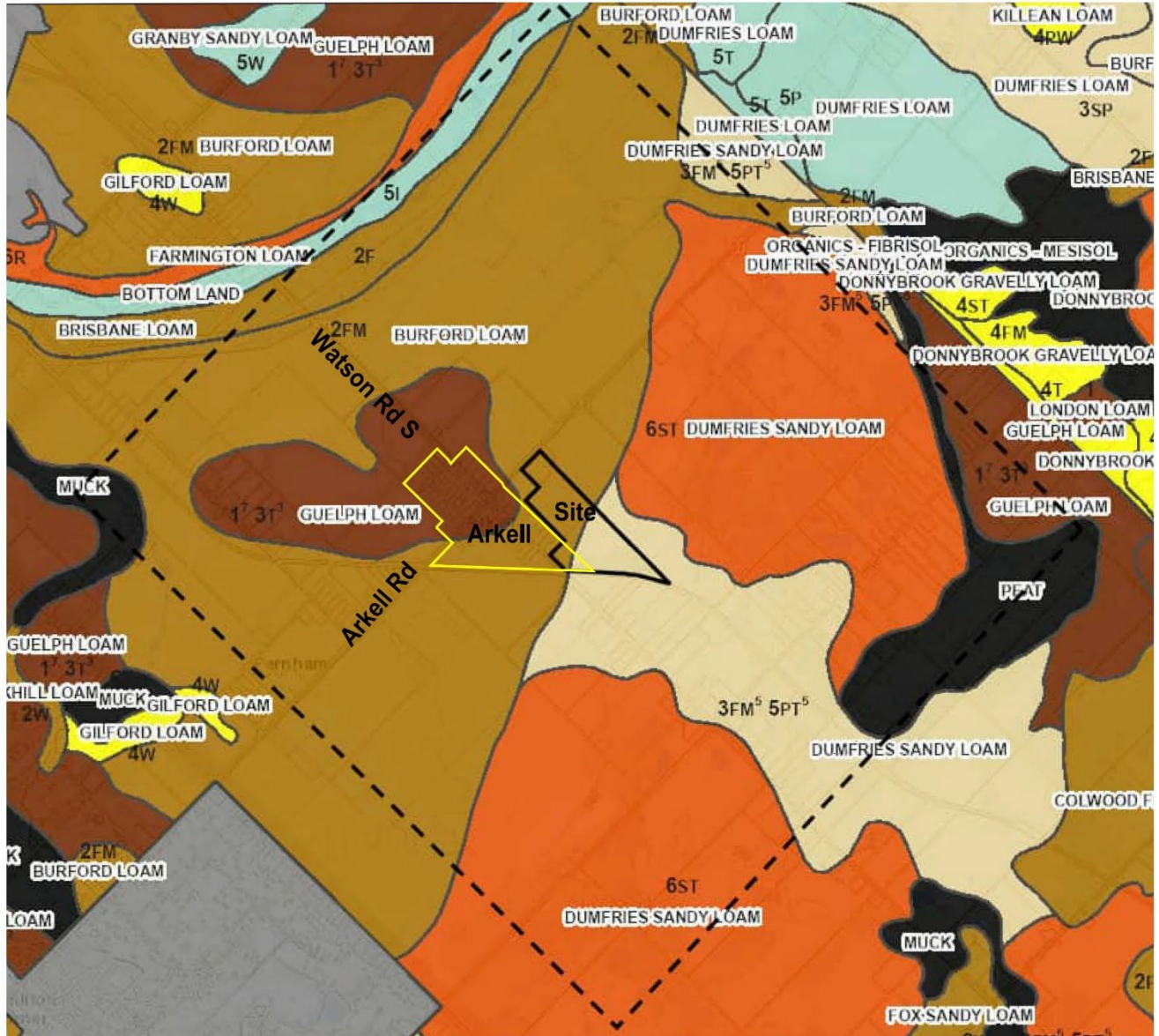


Figure 6
CLI Soil Capability for Agriculture

Legend

- Subject Lands (Primary Study Area)
- - - Secondary Study Area
- Hamlet of Arkell Limits

Soil Capability for Agriculture

- Unclassified
- Class 1
- Class 2
- Class 3
- Class 4
- Class 5
- Class 6
- Class 7

Agricultural Impact Assessment

Part of Lots 7, 8 & 9 Concession 10
Township of Puslinch,
Wellington County
Arkell, Ontario

Date: January 16, 2026

0 200 400
Meters
1:31961.364



Sources:
SHAPEFILE PROVIDED BY THE ONTARIO
MINISTRY OF AGRICULTURE, FOOD AND RURAL
AFFAIRS (OMAFRA) AGMAPS (2024).

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The Burford soils are classified as Grey-Brown Podzolic and have a very dark greyish-brown surface soil about four inches thick. Immediately below the surface is a yellowish-brown Ae horizon which is thin and slightly acidic. As in many Grey-Brown Podzolic soils, this horizon is browner in the upper portion than in the lower. However, in cultivated fields the brown layer is often absent and the horizon is a uniform colour. The B horizon is always located immediately above the calcareous gravel. It is dark brown and contains a considerable concentration of translocated clay. The depth of the profile to the underlying gravel varies from 12 to 30 inches within very short distances.

The Burford soils are producing crops such as spring grains, winter wheat, hay, pasture, and silage corn. They are suitable for orchards and certain canning crops but are not being used for these crops to any great extent. For the most part, the agriculture on these soils is of the generalized type. Dairying is not developed intensively except in the vicinity of Guelph where there is a continuous demand for dairy products. The underlying gravel is in demand for the construction of highways and county roads and the manufacture of certain building materials. Most of the deposits are deep and well-sorted. Large gravel pits are located on the outskirts of Guelph.

Because of the open nature of the Burford soils, moisture deficiencies exist during every growing season. The Burford soils also have a low to medium content of essential plant nutrients.” (Pages 34-35).



Within the Secondary Study Area, background mapping illustrates the location of the Burford loam in the western and northern portions. On the subject lands, the Burford loam is mapped in the north-central portion of the site. Background mapping of CLI-Soil Capability for Agriculture illustrates these soils as Class 2FM.

Guelph loam

The Guelph loam soils occur around the City of Guelph. Within the Secondary Study Area, Guelph loam soils are mapped in proximity to the settlement of Arkell (north and northwest of the settlement). Guelph loam soils are amongst some of best agricultural soils in Ontario.

“The Guelph loam soil parent material consists of glacial till derived from the grey and brown limestones of the underlying rock strata. The soils are predominantly loams although some small areas of sandy loam occur east of Oustic. The higher sand content in these soils may be due to the influence of the outwash sands that completely surround them.

In general, there are very few field stones or boulders; the only handicap to cultivation is the frequency and steepness of slopes. The soils are well drained both internally and externally but retain adequate amounts of moisture for the needs of crops. Erosion hazard is great on the steep slopes.

The surface soil is dark greyish brown and moderately high in organic matter content. Below the surface layer is a brown layer which becomes lighter in colour with depth and rests on a dark brown to dark yellowish brown layer containing more clay than the layers above or below it. The depth of soil to the unaltered parent material is approximately twenty-four inches except where water erosion has removed the upper portion of the soil. The Guelph soils are classified as Grey-Brown Podzolic.” (Page 25).

Table 2: Canada Land Inventory – Soil Capability for Agriculture

CLI CLASS	SSA (ha)	%	PSA (ha)	%
Class 1	72.7	5.3%	0.0	0.0%
Class 2	548.3	40.3%	8.9	47.3%
Class 3	101.4	7.5%	4.2	22.3%
Class 4	0.0	0.0%	0.0	0.0%
Class 5	90.6	6.7%	4.2	22.3%
Class 6	459.4	33.8%	0.0	0.0%
Class 7	0.0	0.0%	0.0	0.0%
Class O	58.6	4.3%	0.0	0.0%
Hamlet	30.0	2.2%	1.5	8.1%
Total	1361	100.0%	18.8	100%

2.4 Microclimate for Speciality Crop Production

Climate data from the OMAFRA document titled “*Agronomy Guide for Field Crops - publication 811 (June 2009)*” was reviewed. The subject lands are located within 2700-2900 average accumulated crop heat units (CH-MI) available for corn production in Ontario. The crop heat units (CHU) index was originally developed for field corn and has been in use in Ontario for 30 years. The CHU ratings are based on the total accumulated crop heat units for the frost-free growing season in each area of the province. CHU averages range between 2500 near North Bay to over 3500 near Windsor. The higher the CHU value, the longer the growing season and the greater the opportunities for growing high-value crops. The subject property is located within the 2700-2900 average accumulated crop heat units (CH-MI) and as such, the agricultural lands are not subject to special climate conditions. Given the typical climatic conditions, there are limited opportunities for growing specialty crops on a large commercial basis in the Secondary Study Area and therefore there are no properties that have been identified as a specialty crop area in the County of Wellington Official Plan (as they do not meet the criteria as identified by the Province).

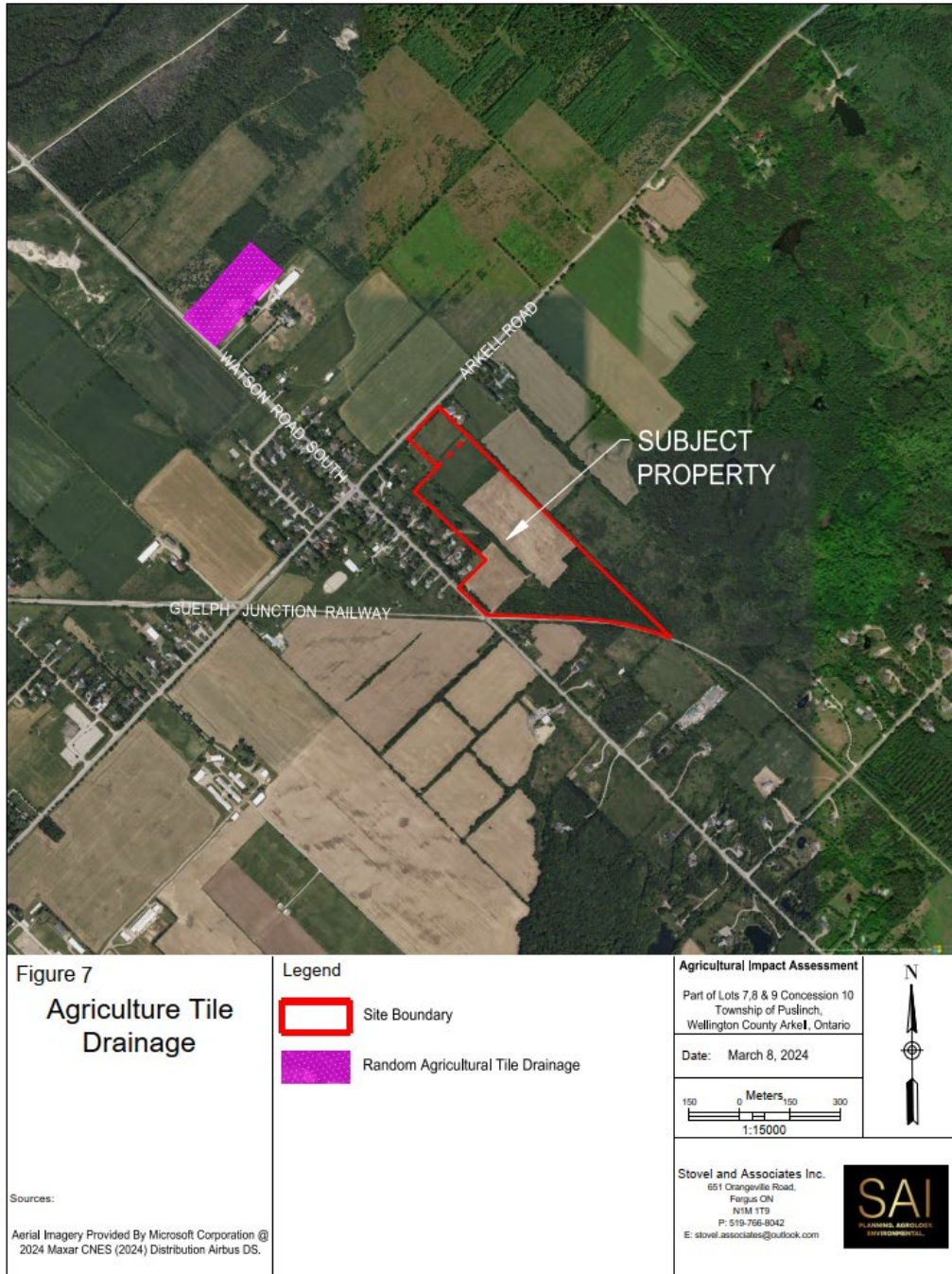


Figure 1-1. Crop heat units (CHU-M1) available for corn production.

This map is based on weather data from 1971–2000 with a common season start date across the province of May 1.
 Source: Weather Innovations Inc. (WIN)

2.5 Agricultural Tile Drainage

Figure 7 illustrates the distribution of tile drainage (random tile drainage) in the study area. There are no systematic tile drainage or constructed drains in the Secondary Study Area. Approximately 4.25 ha of random tile drainage are reported in the Secondary Study Area. The subject lands are not tile drained



3.0 IMPACT ASSESSMENT AND MITIGATION MEASURES

The following section discusses the potential for agricultural impacts resulting from the proposed mineral aggregate operation. The impact assessment has been subdivided into two sections: direct impacts and indirect impacts. Mitigation measures are described, where relevant, to ensure that the impact on agriculture is minimized.

3.1 Direct Impacts

Direct impacts relate to considerations such as the removal of agricultural structures and infrastructure related to agriculture and the consumption of agricultural lands.

Agricultural Structures

The proposed residential subdivision will not result in the removal of any agricultural structures or infrastructure related to agriculture.

No mitigation measures are required.

Consumption of Prime Agricultural Lands in a Prime Agricultural Area

The proposed develop would result in the consumption of approximately 13 ha of Class 2-3 soils. A portion of these lands are already located within the Hamlet of Arkell settlement area.

The agricultural capability of soils on the site is comparatively low due to inherent low fertility and moisture holding deficiencies. The lands associated with the Paris Galt Moraine (south and east of the site) are constrained by steep, undulating topography and are not considered to be prime agricultural lands. The orientation and size of the remaining agricultural fields is relatively small, and the lands are not considered to be large enough to be a viable farm parcel.

As previously stated, the subject lands and the SSA are highly fragmented and not reflective of a prime agricultural area when compared with prime agricultural areas in the County of Wellington and Township of Puslinch.

Consideration of Alternative Locations

Alternative locations were assessed by SAI for a Proposed Expansion of the Hamlet of Arkell. (SAI, Jan 06, 2023 – Letter Report submitted to Meagan Ferris, Manager of Planning and Environment). A copy of this report is included in Appendix C.

Six properties were selected for comparison purposes. Each parcel immediately abuts the existing Hamlet boundary. All six parcels are comprised of higher-capability agricultural lands than the subject property. From an agricultural perspective, the subject property represents the lowest priority option for protection.

It is important to recognize that existing, active livestock operations are located on lands north and west of the Hamlet of Arkell. There is an existing horse farm to the north of Arkell. The MDS I setback from this facility would impact potential settlement expansions in this general area. The University of Guelph agricultural research farm is located west of Arkell. The MDS I setback for westerly expansion of Arkell would not be feasible given the size of this livestock operation. The subject lands are not impacted by MDS I setbacks.

3.2 Indirect Impacts

Indirect impacts relate to the potential for creating land use conflicts with adjacent agricultural operations and the potential for influencing water levels/wells, traffic, noise. These are addressed in the following paragraphs.

Land Use Conflicts

Land use conflicts can occur when non-agricultural land uses are established in agricultural areas. The main type of concern relates to odour, and in Ontario, OMAFRA has developed the Minimum Distance Separation (MDS) formulae to identify potential land use conflicts. MDS I setbacks are calculated based on several factors such as the size of livestock operation (i.e. livestock numbers and/or size of land base of the farm), type of livestock operation, method of storing manure, and the type of non-agricultural land use being proposed.

As previously noted, agricultural operations in proximity to the subject property were inventoried. Farm Data Sheets were delivered to all agricultural operations. Livestock operations were identified on the Agricultural Land Use Map (Figure 5). There are no livestock operations mapped in proximity to the subject property.

Several small livestock operations were recorded in the Secondary Study Area, including:

- #5 – small hobby farm (horse),
- #12 – large equestrian facility,
- #13 – small hobby farm (horse),
- #14 – barn has been removed,
- #22 – structure has been removed.

MDS I setbacks will not impact the proposed development given that existing non-agricultural land uses exist closer to the livestock facilities than the proposed development (MDS Guideline #12). As well, MDS I provisions do not apply within the Hamlet designation (MDS Guideline #36).

#12. Existing Uses that Do Not Conform to MDS

An MDS I setback is required for proposed development or dwellings, even though there may be existing or approved development or dwellings nearby that do not conform to MDS I requirements.

However, a reduced MDS I setback may be permitted provided there are four, or more, non-agricultural uses, residential uses and/or dwellings closer to the subject livestock facility than the proposed development or dwellings and those four or more non-agricultural uses, residential uses and/or dwellings are:

- *located within the intervening area (120° field of view shown in [Figure 4](#) in Section 7 of this MDS Document) between the closest part of the proposed development or dwelling and the nearest livestock facility or anaerobic digester;*
- *located on separate lots; and*
- *of the same or greater sensitivity (i.e., Type A or Type B in accordance with Implementation Guidelines #33 and #34) as the proposed development or dwelling.*

If ALL of the above conditions are met, the MDS I setback for the proposed development or dwelling may be reduced such that it is located no closer to the livestock facility or anaerobic digester than the furthest of the four non-agricultural uses, residential uses and/or dwellings as shown in [Figure 4](#).

#36. Non-Application of MDS Within Settlement Areas

MDS I setbacks are NOT required for proposed land use changes (e.g., consents, rezonings, redesignations, etc.) within approved settlement areas, as it is generally understood that the long-term use of the land is intended to be for non-agricultural purposes.

The proposed development will not result in an MDS I impact on the local agricultural community. A *Minimum Distance Separation (MDS) Analysis* can be found in Appendix D.

Water

ARL Groundwater Resources Ltd. (“ARL”) completed a Groundwater Supply Assessment to address impacts related to servicing the proposed development. ARL concluded that:

Construction of new supply wells associated with a multi-lot residential development on the property has the potential for interference to occur among individual wells as the development is built out. This interference could come in the form of (a) turbidity interference resulting from the process of well drilling and development and (b) water level interference when the wells are operating. The turbidity interference is a temporary problem that should dissipate after the well drilling and development operations are complete. Notification of adjacent well owners and monitoring when each new well is constructed will help to mitigate potential turbidity interference. Measures to minimize the effects of water level interference include optimizing the pump settings to maximize drawdown in each of the individual wells. Consideration could also be given to implementing an outdoor water use bylaw or similar instrument to manage water use during the warm weather months of the year when water demand is higher.

Given that there are no active livestock operations in proximity to the subject property, potential impacts related to water levels/water quality in private wells on agricultural properties is not anticipated to be a concern. The proposed monitoring plan set out by ARL will be satisfactory to ensure no negative impacts.

Traffic

Traffic from the proposed residential development was assessed by Crozier’s in a Traffic Impact Study (“TIS”). The proposed entrances for the residential subdivision (primary entrance on Watson Road and secondary entrance on Arkell Road) were assessed and determined to meet the minimum sight line distance requirements. No additional road improvements were recommended in the TIS.

Given the low number of agricultural operations in proximity to the subject lands, there are no significant impacts anticipated from traffic from the proposed residential subdivision on the agricultural operations in the Secondary Study Area.

Noise

A Noise Impact Assessment (“NIA”) was completed in support of the application in 2006. Relevant mitigation measures were developed, including acoustic berms/barriers and restrictions on building setbacks/building requirements, to ensure that the proposed subdivision meets relevant Ministry guidelines. No noise-related impacts on adjacent agricultural operations are anticipated.

As part of the conditions of draft plan approval, the PJR recommended a condition to provide an update of the NIA. This update will be based on the final approved lot fabric for the proposed development.

No additional mitigation measures, beyond those included in the NIA, are needed to ensure that agricultural operations are not impacted.

3.3 Mitigation

The potential for impacts on the agricultural community is relatively low. Lower impact mitigation measures that should be considered as part of conditions of draft plan approval and site design include the following:

- Disclosure statements to notify potential purchasers of property that the land is in a prime agricultural area where periods of dust, noise, odour, and other impacts associated with nearby farms are common.

Edge planning measures are not deemed necessary given the fact that there are no livestock operations of adjacent lands and the site is well buffered by existing vegetation (i.e. plantation to the south, and hedgerow to the east).

4.0 PLANNING POLICY FRAMEWORK

The following documents were reviewed as part of this AIA:

- Provincial Planning Statement, 2024,
- County of Wellington Official Plan.

The following summarizes the main agricultural policies that were considered in this AIA.

4.1 Provincial Planning Statement 2024

The 2024 Provincial Planning Statement (PPS) was issued under Section 3 of the Planning Act and came into effect on October 20, 2024. The PPS establishes the policy foundation for regulating the development and use of land in the province and provides policy directions on matters of provincial interest related to land use planning and development. It provides a vision for land use planning in Ontario that encourages efficient use of land, resources and public investment in infrastructure. The PPS strongly encourages development that would provide long-term prosperity, environmental health, and social well-being. The 2024 PPS applies to planning decisions made on or after the effective date and applies to the consideration of the proposed official plan and zoning bylaw amendment applications. The following is a summary of the PPS policies that are relevant to the proposed development application.

The PPS is to be read in its entirety and applicable policies are to be applied to specific situations/applications. The following table provides a summary of relevant policies of the PPS and describes how the proposed development is consistent with this policy direction.

PPS (2024) policy 2.3.2 provides the following direction regarding settlement boundary expansions:

2.3.2 New Settlement Areas and Settlement Area Boundary Expansions

1. *In identifying a new settlement area or allowing a settlement area boundary expansion, planning authorities shall consider the following:*
 - a. *the need to designate and plan for additional land to accommodate an appropriate range and mix of land uses;*
 - b. *if there is sufficient capacity in existing or planned infrastructure and public service facilities;*
 - c. *whether the applicable lands comprise specialty crop areas;*
 - d. *the evaluation of alternative locations which avoid prime agricultural areas and, where avoidance is not possible, consider reasonable alternatives on lower priority agricultural lands in prime agricultural areas;*
 - e. *whether the new or expanded settlement area complies with the minimum distance separation formulae;*
 - f. *whether impacts on the agricultural system are avoided, or where avoidance is not possible, minimized and mitigated to the extent feasible as determined through an agricultural impact assessment or equivalent analysis, based on provincial guidance; and*
 - g. *the new or expanded settlement area provides for the phased progression of urban development.*
2. *Notwithstanding policy 2.3.2.1.b), planning authorities may identify a new settlement area only where it has been demonstrated that the infrastructure and public service facilities to support development are planned or available.*

The following table documents conformity of the proposed development with policy 2.3.2.1 of the PPS, 2024.

Table 3: Assessment of Settlement Area Boundary Expansions (Policy 2.3.2.1)

Policy 2.3.2.1	Conformity	Analysis
<i>a) the need to designate and plan for additional land to accommodate an appropriate range and mix of land uses</i>	Yes	The County of Wellington has examined rural residential growth as part of the Official Plan Review (Committee Report prepared by Jameson Pickard, September 12, 2024). Land Need Analysis conducted by the County of Wellington sets out the need for 250 units in the Township of Puslinch. The proposed development (44 units) provides approximately 17% of the needed growth.
<i>b) if there is sufficient capacity in existing or planned infrastructure and public service facilities</i>	Yes	There is not existing or planned infrastructure and public services facilities in the municipality. Capacity for private servicing was assessed by a Qualified Professional.
<i>c) whether the applicable lands comprise specialty crop areas</i>	Yes	Development is not comprised of Specialty Crop Areas.
<i>d) the evaluation of alternative locations which avoid prime agricultural areas and, where avoidance is not possible, consider reasonable alternatives on lower priority agricultural lands in prime agricultural areas</i>	Yes	An alternate site location analysis was completed. The settlement of Arkell is surrounded by good agricultural land so avoidance is not possible. The subject lands are deemed to be a reasonable alternative for expansion of the settlement boundary as the lands represent the lowest priority agricultural lands in the local area immediately adjacent to the settlement.
<i>e) whether the new or expanded settlement area complies with the minimum distance separation formulae</i>	Yes	The proposed Development complies with the MDS formulae.
<i>f) whether impacts on the agricultural system are avoided, or where avoidance is not possible, minimized and mitigated to the extent feasible as determined through an agricultural impact assessment or equivalent analysis, based on provincial guidance</i>	Yes	AIA documents that impacts on the agricultural system are minimal.
<i>g) the new or expanded settlement area provides for the phased progression of urban development</i>	Yes	Proposed expansion of settlement represents a logical progression of development.

The proposed development is consistent with the agricultural provisions of the PPS, 2024.

4.2 County of Wellington Official Plan

The County of Wellington Official Plan was adopted by Wellington County Council on September 24, 1998, approved by the Ministry of Municipal Affairs on April 13, 1998, and came into effect on May 6, 1999. The County Official Plan, as amended, was last revised December 2025. The proposed development was declared complete in 2006.

Prime Agricultural Areas in the OP are defined as: “*Class 1, 2 and 3 agricultural soils, associated Class 4 to 7 soils and additional areas where there is a local concentration of farms which exhibit the characteristics of ongoing agriculture, and specialty crop land will be designated as prime agricultural areas. These areas will be protected for agriculture.*”

While a portion of the site is designated Secondary Agriculture and Hamlet, the majority of the site is designated Prime Agriculture.

Section 4.6.5 of the OP sets out the matters that must be documented in an AIA. Table 4 provides a conformity analysis of these provisions.

Table 4: Official Plan Requirements of an AIA – Arkell Subdivision Proposal

AIA Documentation Requirements	SAI Findings	Conformity
a) the opportunity to use lands of lower agricultural potential;	<ul style="list-style-type: none"> • Site represents the lowest agricultural potential of all lands in proximity to Arkel 	Yes
b) compliance with the <i>minimum distance separation formulae</i> for livestock operations;	<ul style="list-style-type: none"> • No livestock operations in proximity to the site. • No MDS impacts 	Yes
c) the degree to which agricultural expansion may be constrained;	<ul style="list-style-type: none"> • No livestock operations in proximity to the site. Expansion of agricultural facilities will not be impacted. 	Yes
d) potential interference with normal agricultural activities and practices;	<ul style="list-style-type: none"> • Site is well separated from adjacent livestock operations. • No potential interference anticipated. • As part of development, warning clause will be prepared for each new landowner indicating that normal agricultural activities and practices are to be anticipated. 	Yes
e) potential interference with the movement of agricultural machinery on roads;	<ul style="list-style-type: none"> • Traffic Impact Study completed. Entrances will have satisfactory sight lines. • No livestock operations in proximity to the site. • No impacts related to potential interference with movement of agricultural machinery on roads anticipated. 	Yes
f) such other concerns as a Council may consider relevant.	No other concerns from Council at this point.	Yes

Section 4.8.2 sets out policy considerations for the evaluation of urban boundary expansions, including Hamlets. 4.8.2 f) and g) are relevant to this AIA.

f) prime agricultural areas should be avoided where possible. To support the Agricultural System, alternative locations across the County will be evaluated, prioritized and determined based on avoiding, minimizing and mitigating the impact on the Agricultural System and in accordance with the following;

- i) reasonable alternatives that avoid prime agricultural areas are evaluated; and;*
- ii) where prime agricultural areas cannot be avoided, lower priority agricultural lands are used;*

g) any adverse impacts on the agri-food network, including agricultural operations, from expanding settlement areas would be avoided, or if avoidance is not possible, minimized and mitigated as determined through an agricultural impact assessment;

As previously documented, the subject lands represent the lowest capability agricultural lands in proximity to Arkell. There are no reasonable alternatives of lower priority agricultural land available. From an agricultural perspective, the subject property represents the lowest priority option for protection. Impacts on agricultural operations will be minimal given that there is no MDS I conflict and there are no agricultural operations in proximity to the subject property. The proposed development will not result in any adverse impacts on the agri-food network.

5.0 CONCLUSIONS

Stovel and Associates Inc. (“SAI”) was retained by Timberworx Custom Homes Inc. (Timberworx), Slood Construction Ltd. (Slood) and John Slood Investments Ltd. to complete an Agricultural Impact Assessment (“AIA”) of a proposed residential subdivision in the Township of Puslinch (Arkell). The proposed development is an expansion of an existing settlement area and was assessed based on the related policy structure. A portion of the subject lands is already included in the Hamlet boundary.

The project is referred to as Arkell Subdivision. The lands in question are approximately 18.8 ha in size and are located on Part of Lots 7, 8 and 9, Concession 10, Township of Puslinch, County of Wellington.

The subject lands do not include any forms of capital investment related to agriculture and there are no livestock barns in immediate proximity to the site (and no MDS I impact). The lands are fragmented and oddly shaped, since a railroad dissects through this portion of the Township of Puslinch. Approximately 40% of the site is cultivated for agricultural production and the lands are constrained by a variety of factors including excessive stoniness, low moisture holding capacity and low inherent fertility. The lands in question are not reflective of a prime agricultural area.

Relevant guidelines and planning policies were considered in the preparation of this AIA. Background documentation, including agricultural mapping and agricultural statistics, was supplemented by data collected through reconnaissance investigations of the Secondary Study Area and the examination of Farm Data Sheets provided by local farmers. Based on this information, it was concluded that the proposed development will not impact adjacent agricultural operations and is a reasonable use of land given the surrounding land uses. Based on a review of alternative locations for expansion of the Hamlet boundary, it was determined that the subject lands represent the lowest priority agricultural lands for protection.

The proposed development is consistent with the relevant planning policy framework set out in the PPS, 2024 and conforms to the County of Wellington Official Plan.



ROBERT P. STOVEL, MCIP, RPP, P.AG.



ROBERT L. STOVEL, B.Sc.

Appendix A: Farm Data Sheets

FARM DATA SHEET Minimum Distance Separation I (MDSI)

NOTE TO FARM OWNER(S)

By filling out this form you will help to ensure that new land uses will be located a suitable distance from your livestock operation.

TERESA DALLAN
935 WATSON RD S. PUSLINCH →

NO LIVESTOCK ON PROPERTY
FOR ~~LAST~~ OVER 30 YEARS.

Owner(s) of Livestock Facility _____

Contact Information

Email _____ Telephone _____

Civic Address _____ Municipality _____

Lot _____ Concession _____ Division _____

Lot Size (where livestock facility is located) _____ hectares _____ acres

Signature of Livestock Facility Owner _____ Date _____

BARN(S) SIZE Please provide the size of the barns located on the property. This information is used to verify maximum livestock capacity. _____ ft²/m² _____ ft²/m²

- Manure Storage Types** Solid manure: 18% dry matter, or more Liquid manure: <18% dry matter
- V1 Solid, inside, bedded pack
 - V2 Solid, outside, covered
 - V3 Solid, outside, no cover, ≥30% dry matter
 - V4 Solid, outside, no cover, 18% - <30% dry matter, with covered liquid runoff storage
 - V5 Liquid, inside, underneath slatted floor
 - V6 Liquid, outside, with a permanent, tight-fitting cover
 - L1 Solid, outside, no cover, 18% - <30% dry matter, with uncovered liquid runoff storage
 - L2 Liquid, outside, with a permanent floating cover
 - M1 Liquid, outside, no cover, straight-walled storage
 - M2 Liquid, outside, roof, but with open sides
 - H1 Liquid, outside, no cover, sloped-sided storage

Animal Type of Material	Description	Housing Capacity (maximum)	Manure Storage Type (select from list)
Beef Cattle	Cows, including calves to weaning (all breeds)		/
	Feeders (7 – 16 months)		
	Backgrounders (7 – 12.5 months)		
	Shortkeepers (12.5 – 17.5 months)		
Dairy Cattle	Milking-age cows (dry or milking)		
	Large-framed; 545 – 658 kg (e.g. Holsteins)		
	Medium-framed; 455 – 545 kg (e.g. Guernseys)		
	Small-framed; 364 – 455 kg (e.g. Jerseys)		
	Heifers (5 months to freshening)		
	Large-framed; 182 – 545 kg (e.g. Holsteins)		
	Medium-framed; 148 – 455 kg (e.g. Guernseys)		
	Small-framed; 125 – 364 kg (e.g. Jerseys)		
	Calves (0 – 5 months)		
	Large-framed; 45 – 182 kg (e.g. Holsteins)		
Medium-framed; 39 – 148 kg (e.g. Guernseys)			
Small-framed; 30 – 125 kg (e.g. Jerseys)			
Horses	Large-framed, mature; >681 kg (e.g. draft or draft cross breeds including unweaned offspring)		
	Medium-framed, mature; 227 – 680 kg (e.g. saddle, riding and racing breeds including unweaned offspring)		
	Small-framed, mature; <227 kg (e.g. ponies and miniatures including unweaned offspring)		

Teresa Dallan

FARM DATA SHEET (continued)
Minimum Distance Separation I (MDSI)

Animal Type of Material	Description	Housing Capacity (maximum)	Manure Storage Type (select from list)
Swine	Sows with litter, dry sows or boars		/
	Breeder gilts (entire barn designed specifically for this purpose)		
	Weaners (7 – 27 kg)		
	Feeders (27 – 136 kg)		
Sheep	Ewes & rams (for meat lambs; includes unweaned offspring & replacements)		
	Ewes & rams (dairy operation; includes unweaned offspring & replacements)		
	Lambs (dairy or feeder lambs)		
Goats	Does & bucks (for meat kids; includes unweaned offspring and replacements)		
	Does & bucks (for dairy; includes unweaned offspring & replacements)		
	Kids (dairy or feeder kids)		
Chickens	Layer hens (for eating eggs; after transfer from pullet barn)		
	Layer pullets (day-olds until transferred into layer barn)		
	Broiler breeder growers (males/females transferred out to layer barn)		
	Broiler breeder layers (males/females transferred in from grower barn)		
	Broilers on any length of cycle		
Turkeys	Turkey poults (day-old until transferred to grow out turkey barn)		
	Turkey breeder layers (males/females transferred in from grower barn)		
	Breeder toms		
	Broilers (day-olds to 6.2 kg)		
	Hens (day-olds up to 6.2 to 10.8 kg; 7.5 kg is typical)		
	Toms (day-olds to over 10.8 to 20 kg; 14.5 kg is typical)		
	Turkeys at any other weights, or if unknown (by floor area)		
Veal	Milk-fed		
	Grain-fed		
Other	Please refer to Factor Table 1 of The Minimum Distance Separation (MDS) Document for complete list of animal types		
Imported manure	Use the volume of the manure storages		
Unoccupied livestock barns	A livestock barn that does not currently house any livestock, but that housed livestock in the past and continues to be structurally sound and reasonably capable of housing livestock.*		

*NOTE: This should only be used where obtaining information from the farm operator(s) and/or owner(s) was not possible (see Implementation Guideline 20 for more information).

FARM DATA SHEET
Minimum Distance Separation I (MDSI)

NOTE TO FARM OWNER(S)
 By filling out this form you will help to ensure that new land uses will be located a suitable distance from your livestock operation.

Owner(s) of Livestock Facility ARLO - OMAFA - UOYK

Contact Information
 Email davidandlen@uoayukph.ca Telephone (226) 979-2950
 Civic Address 413+483 Arrell Blvd. Municipality Puslinch
 Lot _____ Concession _____ Division _____
 Lot Size (where livestock facility is located) _____ hectares 700 acres
 Signature of Livestock Facility Owner _____ Date _____

BARN(S) SIZE Please provide the size of the barns located on the property. This information is used to verify maximum livestock capacity. _____ ft²/m² _____ ft²/m²

- Manure Storage Types** Solid manure: 18% dry matter, or more Liquid manure: <18% dry matter
- V1 Solid, inside, bedded pack
 - V2 Solid, outside, covered
 - V3 Solid, outside, no cover, ≥30% dry matter
 - V4 Solid, outside, no cover, 18% - <30% dry matter, with covered liquid runoff storage
 - V5 Liquid, inside, underneath slatted floor
 - V6 Liquid, outside, with a permanent, tight-fitting cover
 - L1 Solid, outside, no cover, 18% - <30% dry matter, with uncovered liquid runoff storage
 - L2 Liquid, outside, with a permanent floating cover
 - M1 Liquid, outside, no cover, straight-walled storage
 - M2 Liquid, outside, roof, but with open sides
 - H1 Liquid, outside, no cover, sloped-sided storage

Animal Type of Material	Description	Housing Capacity (maximum)	Manure Storage Type (select from list)
Beef Cattle	Cows, including calves to weaning (all breeds)		
	Feeders (7 – 16 months)		
	Backgrounders (7 – 12.5 months)		
	Shortkeepers (12.5 – 17.5 months)		
Dairy Cattle	Milking-age cows (dry or milking)		
	Large-framed; 545 – 658 kg (e.g. Holsteins)		
	Medium-framed; 455 – 545 kg (e.g. Guernseys)		
	Small-framed; 364 – 455 kg (e.g. Jerseys)		
	Heifers (5 months to freshening)		
	Large-framed; 182 – 545 kg (e.g. Holsteins)		
	Medium-framed; 148 – 455 kg (e.g. Guernseys)		
	Small-framed; 125 – 364 kg (e.g. Jerseys)		
	Calves (0 – 5 months)		
	Large-framed; 45 – 182 kg (e.g. Holsteins)		
Medium-framed; 39 – 148 kg (e.g. Guernseys)			
Small-framed; 30 – 125 kg (e.g. Jerseys)			
Horses	Large-framed, mature; >681 kg (e.g. draft or draft cross breeds including unweaned offspring)		
	Medium-framed, mature; 227 – 680 kg (e.g. saddle, riding and racing breeds including unweaned offspring)	60	V1 + V2
	Small-framed, mature; <227 kg (e.g. ponies and miniatures including unweaned offspring)		

FARM DATA SHEET (continued)
Minimum Distance Separation I (MDSI)

Animal Type of Material	Description	Housing Capacity (maximum)	Manure Storage Type (select from list)
Swine	Sows with litter, dry sows or boars	350	V5 + M1
	Breeder gilts (entire barn designed specifically for this purpose)	120	V5 + M1
	Weaners (7 – 27 kg)	1000	V5 + M1
	Feeders (27 – 136 kg)	520	V5 + M1
Sheep	Ewes & rams (for meat lambs; includes unweaned offspring & replacements)		
	Ewes & rams (dairy operation; includes unweaned offspring & replacements)		
	Lambs (dairy or feeder lambs)		
Goats	Does & bucks (for meat kids; includes unweaned offspring and replacements)		
	Does & bucks (for dairy; includes unweaned offspring & replacements)		
	Kids (dairy or feeder kids)		
Chickens	Layer hens (for eating eggs; after transfer from pullet barn)	6000	V2
	Layer pullets (day-olds until transferred into layer barn)	3000	V2
	Broiler breeder growers (males/females transferred out to layer barn)	1000	V2
	Broiler breeder layers (males/females transferred in from grower barn)	1000	V2
	Broilers on any length of cycle	2000	V2
Turkeys	Turkey poults (day-old until transferred to grow out turkey barn)	1000	V2
	Turkey breeder layers (males/females transferred in from grower barn)		
	Breeder toms		
	Broilers (day-olds to 6.2 kg)	500	V2
	Hens (day-olds up to 6.2 to 10.8 kg; 7.5 kg is typical)	500	V2
	Toms (day-olds to over 10.8 to 20 kg; 14.5 kg is typical)	500	V2
	Turkeys at any other weights, or if unknown (by floor area)		
Veal	Milk-fed		
	Grain-fed		
Other	Please refer to Factor Table 1 of The Minimum Distance Separation (MDS) Document for complete list of animal types		
Imported manure	Use the volume of the manure storages		
Unoccupied livestock barns	A livestock barn that does not currently house any livestock, but that housed livestock in the past and continues to be structurally sound and reasonably capable of housing livestock.*	1000	V1 + V2

*NOTE: This should only be used where obtaining information from the farm operator(s) and/or owner(s) was not possible (see Implementation Guideline 20 for more information).

FARM DATA SHEET

Minimum Distance Separation I (MDSI)

ALL POLE SHEDS ON THE PROPERTY ARE NOW USED FOR HAY + EQUIPMENT STORAGE - THE BANK BARN IS USED FOR FAMILY ENTERTAINMENT UPSTAIRS + STORAGE DOWNSTAIRS

Owner(s) of Livestock Facility ROBERT + THOMAS JEFFERSON

NOTE TO FARM OWNER(S)
By filling out this form you will help to ensure that new land uses will be located a suitable distance from your livestock operation.

Contact Information

Email rwjeffers@hotmail.com Telephone 519-831-5831
Civic Address 86 FARNHAM RD Municipality PUSLINCH
Lot 5 Concession 9 Division _____
Lot Size (where livestock facility is located) _____ hectares 70 acres

Signature of Livestock Facility Owner [Signature] Date Oct 17/22

BARN(S) SIZE Please provide the size of the barns located on the property. This information is used to verify maximum livestock capacity. 4300 ft²/m²

- Manure Storage Types** Solid manure: 18% dry matter, or more Liquid manure: <18% dry matter
- V1 Solid, inside, bedded pack
 - V2 Solid, outside, covered
 - V3 Solid, outside, no cover, ≥30% dry matter
 - V4 Solid, outside, no cover, 18% - <30% dry matter, with covered liquid runoff storage
 - V5 Liquid, inside, underneath slatted floor
 - V6 Liquid, outside, with a permanent, tight-fitting cover
 - L1 Solid, outside, no cover, 18%- <30% dry matter, with uncovered liquid runoff storage
 - L2 Liquid, outside, with a permanent floating cover
 - M1 Liquid, outside, no cover, straight-walled storage
 - M2 Liquid, outside, roof, but with open sides
 - H1 Liquid, outside, no cover, sloped-sided storage

Animal Type of Material	Description	Housing Capacity (maximum)	Manure Storage Type (select from list)
Beef Cattle	Cows, including calves to weaning (all breeds)		
	Feeders (7 – 16 months)		
	Backgrounders (7 – 12.5 months)		
	Shortkeepers (12.5 – 17.5 months)		
Dairy Cattle	Milking-age cows (dry or milking)		
	Large-framed; 545 – 658 kg (e.g. Holsteins)		
	Medium-framed; 455 – 545 kg (e.g. Guernseys)		
	Small-framed; 364 – 455 kg (e.g. Jerseys)		
	Heifers (5 months to freshening)		
	Large-framed; 182 – 545 kg (e.g. Holsteins)		
	Medium-framed; 148 – 455 kg (e.g. Guernseys)		
	Small-framed; 125 – 364 kg (e.g. Jerseys)		
	Calves (0 – 5 months)		
	Large-framed; 45 – 182 kg (e.g. Holsteins)		
Medium-framed; 39 – 148 kg (e.g. Guernseys)			
Small-framed; 30 – 125 kg (e.g. Jerseys)			
Horses	Large-framed, mature; >681 kg (e.g. draft or draft cross breeds including unweaned offspring)		
	Medium-framed, mature; 227 – 680 kg (e.g. saddle, riding and racing breeds including unweaned offspring)		
	Small-framed, mature; <227 kg (e.g. ponies and miniatures including unweaned offspring)		

FARM DATA SHEET (continued)
Minimum Distance Separation I (MDSI)

Animal Type of Material	Description	Housing Capacity (maximum)	Manure Storage Type (select from list)
Swine	Sows with litter, dry sows or boars		
	Breeder gilts (entire barn designed specifically for this purpose)		
	Weaners (7 – 27 kg)		
	Feeders (27 – 136 kg)		
Sheep	Ewes & rams (for meat lambs; includes unweaned offspring & replacements)		
	Ewes & rams (dairy operation; includes unweaned offspring & replacements)		
	Lambs (dairy or feeder lambs)		
Goats	Does & bucks (for meat kids; includes unweaned offspring and replacements)		
	Does & bucks (for dairy; includes unweaned offspring & replacements)		
	Kids (dairy or feeder kids)		
Chickens	Layer hens (for eating eggs; after transfer from pullet barn)		
	Layer pullets (day-olds until transferred into layer barn)		
	Broiler breeder growers (males/females transferred out to layer barn)		
	Broiler breeder layers (males/females transferred in from grower barn)		
	Broilers on any length of cycle		
Turkeys	Turkey poults (day-old until transferred to grow out turkey barn)		
	Turkey breeder layers (males/females transferred in from grower barn)		
	Breeder toms		
	Broilers (day-olds to 6.2 kg)		
	Hens (day-olds up to 6.2 to 10.8 kg; 7.5 kg is typical)		
	Toms (day-olds to over 10.8 to 20 kg; 14.5 kg is typical)		
Veal	Milk-fed		
	Grain-fed		
Other	Please refer to Factor Table 1 of The Minimum Distance Separation (MDS) Document for complete list of animal types		
Imported manure	Use the volume of the manure storages		
Unoccupied livestock barns	A livestock barn that does not currently house any livestock, but that housed livestock in the past and continues to be structurally sound and reasonably capable of housing livestock.*		

*NOTE: This should only be used where obtaining information from the farm operator(s) and/or owner(s) was not possible (see Implementation Guideline 20 for more information).

FARM DATA SHEET
Minimum Distance Separation I (MDSI)

NOTE TO FARM OWNER(S)

By filling out this form you will help to ensure that new land uses will be located a suitable distance from your livestock operation.

Owner(s) of Livestock Facility Louis Tonin

Contact Information

Email _____ Telephone _____

Civic Address 900 Watson Road S Municipality Puslinch

Lot Pt. Lots 8 and 9 Concession 10 Division _____

Lot Size (where livestock facility is located) 2.98 hectares 7.36 acres

Signature of Livestock Facility Owner P. Willis Lynn Brondal Date Dec 17th 2022

BARN(S) SIZE Please provide the size of the barns located on the property. This information is used to verify maximum livestock capacity. _____ ft²/m² _____ ft²/m²

Manure Storage Types Solid manure: 18% dry matter, or more Liquid manure: <18% dry matter

- | | | | |
|----|---|----|---|
| V1 | Solid, inside, bedded pack | L1 | Solid, outside, no cover, 18% - <30% dry matter, with uncovered liquid runoff storage |
| V2 | Solid, outside, covered | L2 | Liquid, outside, with a permanent floating cover |
| V3 | Solid, outside, no cover, ≥30% dry matter | M1 | Liquid, outside, no cover, straight-walled storage |
| V4 | Solid, outside, no cover, 18% - <30% dry matter, with covered liquid runoff storage | M2 | Liquid, outside, roof, but with open sides |
| V5 | Liquid, inside, underneath slatted floor | H1 | Liquid, outside, no cover, sloped-sided storage |
| V6 | Liquid, outside, with a permanent, tight-fitting cover | | |

Animal Type of Material	Description	Housing Capacity (maximum)	Manure Storage Type (select from list)
Beef Cattle	Cows, including calves to weaning (all breeds)		
	Feeders (7 – 16 months)		
	Backgrounders (7 – 12.5 months)		
	Shortkeepers (12.5 – 17.5 months)		
Dairy Cattle	Milking-age cows (dry or milking)		
	Large-framed; 545 – 658 kg (e.g. Holsteins)		
	Medium-framed; 455 – 545 kg (e.g. Guernseys)		
	Small-framed; 364 – 455 kg (e.g. Jerseys)		
	Heifers (5 months to freshening)		
	Large-framed; 182 – 545 kg (e.g. Holsteins)		
	Medium-framed; 148 – 455 kg (e.g. Guernseys)		
	Small-framed; 125 – 364 kg (e.g. Jerseys)		
	Calves (0 – 5 months)		
	Large-framed; 45 – 182 kg (e.g. Holsteins)		
Medium-framed; 39 – 148 kg (e.g. Guernseys)			
Small-framed; 30 – 125 kg (e.g. Jerseys)			
Horses	Large-framed, mature; >681 kg (e.g. draft or draft cross breeds including unweaned offspring)		
	Medium-framed, mature; 227 – 680 kg (e.g. saddle, riding and racing breeds including unweaned offspring)		
	Small-framed, mature; <227 kg (e.g. ponies and miniatures including unweaned offspring)		

P. Willis Lynn Brondal

FARM DATA SHEET (continued)
Minimum Distance Separation I (MDSI)

Animal Type of Material	Description	Housing Capacity (maximum)	Manure Storage Type (select from list)
Swine	Sows with litter, dry sows or boars		
	Breeder gilts (entire barn designed specifically for this purpose)		
	Weaners (7 – 27 kg)		
	Feeders (27 – 136 kg)		
Sheep	Ewes & rams (for meat lambs; includes unweaned offspring & replacements)		
	Ewes & rams (dairy operation; includes unweaned offspring & replacements)		
	Lambs (dairy or feeder lambs)		
Goats	Does & bucks (for meat kids; includes unweaned offspring and replacements)		
	Does & bucks (for dairy; includes unweaned offspring & replacements)		
	Kids (dairy or feeder kids)		
Chickens	Layer hens (for eating eggs; after transfer from pullet barn)		
	Layer pullets (day-olds until transferred into layer barn)		
	Broiler breeder growers (males/females transferred out to layer barn)		
	Broiler breeder layers (males/females transferred in from grower barn)		
	Broilers on any length of cycle		
Turkeys	Turkey poults (day-old until transferred to grow out turkey barn)		
	Turkey breeder layers (males/females transferred in from grower barn)		
	Breeder toms		
	Broilers (day-olds to 6.2 kg)		
	Hens (day-olds up to 6.2 to 10.8 kg; 7.5 kg is typical)		
	Toms (day-olds to over 10.8 to 20 kg; 14.5 kg is typical)		
	Turkeys at any other weights, or if unknown (by floor area)		
Veal	Milk-fed		
	Grain-fed		
Other	Please refer to Factor Table 1 of The Minimum Distance Separation (MDS) Document for complete list of animal types		
Imported manure	Use the volume of the manure storages		
Unoccupied livestock barns	A livestock barn that does not currently house any livestock, but that housed livestock in the past and continues to be structurally sound and reasonably capable of housing livestock.*		

*NOTE: This should only be used where obtaining information from the farm operator(s) and/or owner(s) was not possible (see Implementation Guideline 20 for more information).

On-site structures/shed are used for storage and are not capable for housing livestock.

P. Willis Lynn Brambal

Appendix B: Photo of Agricultural Operations and Table of Agricultural Operations

Operation #2: 1096 Victoria RD S



Operation #3: 111 Carter RD



Operation #4: 86 Farnham RD



Operation #5: 83 Carter RD



Operation #6: 129 Farnham RD



Operation #7: 498 Arkell RD



Operation #8: 540 Arkell RD



Operation #9: 508 Arkell RD



Operation #10: 413-483 Arkell RD



Operation #10: 413-483 Arkell RD



Operation #11: 529 Arkell RD



Operation #12: 756-758 Watson RD S



Operation #13: 857 Watson RD S



Operation #14: 935 Watson RD S - No longer exists

Operation #15: 930 Watson RD S



Operation #16: 954 Watson RD S



Operation #17: 711 Arkell RD



Operation #18: 735 Arkell RD



Operation #19: 169 Hume RD



Operation #20: 258 Hume RD



Operation #21: 217 Hume RD



Appendix C: Alternate Site Evaluation Letter

Stovel and Associates Inc.

Planners, Agrologists and Environmental Consultants

January 06, 2023

Meagan Ferris, RPP, MCIP, Manager of Planning and Environment
County of Wellington Planning and Development
74 Woolwich Street
Guelph, ON
N1H 3T9

**RE: Alternate Site Evaluation – Proposed Expansion of the Hamlet of Arkell
Part of Lots 7, 8 and 9, Concession 10
Township of Puslinch
Related Applications: OP-2006-06, ZBA P10/2006, Draft Plan of Subdivision
Application 23T-06003**

Dear Meagan:

Stovel and Associates Inc. (“SAI”) is retained by 1000286480 Ontario Inc. and Sloop Construction Inc. (“Sloop”) to address the agricultural concerns associated with the above-mentioned planning applications. Please accept the following with respect to consideration of lower priority agricultural lands.

Background

An application for a residential subdivision was submitted to the County of Wellington in 2006 by Mr. Tom Kukovica. As part of this draft plan of subdivision application, an Official Plan Amendment (“OPA”) and Zoning By-law Amendment (“ZBA”) application was also submitted. Map 1 illustrates the location of the subject property.

Since that time, Sloop purchased a portion of the lands and in 2022, 1000286480 Ontario Inc. acquired an interest in the property.

The lands in question include a portion of the existing Hamlet of Arkell. For this investigation, the lands designated Hamlet will not form part of the agricultural analysis as these lands have already been removed from the Agricultural System. The remaining portion of the site is designated Prime Agricultural and Secondary Agriculture. These lands are approximately 15.2 ha in size and are the focus of this report.

The initial circulation of the application generated a series of comments from agencies. Of note are the comments from the County of Wellington (“County”) Planning and Development Department (November 11, 2006). The County recommended that the applicant consider alternative locations of lower-priority agricultural lands.

Stovel and Associates Inc. 651 Orangeville Road, Fergus, ON N1M 1T9 519 766-8042

Agricultural Analysis

Map 2 illustrates the distribution of agricultural soils and the associated Canada Land Inventory ("CLI") – Soil Capability for Agriculture ratings on the subject property. The subject property is mapped as follows:

- Class 2 soils: 5.9 ha.
- Class 3 (50%) and Class 5 (50%) soils: 9.3 ha.

Map 3 illustrates the Alternate Site Locations for potential hamlet expansion for Arkell. Six properties were selected for comparison purposes. Each parcel immediately abuts the existing Hamlet boundary. All six parcels are comprised of higher-capability agricultural lands than the subject property.

From an agricultural perspective, the subject property represents the lowest priority option for protection.

We trust that you will find this report to be of sufficient detail. Should you have any questions, please do not hesitate to contact the undersigned.

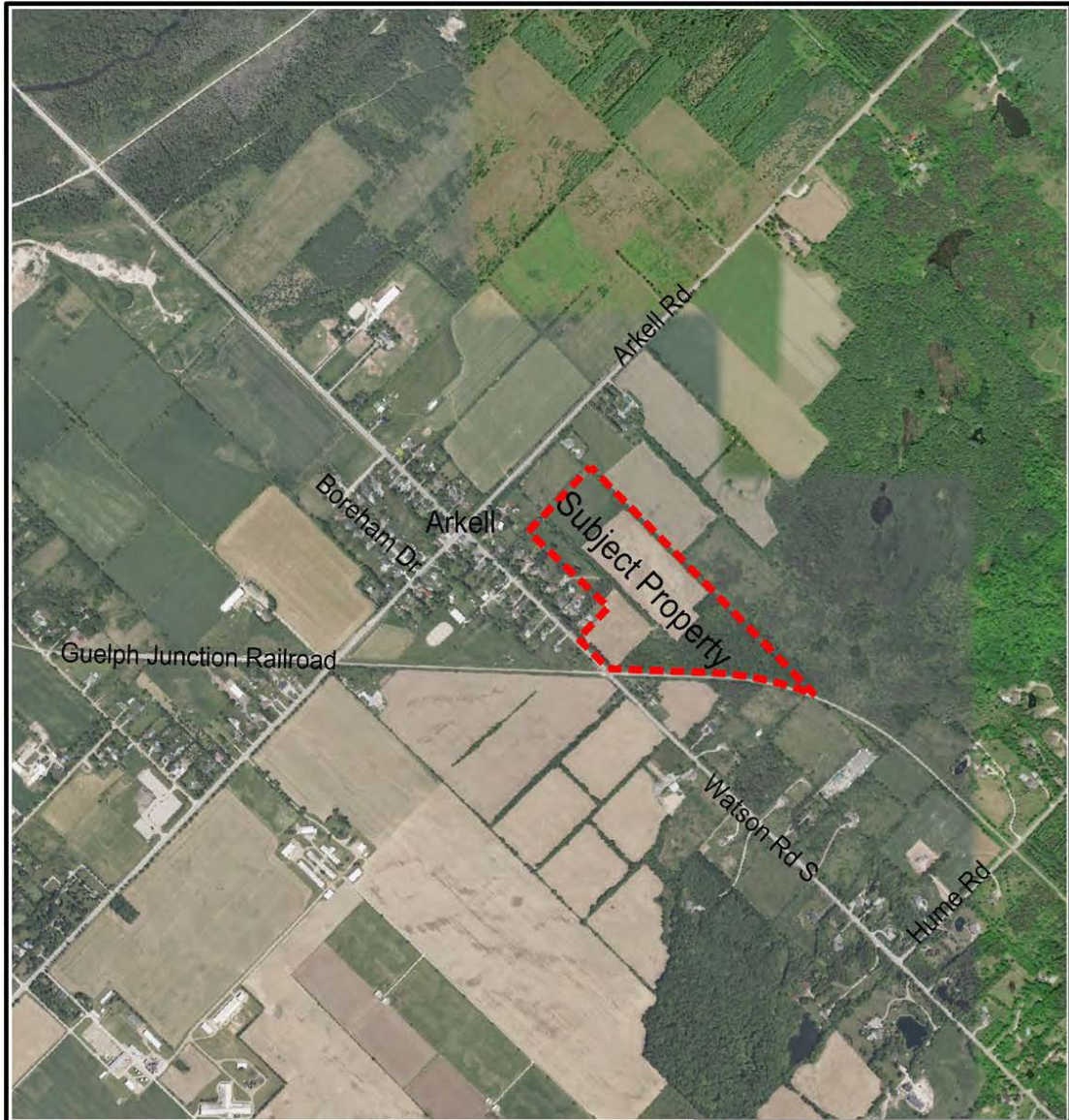
Yours truly,




Robert Stovel

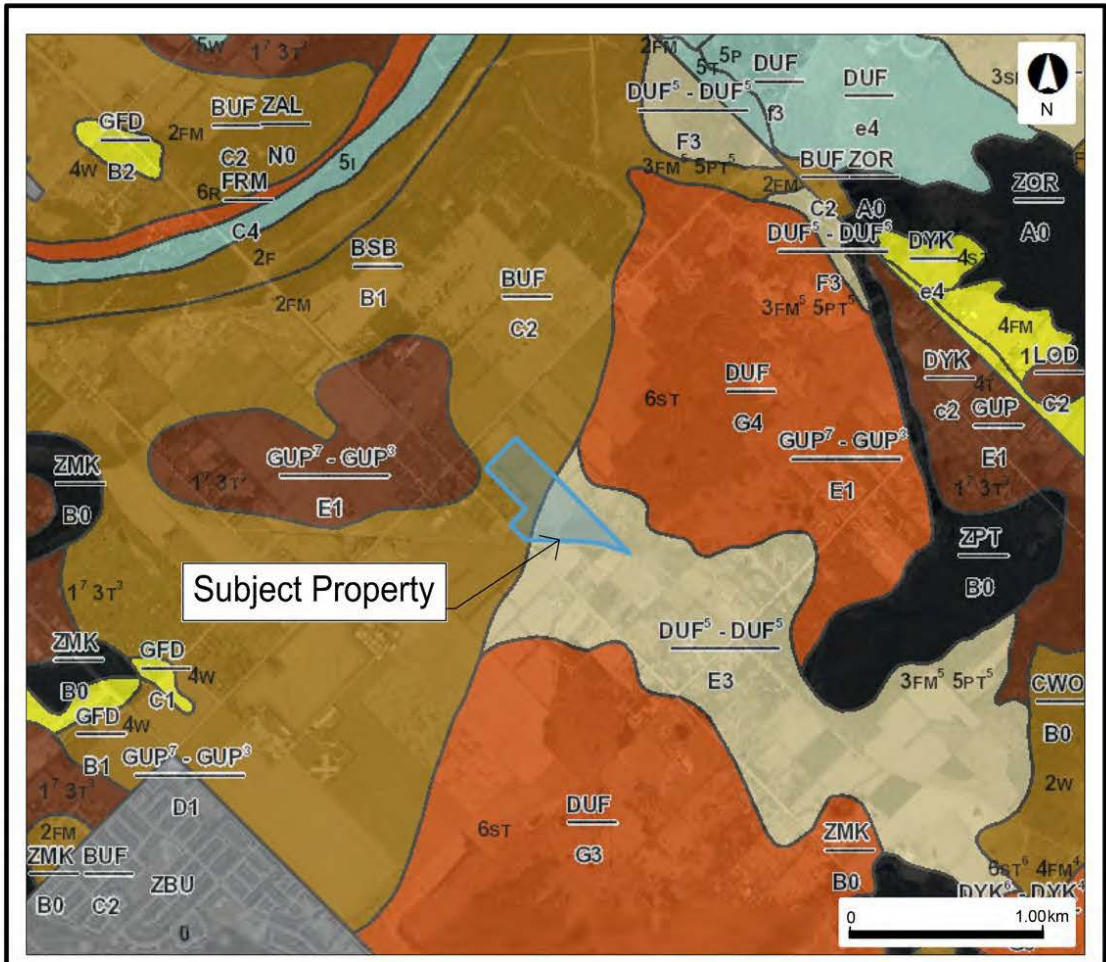
Robert P. Stovel, M.Sc., M.C.I.P., R.P.P., P. Ag.

cc. 1000286480 Ontario Inc. and Sloat Construction Inc.

Stovel and Associates Inc. 651 Orangeville Road, Fergus, ON N1M 1T9 519 766-8042



Location of Subject Property		Map 1
Part of Lots 7, 8, & 9 Concession 10 Arkell Alternate Site Evaluation		
 Stovel and Associates Inc. <small>851 Chongweila Road, Fergus On. N2M 1T9</small>	P: 519-766-8042 E: stovel.associates@outlook.com	
	Client: Sloat Construction Inc. 1000286480 Ontario Inc.	Date: 12-21-2022
	Aprox. 1:15,000	
<small>Imagery Provided by Microsoft Corporation - MAXAR Distribution Airbus</small>		



Legend

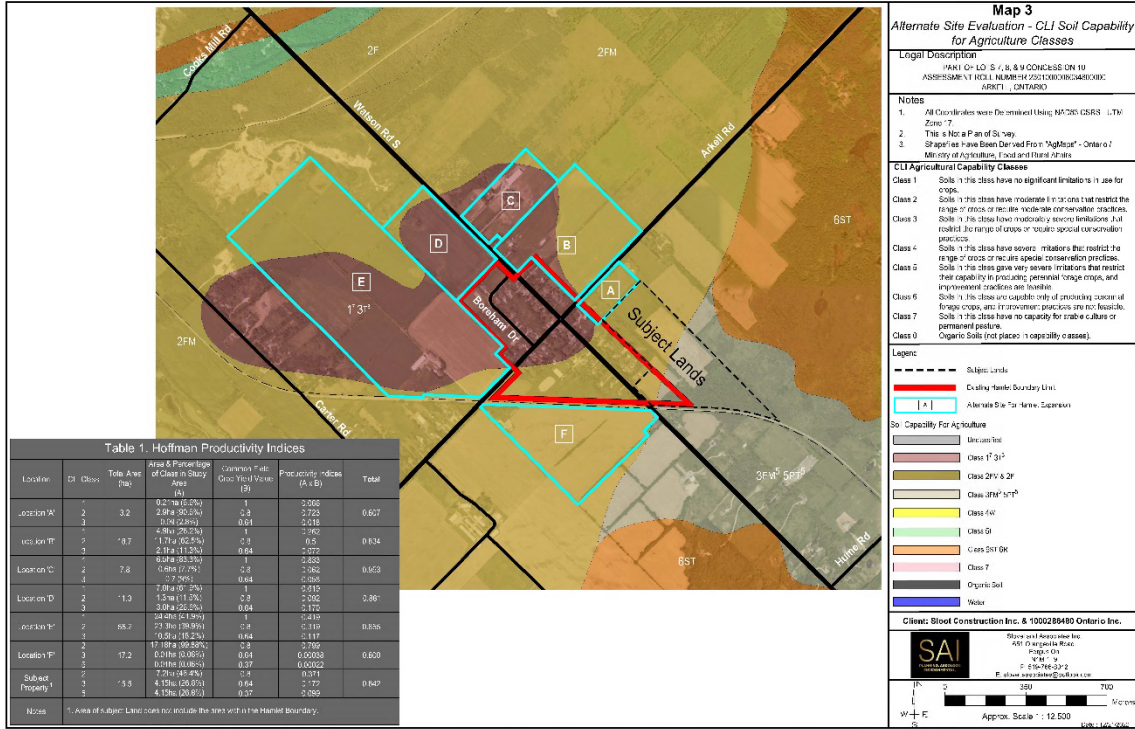
- Soil Name Label
- Soil Code

Soil Capability for Agriculture

- Unclassified
- Class 1¹ / 3T²
- Class 2FM
- Class 3FM⁵ / 5PT⁵
- Class 4w
- Class 5i
- Class 6ST
- Class 7
- Organic Soil
- Water

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

Soil Capability for Agriculture		Map 2
Part of Lots 7, 8, & 9 Concession 10 Arkell Alternate Site Evaluation		
	Stovel and Associates Inc. 851 Chongville Road, Fergus, ON N4M 1T9	P: 519-766-8042 E: stovel.associates@outlook.com
Client: Sloat Construction Inc. 1009286480 Ontario Inc.		Date: 12-21-2022
Approx. 1:30,000		
PDF Taken from The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) AgMaps (2022). Derived by Stovel & Associates Inc. Date: 12-21-2022		



Map 3

Alternate Site Evaluation - CLI Soil Capability for Agriculture Classes

Legal Description
PART OF LOTS 7, 8, & 9 CONCESSION 10 TO ASSHURDAVILLE, TOWNSHIP OF PUSHLIN, COUNTY OF ARKELL, ONTARIO

Notes

- All Coordinates were Determined Using NAD 83 UTM Zone 17.
- This is Not a Plan of Survey.
- Significant have been Derived From "Night Owl" Ontario Ministry of Agriculture, Food and Forests.

CLI Agricultural Capability Classes

Class 1 Soils in this class have no significant limitations in use for crops.

Class 2 Soils in this class have moderate limitations that restrict the range of crops or require special conservation practices.

Class 3 Soils in this class have moderate to severe limitations that restrict the range of crops or require special conservation practices.

Class 4 Soils in this class have severe limitations that restrict the range of crops or require special conservation practices.

Class 5 Soils in this class have very severe limitations that restrict their capability in producing perennial forage crops, and improved pastures and meadows.

Class 6 Soils in this class are suitable only for producing pasture of forage crops, and if treatment practices are not feasible.

Class 7 Soils in this class have no capacity for either culture or permanent pasture.

Class 8 Organic Soils (not placed in capability classes).

Legend

- Subject Lands
- Existing Fence Boundary Lines
- Alternate Site For Horse Expansion
- Unclassified
- Class 1 3P
- Class 2P & 2F
- Class 3P & 3F
- Class 4P
- Class 5P
- Class 6P & 6F
- Class 7
- Organic Soil
- Water

Client: Stout Construction Inc. & 100028640 Ontario Inc.

SAI Survey and Assessment Inc.
451 D'Angelo Way
P.O. Box 114
F. 100-162-312
F. 100-162-312
F. 100-162-312

Approx. Scale: 1:12,500

Table 1: Hoffman Productivity Indices

Location	Class	Total Area (ha)	Area & Percentages of Class in Study Area (A)	Conversion Field Capacity Index (B)	Productivity Indices (A x B)	Total
Location M	1	3.2	0.2% (0.02%)	1	2.066	0.657
	2		2.8% (0.08%)	2.3	3.723	
	3		0.04% (0.001%)	0.64	0.218	
Location TP	1	18.7	4.8% (20.2%)	1	3.962	0.934
	2		11.7% (49.5%)	2.3	1.05	
	3		2.1% (11.3%)	0.64	2.072	
Location C	1	7.8	0.0% (0.0%)	1	0.000	0.653
	2		27.5% (1.1%)	0.64	0.066	
	3		0.0% (0.0%)	0.00	0.000	
Location D	1	11.3	1.5% (11.3%)	1	2.000	0.36
	2		0.0% (0.0%)	0.00	0.000	
	3		34.4% (51.8%)	1	0.410	
Location F	1	68.7	21.9% (18.9%)	2.3	0.110	0.836
	2		0.0% (0.0%)	0.00	0.000	
	3		17.0% (14.6%)	0.64	0.117	
Location F	1	17.2	0.0% (0.0%)	0.00	0.000	0.620
	2		0.0% (0.0%)	0.00	0.000	
	3		0.0% (0.0%)	0.00	0.000	
Subject Property	1	14.5	2.7% (18.6%)	1	0.371	0.647
	2		4.1% (28.3%)	0.64	1.122	
	3		4.1% (28.3%)	0.37	0.069	

Notes: 1. Area of Subject Lands does not include the area within the Market Boundary.

Appendix D: MDS Letter

Stovel and Associates Inc.

Planners, Agrologists and Environmental Consultants

August 13, 2025

Township of Puslinch C/O Lynne Banks and Monika Farncombe
7404 Wellington Rd 34
Puslinch ON
N0B 2J0

**RE: Minimum Distance Separation (MDS) Analysis
Part of Lots 7, 8, and 9
Concession 10
Township of Puslinch
County of Wellington**

Stovel and Associates Inc. (SAI) was retained by Shawn Marsh of 1000286480 Ontario Inc. to conduct an analysis of the Minimum Distance Separation (MDS) requirements associated with a proposed settlement boundary expansion in Arkell, Township of Puslinch.

Proposals for new or expanded settlement area must be consistent with the Provincial Planning Statement, 2024 (PPS, 2024). Policy 2.3.2.1 e) sets out the requirement to comply with minimum distance separation formulae, as noted below:

2.3.2.1 (New Settlement Areas and Settlement Area Boundary Expansions)

"In identifying a new settlement area or allowing a settlement area boundary expansion, planning authorities shall consider the following:

- a) the need to designate and plan for additional land to accommodate an appropriate range and mix of land uses;*
- b) if there is sufficient capacity in existing or planned infrastructure and public service facilities;*
- c) whether the applicable lands comprise specialty crop areas;*
- d) the evaluation of alternative locations which avoid prime agricultural areas and, where avoidance is not possible, consider reasonable alternatives on lower priority agricultural lands in prime agricultural areas;*
- e) whether the new or expanded settlement area complies with the minimum distance separation formulae;*
- f) whether impacts on the agricultural system are avoided, or where avoidance is not possible, minimized and mitigated to the extent feasible as determined through an agricultural impact assessment or equivalent*

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- g) *analysis, based on provincial guidance; and the new or expanded settlement area provides for the phased progression of urban development.*"

Study Methods

To evaluate potential Minimum Distance Separation (MDS) implications for the proposed development, a reconnaissance-level survey of agricultural operations on lands adjacent to the proposed development was completed (Figure 1). Three livestock operations were identified in proximity to the site:

- Farm #1: 857 Watson Road S – existing hobby horse farm in the settlement of Arkell.
- Farm #2: 756 Watson Road S – existing, large horse farm north of Arkell.
- Farm #3: 930 Watson Road S – existing vacant building potentially capable of housing livestock (i.e. horses).

Farm Data Sheets were circulated to these properties. No replies were received.

Background data were reviewed. County Planning Report, May 9th, 2023 – D13/TON provides information related to Farm #3 for an unrelated, prior consent application (Report Attached – Appendix A).

The Minimum Distance Separation (MDS) Formulae - Publication 853

An MDS I assessment is required for settlement expansions into agricultural lands to ensure appropriate separation from livestock operations, prevent land use conflicts, and protect agricultural viability. The following guidelines were determined to be relevant:

Guideline 12 – Existing Non-Conforming Uses:

An MDS I setback is required for new development even if there are existing or approved developments that do not meet the MDS standard. The setback may be reduced if four or more non-agricultural or residential uses, or dwellings, are located closer to the livestock facility than the proposed development, provided they are:

- *Located within the 120° intervening field of view,*
- *On separate lots, and*
- *Of equal or greater sensitivity (Type A or B usage).*

Guideline 36 – Non-Application Within Settlement Areas:

MDS I setbacks are not required for proposed land use changes, including severances, rezonings, or redesignations, when they occur within approved settlement areas, as the long-term intent is typically non-agricultural.

Findings

There are relatively few active livestock operations in proximity to the subject lands. The existing horse farm located at 857 Watson Road S (Operation #1) is within the Hamlet boundary for Arkell. As a result, Guideline 36 applies and no MDS I setback is required.

Operation #2 is an active horse farm north of the site, at 756 Watson Road S. This farm is approximately 570 metres from the site. Given the presence of more than four non-farm residences between this farm and the site, the calculated MDS I setback does not encroach into the subject lands as it would only extend to the fourth closest non-farm residence.


Operation #3 is a small, vacant building (potentially capable of housing horses) located at 930 Watson Road has a calculated MDS I setback of 176 metres (County Planning Report, May 9th, 2023 – D13/TON, see Appendix A). This setback extends 176 metres north of the barn and encroaches into the subject property by about 38.8 metres. The encroached area is not proposed for development and will not affect the project. Figure 2 illustrates the extent of the MDSI arc

No other MDS I setbacks apply to the proposed urban boundary expansion.

Conclusion

In accordance with OMAFRA's Publication 853, the proposed development will not result in any MDS I conflicts with agricultural operations. Based on this, the proposed settlement boundary expansion is consistent with PPS (2024) Policy 2.3.2.1 e). Should you have any concerns or questions, please do not hesitate to contact me.

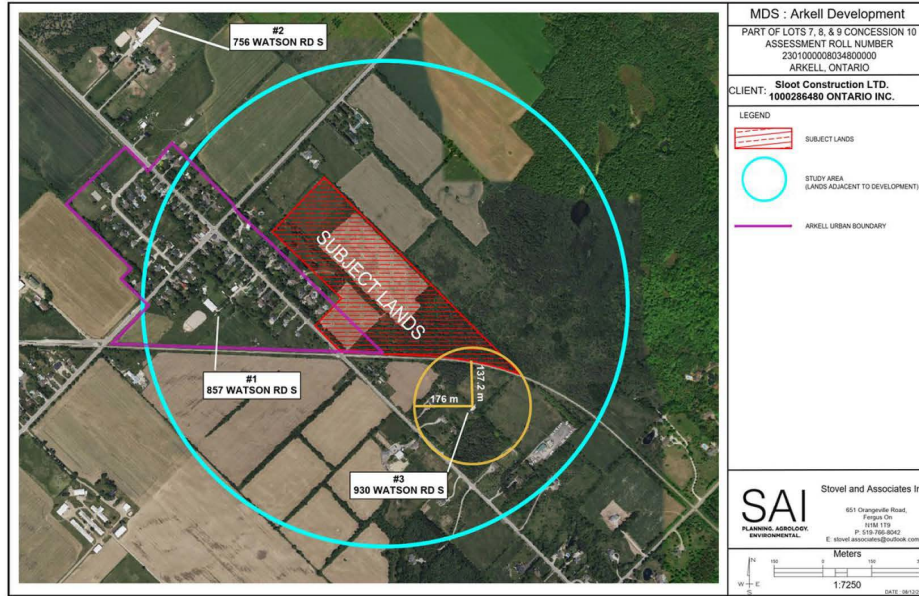
Yours truly,


Robert P. Stovel, M.Sc., M.C.I.P., R.P.P., P. Ag.


Robert L. Stovel, B.Sc.

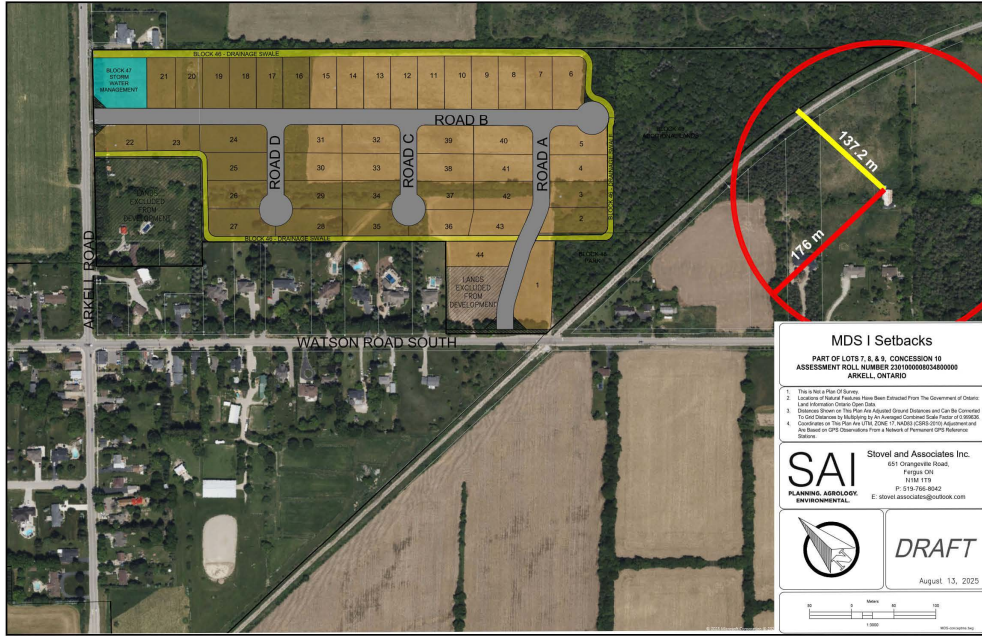
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Figure 1 – Agricultural Operations Surrounding Site



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Figure 2: MDS Map



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Appendix A: County Planning Report

Appendix A



PLANNING REPORT for the TOWNSHIP OF PUSLINCH

Prepared by the County of Wellington Planning and Development
Department

MEETING DATE: May 9th, 2023
TO: Lynne Banks, Development and Legislative Coordinator
 Township of Puslinch
FROM: Zach Prince, Senior Planner
 County of Wellington
SUBJECT: **MINOR VARIANCE APPLICATION D13/TON (Tonin)**
Louis Tonin
900 Watson Rd S
Part Lots 8 and 9, Concession 10
SCHEDULES: **1 – Applicant's Sketch**

We have reviewed the application for minor variance and provide the following comments. These comments are offered without the benefit of a site visit.

Planning Opinion

The purpose of this application is for relief from Minimum Distance Separation Formula (MDS I) requirements to meet a condition of consent application B01/03 which was conditionally granted by the County of Wellington Land Division Committee in March 2023. The consent application would sever a 0.93 ha (2.29 ac) vacant parcel and a 1.97 ha (4.87 ac) lot with an existing dwelling and barn would be retained. As part of the related consent application, MDS I was reviewed by Planning staff and it was determined that relief would be required to the existing barns in the area. Due to the number of lots within the area, the proposal has been calculated as a Type B land use under Guideline #34.

With respects to the MDS relief, planning staff notes that the setback from the barn located on the retained lands is based on the farm data sheet provided on a neighbouring severance application indicating the capacity for 8 medium sized horses. The barn located at 935 Watson Rd S is based on the unoccupied barn requirements and similarly is being used in a recent consent application (B48/22). The barn located at 930 Watson Rd S is based on information provided by the owner that indicates there are 9 horse stalls in the building and is currently unoccupied. The surrounding area includes the adjacent Guelph Junction Rail Line, existing agricultural parcels and rural residential lots as seen in **Figure 1**.

This minor variance application would maintain the general intent and purpose of the Official Plan and Zoning By-law, and is desirable and appropriate for the development of the subject property. We consider the request minor and have no concerns with the application.

PLANNING REPORT for the TOWNSHIP OF PUSLINCH
D13/TON – May 9th, 2023

Stovel and Associates Inc. 651 Orangeville Road, Fergus, ON N1M 1T9 519 766-8042

Section of the By-law	Requirements	Proposed	Relief Requested
Section 4.16.2 - General Provisions MDS II New or Expanding Livestock Facilities and Manure Storage facilities. 935 Watson Road S	305 m (1,000 ft)	105 m (344 ft)	200 m (656 ft)
Section 4.16.2 - General Provisions MDS II New or Expanding Livestock Facilities and Manure Storage facilities. 930 Watson Road S	176 m (577 ft)	115 m (377 ft)	61 m (200 ft)
Section 4.16.2 - General Provisions MDS II New or Expanding Livestock Facilities and Manure Storage facilities. 900 Watson Road S	173 m (567 ft)	85 m (279 ft)	88 m (288 ft)

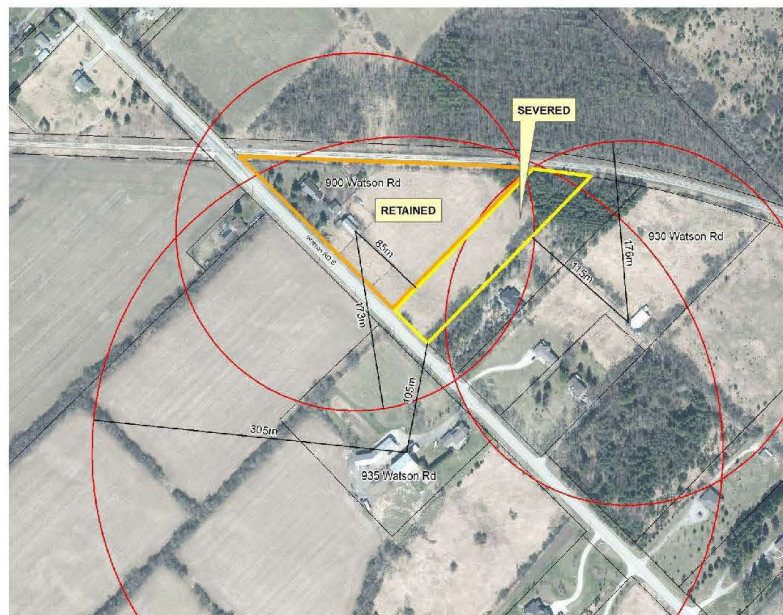


Figure 1 - Subject Property

PLANNING REPORT for the TOWNSHIP OF PUSLINCH
D13/TON - May 9th, 2023

Stovel and Associates Inc. 651 Orangeville Road, Fergus, ON N1M 1T9 519 766-8042

Our discussion of this application relative to the four tests under the Planning Act is as follows:

Four Tests	Discussion
That the requested variance is minor in nature	<ul style="list-style-type: none"> Consent application B01/23 was conditionally approved by the County of Wellington in March 2023 and this application is to satisfy a condition for MDS I relief. There is a conditionally approved vacant lot located across the road from the proposed lot which requires the same MDS I relief, farm data sheets were provided for this application (B47/22). The applicant has indicated the existing barn located on the retained lands (900 Watson) is vacant and have received a demolition permit to remove the structure. The owners of the neighbouring barns at 930 and 935 Watson Rd S have indicated the barn on their lands are vacant as well. Due to the number of residential lots in the immediate area the proposed lot has been considered a Type B land use.
That the intent and purpose of the Zoning By-law is maintained	<ul style="list-style-type: none"> The subject property is zoned Agricultural (A). The agricultural zone allows for residential uses. The intent of the MDS I setback is to provide a minimum distance between livestock facilities and sensitive lands uses (i.e. dwellings). MDS setbacks are intended to promote and protect agricultural uses while also reducing odour complaints and land use incompatibility. There are existing rural residential uses in the area which would impact the potential for future expansions to existing livestock buildings and new livestock buildings.
That the general intent and purpose of the Official Plan is maintained	<ul style="list-style-type: none"> The property is designated Prime Agricultural, and Secondary Agricultural. The Guelph Junction Rail line is an active rail line to the North of the property. Rural residential uses and agricultural uses are permitted in the Official Plan. The retained lands are adjacent to the Arkell Hamlet area Local zoning by-laws implement MDS I requirements
That the variance is desirable and appropriate development and use of the land, building or structure	<ul style="list-style-type: none"> The subject property is adjacent to existing rural residential uses and in close proximity to the Arkell Hamlet Area. We do not anticipate that a new residential use in this location would hinder or preclude the present use or future potential for the agricultural operations in question given that a number of existing rural residential uses are existing in the immediate area.

Additional Comments

All 3 of the above noted barns are currently not housing livestock. Since the initial application the owner of 900 Watson Road S has applied for and received a demolition permit for the barn located on the retained lands. The owners of 935 Watson Road S have a conditionally approved severance on their lands in which MDS will also need to be addressed, through discussions with

PLANNING REPORT for the TOWNSHIP OF PUSLINCH
D13/TON – May 9th, 2023

Stovel and Associates Inc. 651 Orangeville Road, Fergus, ON N1M 1T9 519 766-8042

the owner this barn may be demolished or rezoned to no longer house livestock. The owner of the barn at 930 Watson Road South indicating they do not intend to have livestock in the future.

I trust that these comments will be of assistance to the Committee in their consideration of this matter. We would appreciate a copy of the Committee's decision with respect to this application.

Respectfully submitted

Zach Prince, RPP MCIP, Senior Planner
Planning and Development Department



Zach Prince, RPP MCIP, Senior Planner

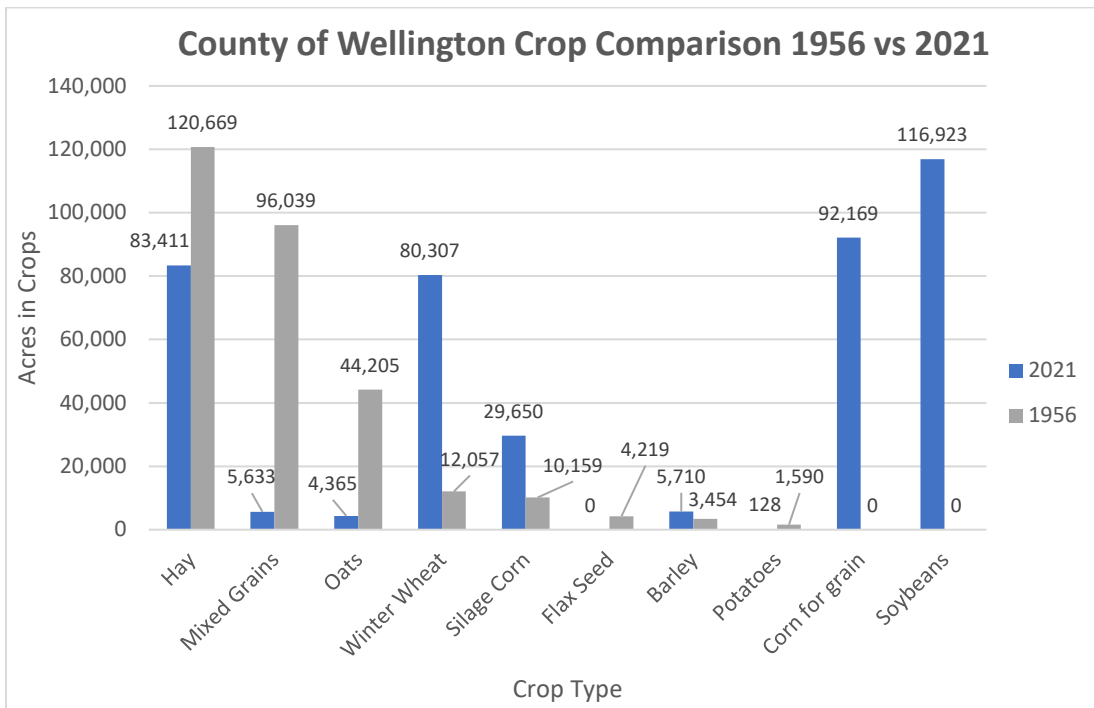
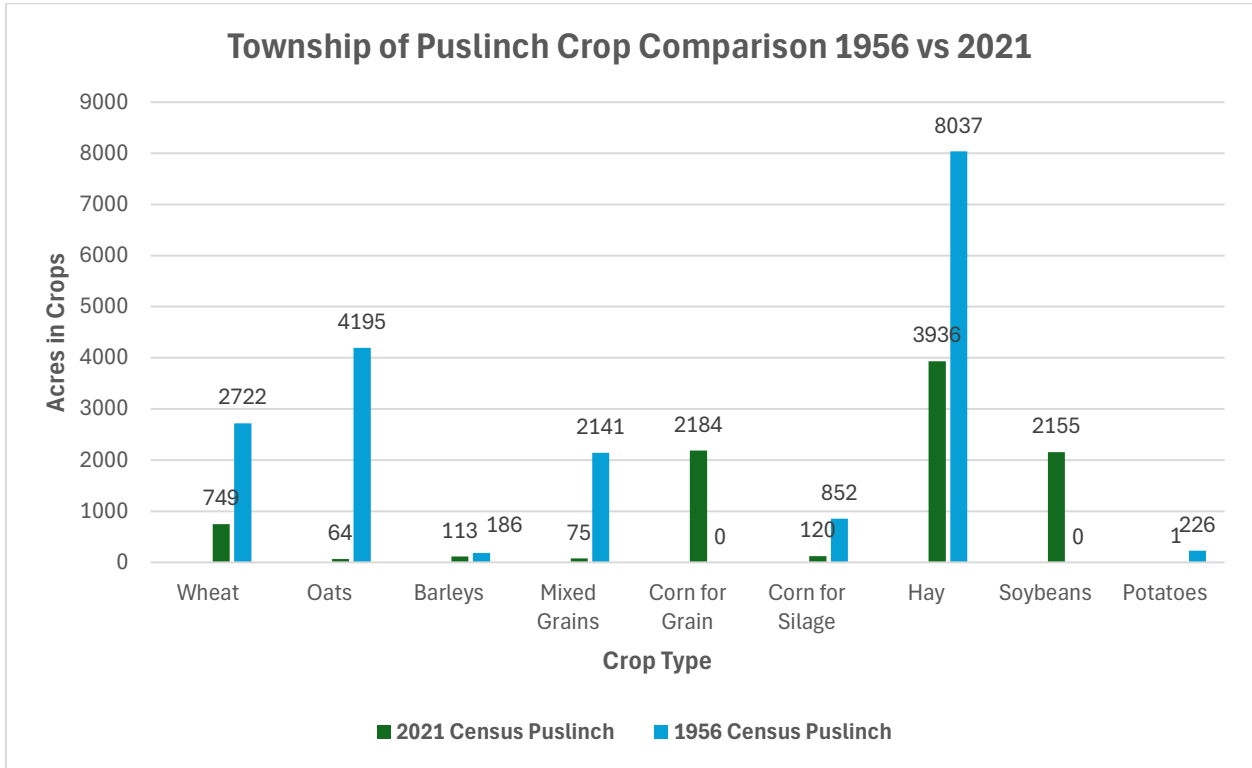
PLANNING REPORT for the TOWNSHIP OF PUSLINCH
D13/TON - May 9th, 2023

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Appendix E: Ontario Business, Agri-food, and Farm Data Profiles

County of Wellington and Township of Puslinch

Historic Comparison (1956 vs 2021)



Appendix F – Curriculum Vitae of Report Authors

ROBERT P. STOVEL, M.Sc., RPP, MCIP, P.Ag.

EDUCATION

M.Sc, Rural Planning, University School of Rural Planning and Development, University of Guelph, 1988.

B.A. Geography, Wilfrid Laurier University, 1986.

MEMBERSHIPS

Member of the Ontario Professional Planners Institute.

Member of the Canadian Institute of Planners.

Member of the Ontario Institute of Agrologists.

POSITIONS HELD

1995 - Present: Stovel and Associates Inc., Fergus, Ontario - President.

1993 - 1995: Ecological Services Group, Guelph, Ontario - Senior Project Manager.

1988 - 1992: Ecological Services For Planning Ltd., Guelph, Ontario - Planner.

EXPERIENCE

Extensive project experience on public sector and private sector developments. Planning assignments include site plan preparation, official plan amendments, zoning by-law amendments, consent applications, plan of subdivision and plan of condominium applications and peer review. These projects have required considerable government and non-government agency liaison, interdisciplinary team coordination and the integration of a variety of disciplines. I have been qualified to provide evidence at both the Ontario Municipal Board and Joint Board.

Hydroelectric and natural gas Environmental Assessment and Planning projects include: Union Gas 12 " Route Selection and Corridor Study (Orillia) and Lennox to Bowmanville 500 Kv Environmental Study and Monitoring Program.

Selected projects in planning projects include the following: selected plan review for the Town of Halton Hills planning department, testimony at the OMB related to the Hoddinott Plan of Condominium development, environmental planning evaluation in support of proposed residential severance in Ballinafad, planning opinion report for the Van Ryn application, and environmental and agricultural planning justification reports relating to estate residential development applications in the Town of Milton and the Town of Halton Hills.

Public sector projects include the following: planning/resources management review for the Town of Halton Hills (residential development), County of Grey (agricultural) and the Township of North Dumfries (aggregate); input to provincial highway expansion in the County of Peterborough (MTO Class EA of Highway 7) and the County of Essex (MTO Class EA of Highway 3); municipal landfill site searches and site expansions in the County of Victoria, County of Peterborough, County of Essex, and Regional Municipality of Haldimand-Norfolk; municipal road widening project in the Region of York (Weston Road); municipal bridge project in the Township of Mono (County of Dufferin); YDSS expansion project in the Town of Markham and Town of Pickering; and municipal water and sewage works EA in the City of Stratford.

- Coordinated private sector pit and quarry licence applications include: Flamboro Quarries Licence Expansion, Cox Construction's Puslinch Pit Expansion, Ospringe Pit Expansion, Lockhart Pit Expansion (Woolwich Township), and Shoemaker Pit (TMGL - Pilkington Township), Dufferin Construction - Wayside Borrow Pit (Hamilton Airport), Greenwood Construction (East Garafraxa Pit Expansion), MTO Highway 8 Bridge and Road Development in the City of Kitchener (MTO/Seegmiller), MTO 406 Aggregate Permit Project (Niagara).
 - Prepared Planning Impact Assessment for the proposed Audrey Meadows development (48 lots).
 - Prepared Planning Impact Assessment reports for Redi-Mix plant, and three mineral aggregate operations in the Chatsworth Township.
 - Prepared Planning Justification Report for the Trafalgar Road Sports Complex.
 - Prepared Planning Impact Studies for: Inverhaugh Pit, Puslinch Pit and Roszell Pit applications.
 - Prepared planning report for the Eisen Stone Yard project in the former Township of Nichol.
 - Prepared consent applications in both rural and urban settings in the County of Wellington.
 - Prepared Planning reports for the justification of golf course expansion and limited residential lot development adjacent to recreational uses in the County of Wellington.
 - Provided rural planning and agricultural examination of near urban area development in the Glen Williams and Glen Lamond area.
 - Examined the potential for agricultural conflicts for the proposed urban boundary adjustments in the urban areas of Fergus and Elora.
- Provided opinion evidence at Joint Board hearing on behalf of Town of Milton (Central Milton Holdings Limited).
- Completed Environmental Impact Study for proposed Audrey Meadows Estate Residential Subdivision in the Township of Puslinch.
- Completed Level 1 and/or Level 2 Natural Environment Reports for the following pit licence applications: Bosomworth Pit (Pilkington), Whitelaw Pit (Pilkington), Darrington Pit (Pilkington), Hale Farm (Minto), I-ON-X Acres Pit (Southwest Oxford), Schwartz Pit Expansion (Sullivan), Greenwood Pit (East Garafraxa), Palen Pit Expansion (Hibbert), Kraemer Pit (Huron East), Martin Pit (Huron East), and the Hartung Pit (North Perth).
- Completed the required seminar on the Ontario Wetland Evaluation System (3rd Edition), and the Wetland Environmental Impact Study, Technical Manual.
- Designed and implemented wetland monitoring programs for aggregate developments and estate residential developments.
- Completed wetland surveys in the following wetland complexes: Orangeville Reservoir, Hayesland-Christie, Dalrymple Lake, Star Wetland, Eramosa River Blue-Springs Creek, Philips Lake, Mossington Park, Cranberry/Oil Well bog, Humber River Marshes, Speed River, Beaverton River, Mill Creek, and Irish Creek.
- Completed forestry evaluations for woodlands in Puslinch Township, Centre Wellington, City of Hamilton, Woolwich Township, Southwest Oxford, Peel Region and Region of York.

CURRICULUM VITAE

Robert L. Stovel, B.Sc.

PROFESSIONAL PROFILE

Robert L. Stovel is a Planner with Stovel and Associates Inc. with professional experience in statutory land use planning, aggregate resource management, and agricultural land use planning across Ontario. His work involves the application and interpretation of provincial and municipal planning policy, including the Planning Act, Provincial Planning Statement, and the Aggregate Resources Act, in support of public and private-sector development applications.

Mr. Stovel works under the supervision of Registered Professional Planners and is progressively assuming increased responsibility in the preparation and coordination of planning materials, agency consultation, and policy analysis. He regularly liaises with municipal planning staff, conservation authorities, and provincial agencies, and contributes to interdisciplinary consultant teams addressing land use compatibility, agricultural protection, and resource management.

PROFESSIONAL EXPERIENCE

Planner

Stovel and Associates Inc., Fergus, Ontario, 2021 – Present

Mr. Stovel has worked on a range of public-sector and private-sector planning assignments involving aggregate resource development, agricultural land use planning, and rural development.

His responsibilities include:

- Preparation of Planning Justification Reports in support of Official Plan Amendments, Zoning By-Law Amendments, consents, and subdivision applications.
- Interpretation and analysis of provincial and municipal planning policy under the supervision of senior planners.
- Coordination with municipal planning staff, conservation authorities, and Provincial agencies.
- Participation in interdisciplinary consultant teams involving engineering, environmental, and agricultural specialists.

PLANNING COMPETENCIES & PROFESSIONAL EXPERIENCE

Preparation and evaluation of Planning Justification Reports for Official Plan Amendments, Zoning By-Law Amendments, consents, and plans of subdivision Application and interpretation of the Provincial Planning Statement and municipal Official Plans. Planning support for Aggregate Resources Act licence applications,

including land use compatibility and rehabilitation planning. Agricultural land use planning within Prime Agricultural Areas, including Agricultural Impact Assessments (AIAs) and Minimum Distance Separation (MDS I) analysis. Coordination with municipal staff, conservation authorities, and provincial agencies in support of planning approvals. Contribution to interdisciplinary planning teams addressing environmental, agricultural, and engineering considerations.

SELECTED AGGREGATE RESOURCE PROJECT EXPERIENCE

- Lockhart Pit Expansion (D & J Lockhart Excavators Ltd.), Township of Woolwich (Planning approvals and Aggregate Resources Act Licence Application), 2021-Present.
- Lichty Pit (James Thome Construction Ltd.), Township of Centre Wellington (Planning approvals and Aggregate Resources Act Licence Application), 2021-Present.
- Innes Line Pit (SAMI), Township of South-West Oxford (Planning approvals and Aggregate Resources Act Licence Application), 2021-Present.
- Leslie Expansion Pit (Leslie Sand and Gravel Inc.), Township of Guelph-Eramosa (Planning Approvals and Aggregate Resources Act Licence Application), 2024-Present.
- Township of Puslinch, Peer Review of Application, CBM Lanci Pit Expansion and Aberfoyle South Pit Expansion, 2023-Present.
- Town of Caledon, Peer Review of Agricultural Impact Assessment, CBM Caledon Quarry, 2024-Present.
- Town of Caledon, Assistance in preparing Site Plan Section, Caledon Aggregate Standards Manual, 2025-Present.
- Township of Melancthon, Peer Review of AIA and Site Plans, Strada Aggregates Inc., Strada Pit & Quarry, 2025-Present.
- Preparation of annual Compliance Assessment Reports (CARs) for active gravel pits across Ontario.
- Preparation and Peer Review of site plan amendments and partial surrender amendments for municipal and private-sector pit operations.

SELECTED MUNICIPAL & AGRICULTURAL PLANNING EXPERIENCE

- Preparation of Agricultural Impact Assessments (AIAs) for development proposals within Prime Agricultural Areas.
- Peer review of AIAs and Minimum Distance Separation (MDS I) calculations under senior planner supervision.
- Preparation of agricultural rehabilitation plans for disturbed and post-extraction landscapes.
- Background policy research for the County of Middlesex addressing minimum farm parcel size in the Prime Agricultural Area.
- Planning support for rural consents, severances, and subdivision applications in the County of Wellington.

EDUCATION

Bachelor of Science (B.Sc.)
Providence College, 2020

PROFESSIONAL OBJECTIVE

Actively working toward eligibility for the Registered Professional Planner (RPP) designation through progressive professional experience under the supervision of Registered Professional Planners.

**PLANNING JUSTIFICATION REPORT
FOR ARKELL SUBDIVISION**

PREPARED FOR:

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Guelph, ON
&
Sloot Construction Ltd.
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Puslinch ON
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January 2026

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1.0 INTRODUCTION

1.1 Site Location

Stovel and Associates Inc. (“SAI”) was retained by Timberworx Custom Homes Inc. (“Timberworx”), Slood Construction Ltd. (“Slood”) and John Slood Investments Ltd. to complete a Planning Justification Report (“PJR”) for a proposed residential development in the Township of Puslinch (Arkell). Given the location of the site, a settlement boundary expansion is required. Additional lands have been conditionally purchased by the ownership group to provide for an entrance onto Arkell Road. These additional lands are approximately 1.6 ha in size and are owned by Victor Satzewich and Linda Mahood. The project is referred to as Arkell Subdivision. The lands in question (including the Satzewich/Mahood parcel) are approximately 18.8 ha in size and are located on Part of Lots 7, 8 and 9, Concession 10.

Watson Road abuts the property on the southeastern limits of the site and Wellington County Road 37 (also known as Arkell Road) is located on the west/northwestern limits of the site (see Figure 1).

In the context of this report, the lands in question are referred to as the site, subject lands or subject property.

1.2 History

In 2006, Mr. Tom Kukovica (the owner of the subject property at the time) applied for Draft Plan of Subdivision, Official Plan Amendment and Zoning Bylaw Amendment. The applications were deemed complete in September 2006. The proposal included 35 residential lots (minimum 1 acre in size) serviced by private individual wells and septic systems. The application was circulated to public agencies for comment and to landowners within 120m of the site. Following the receipt of the comments, replies were prepared by the Kukovica consulting team. Appendix A sets out the outstanding issues associated with the original application.

Astrid J. Clos Planning Consultants (“AJC Planning”) conducted a review of the Municipal Comprehensive Review from The County of Wellington – Progress Report #3. The letter prepared by Astrid Clos. requests that the Proposed Kukovica Subdivision be considered as a Hamlet Expansion (March 19, 2021). The following excerpt from AJC Planning summarizes the proposal:

“JOHN SLOOD INVESTMENTS LIMITED and SLOOD CONSTRUCTION LTD. is the owner of the property abutting the Arkell Hamlet and is legally described as Part of Lots 7, 8 and 9, Concession 10, Township of Puslinch. County Official Plan Amendment, Zone Change and Draft Plan of Subdivision applications were deemed to be complete in September 2006 for this property.

Please find this documentation attached for your reference.

These applications propose to expand the Arkell Hamlet to the east by approximately 18.2 hectares and change the zoning to implement a proposed residential Draft Plan of Subdivision to permit 35 residential lots. The area breakdown is provided below:

1.65 hectares (area of 3 severed lots)

1.83 hectares (area within the Hamlet)

18.2 hectares (area of Hamlet expansion)

21.68 hectares (Total Draft Plan Area)”

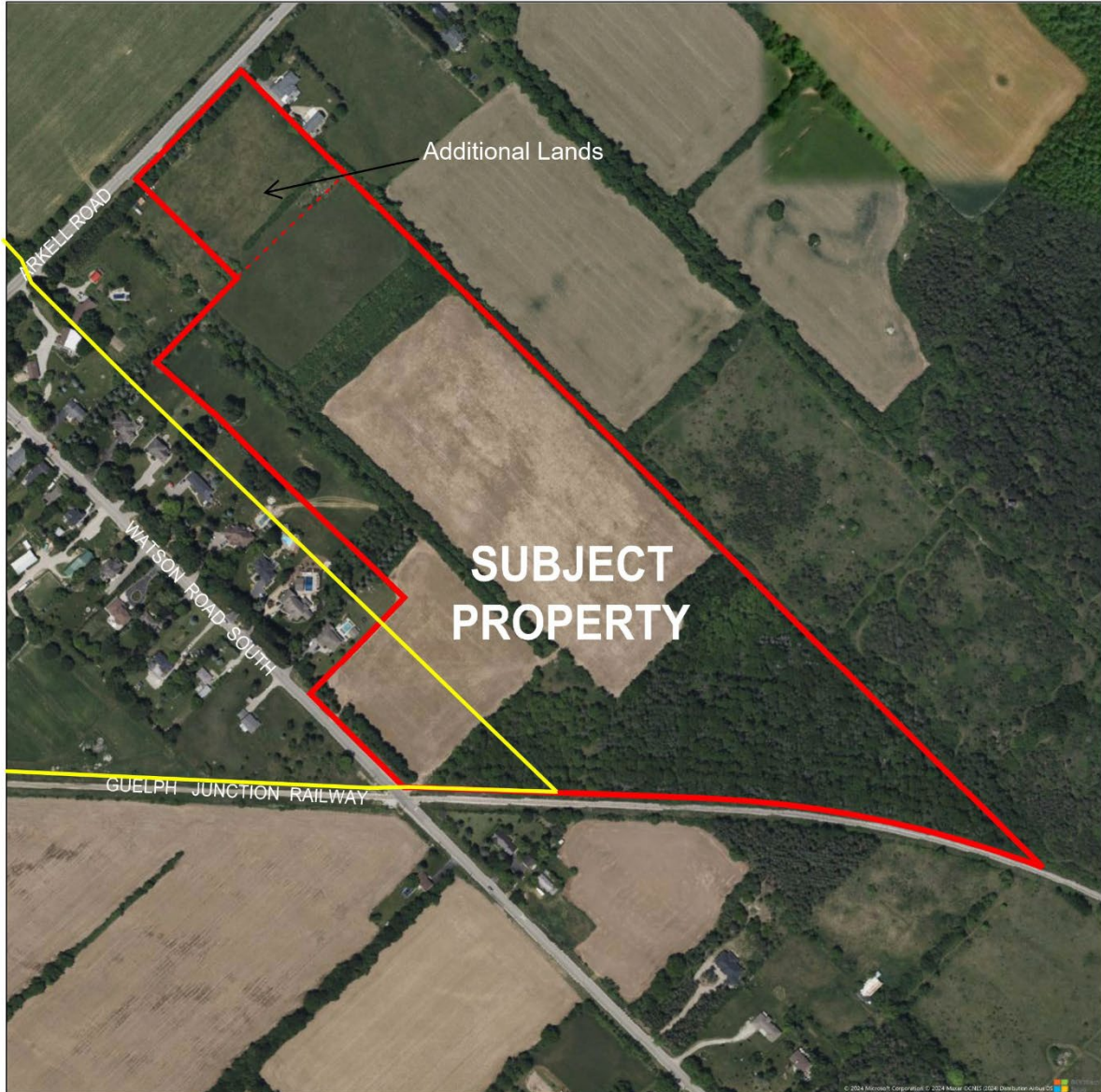


Figure 1
Site Location

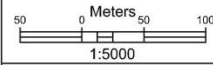
- Legend**
- Site Boundary
 - Hamlet of Arkell Limits

Sources:
Aerial Imagery Provided By Microsoft Corporation @ 2024 Maxar CNES (2024) Distribution Airbus DS.

Planning Justification Report

Part of Lots 7.8 & 9 Concession 10
Township of Puslinch,
Wellington County Arkell, Ontario

Date: March 5, 2024



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In 2021, the current ownership group engaged with the Township of Puslinch and County of Wellington to resolve technical issues associated with the proposed development. Updated technical analysis was submitted to the municipality for technical peer review. The findings of these updated reports are summarized in this document. The updated reports include the following:

- Agricultural Impact Assessment (SAI, 2026).
- Nitrate Impact Assessment (Crozier, 2024).
- Functional Servicing and Stormwater Management Report (Crozier, 2026).
- Groundwater Supply Assessment (ARL Groundwater Resources Ltd, 2023).
- Water Balance Assessment (Crozier, 2025).
- Traffic Impact Study (Crozier, 2025).

1.3 County Official Plan and Township Zoning Bylaw

The lands in question are designated Hamlet, Prime Agricultural, and Secondary Agricultural in the County of Wellington Official Plan (“County OP”) (see Figure 2). Lands designated Hamlet may be used for residential purposes. An amendment to the County OP is required to expand the settlement boundary to permit residential development outside of the Hamlet limits.

The lands in question are zoned Agriculture (Comprehensive Zoning By-Law No. 023-18, Consolidated May 2021). The site will need to be rezoned from Agriculture to Hamlet Residential to permit the establishment of a residential subdivision.

At the time of the application was deemed complete in 2006, the Zoning By-Law enforced by the Township was “*Puslinch Township Zoning By-Law 19/85*”, but this bylaw was updated by Comprehensive Zoning By-Law No. 023-18 in 2021. The zoning standards set out in Zoning By-Law No. 023-18 for Hamlet Residential have guided the design of this proposed development

1.4 Purpose and Scope

This report provides the planning justification for the proposed development application. The following study objectives are addressed in this report:

Planning impact assessments may be required to evaluate:

- a) the need for the proposed use other than for aggregate operations, taking into account other available lands or buildings in the area;*
- b) the appropriateness of the proposed site for the use proposed taking into consideration the size and shape of the land and its ability to accommodate the intensity of use proposed;*
- c) the adequacy of the proposed method of servicing the site;*
- d) the compatibility of the proposed use with consideration given to the height, location, proximity and spacing of buildings; the separation between various land uses; impacts from noise, odour, dust or other emissions from the proposed use and from adjacent land uses; loss of privacy, shadowing or impact on cultural heritage resources and landscapes;*
- e) the impact on natural resources such as agricultural land and mineral aggregate deposits;*
- f) the impact on biodiversity and connectivity of natural features and areas;*
- g) the exterior design in terms of bulk, scale and layout of buildings and other design elements;*
- h) the possibility that site contamination has occurred or the site may contain historic petroleum wells or associated works, and if so, demonstrate compliance with provincial regulations;*
- i) methods of reducing or eliminating negative impacts;*
- j) other planning matters considered important by a Council. (County of Wellington Official Plan. December 2025. Page 29-30 – Policy 4.6.2).*

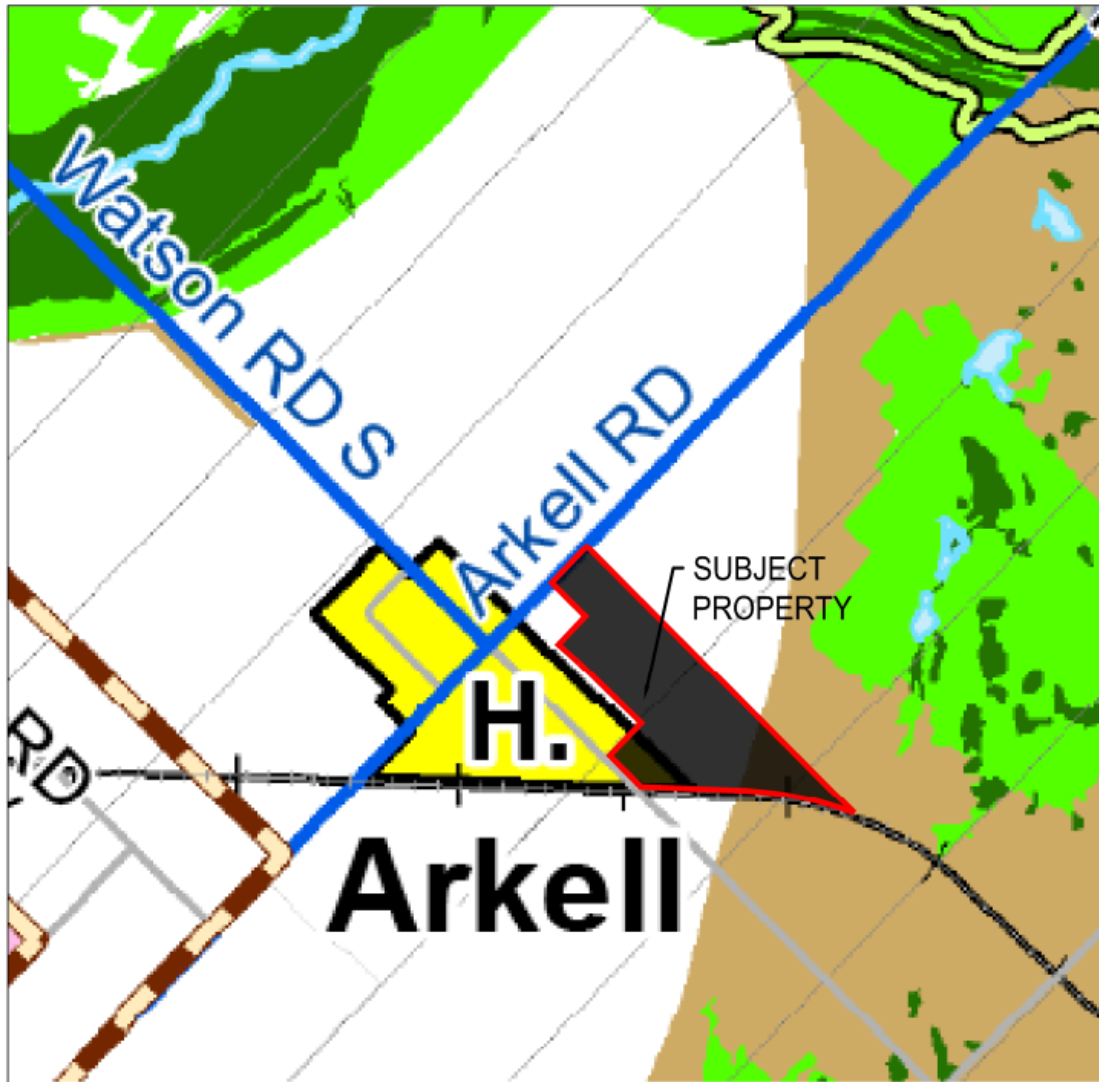


Figure 2

County Official Plan
Land Use Designation

Sources:

County of Wellington Official Plan
Schedule B7 - Land Use - Puslinch

The Greenlands System

- Core Greenlands
- Greenlands
- Earth Substrate ANS1

The Rural System

- Prime Agricultural
- Secondary Agricultural
- Hamlet Area
- Secondary Urban Centre
- Minor Aggregate Area
- Recreational
- Rural Employment Area
- Country Residential
- Policy Area
- Regionally Significant Economic Development Study Area
- Site Boundary

Other

- Landfill Site
- Proposed Interchange
- Proposed Major Roadways
- County Roads
- Provincial Highway
- Railways
- Waterbody
- Watercourse

Planning Justification Report

Part of Lots 7, 8 & 9 Concession 10
Township of Puslinch,
Wellington County Arkell, Ontario

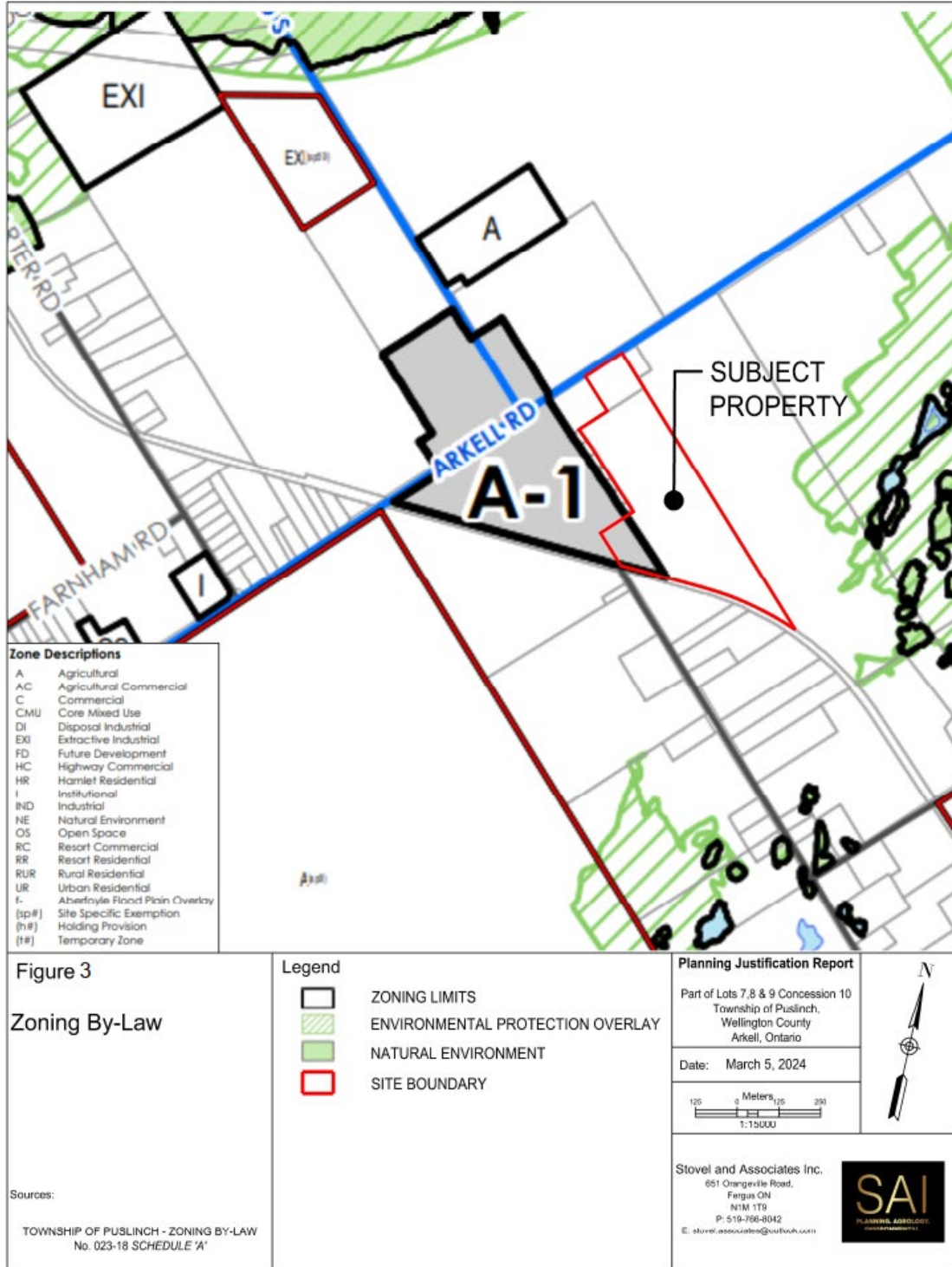
Date: March 5, 2024

NOT TO SCALE
N.T.S.



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2.0 SITE LOCATION AND SURROUNDING LAND USES

2.1 Site Description

The total area of the subject site is approximately 18.8 hectares in size. The site mainly comprises agricultural fields that have been used for common field crops. The agricultural fields comprise approximately 9.75 ha of the site. Approximately 1 ha of the subject lands are in the settlement boundary.

There is a plantation in the southern portion of the subject site. This plantation is approximately 4.5 ha in size. The plantation is described by GWS Ecological and Forestry Services Inc. (Appendix B) as follows:

“An immature mixed wood plantation occupies approximately 11 acres at the south end of the site. The species composition is estimated to be white pine - 40%, white spruce - 20%, black walnut, 20% and black locust - 20%.

These trees are about 25 years old and mostly of pole timber size being 4 to 9 inches in diameter at breast height (dbh). Tree growth has generally been good as the white pine and deciduous trees are 25 to 50 feet tall while the spruce are 20 to 35 feet tall. However, where pine and spruce are growing in close proximity to black walnut there has been much dieback and mortality to the conifers due to juglone poisoning from the walnut. In spite of this mortality the overstory is still fully stocked with living trees. The understory consists of a low to moderately dense shrub layer of common buckthorn, red elderberry and raspberry. Common buckthorn is a very aggressive alien species that is undesirable in woodlands due to its high reproductive potential, shade tolerance and rapid growth under a wide variety of site conditions. Garlic mustard, another non-native invasive species, is also abundant throughout the woodland area. No rare or unusual plants were noted and none are expected in this man-made forest. To date, no thinning has been carried out in this plantation. Common wildlife species were observed utilizing this woodland habitat, including white-tailed deer, black squirrel, red squirrel, cottontail rabbit, Blue Jay, Black-capped Chickadee and American Crow. Other common woodland birds and mammals likely inhabit this area. Given the above characteristics there is insufficient justification to consider this plantation as locally significant within Puslinch Township. Development intrusions into this woodland are therefore considered acceptable.” (GWS Ecological & Forestry Services Inc., 2007).

Appendix C provides findings from a 2023 Bird Survey conducted by Colville Consulting Ltd. No threatened or endangered species were inventoried onsite. One Eastern wood-pewee was recorded on an edge tree not part of the plantation.

The proposed residential development has been kept out of the plantation. Some minor, edge pruning/removals may be required to permit the construction of services (i.e. road, surface drain). These areas are largely comprised of invasive, non-native species such as Common buckthorn. A Tree Protection and Management Plan will document and assess required clearings as part of the draft plan of subdivision process.

2.2 Surrounding Uses

The subject property is located partially within the Settlement of Arkell. Existing residential lots are located west and north of the site. Lands to the east of the site and north of Arkell Road are cultivated for common field crop production. The settlement boundary for Arkell extends west of Arkell Road that includes six residential parcels.

The Guelph Junction Railroad (“GJR”) is located on the southern limit of the site. The lands further to the south of the site (south of the GJR) include several non-farm residences, scattered small agricultural fields and small woodlands.

There are no significant agricultural operations adjacent to the site. Approximately 890 m to the west are the agricultural research buildings of the University of Guelph.

3.0 PROPOSED DEVELOPMENT

3.1 Description of Development Proposal

The proposed development is comprised of 44 single detached dwellings (See Figure 4 below). Within the existing Hamlet area, two residential lots are proposed (as part of the draft plan of subdivision). A stormwater management area is proposed in the northeastern portion of the site.

The current conceptual layout for the proposed development does not include residential development within the onsite plantation. A municipal park was proposed within the Hamlet area, however, it is recognized that the Township of Puslinch is not interested in these lands for a park. Following discussion with Township Council, additional lands could be added to proposed Lot 1.

The residential lots are proposed to be created through a Plan of Subdivision. The residential lots will be serviced utilizing advanced tertiary septic systems and private, drilled individual wells. Lot sizes range from approximately 0.2 to 0.3 ha in size. Lot frontages range from 30-40 m, not including the lots on curves or cul de sacs. Each home is expected to have a double-car garage with additional parking for a minimum of two cars within each driveway.

The proposed development will have two entrances: one on Watson Road and one on Arkell Road. The internal streets will utilize an urban cross-section with pavement, curb, and gutter. The road section has been designed using a standard 20m right of way.

The internal road network sets out the following:

- There is approximately 1200m of road in the proposed subdivision;
- The roads will provide a full urban cross-section with curb, gutter and sidewalks;
- For the most part, the internal roads are double-loaded.

The engineering proposal includes design elements to capture surface runoff water and to promote infiltration.

3.2 Traffic Impact Study

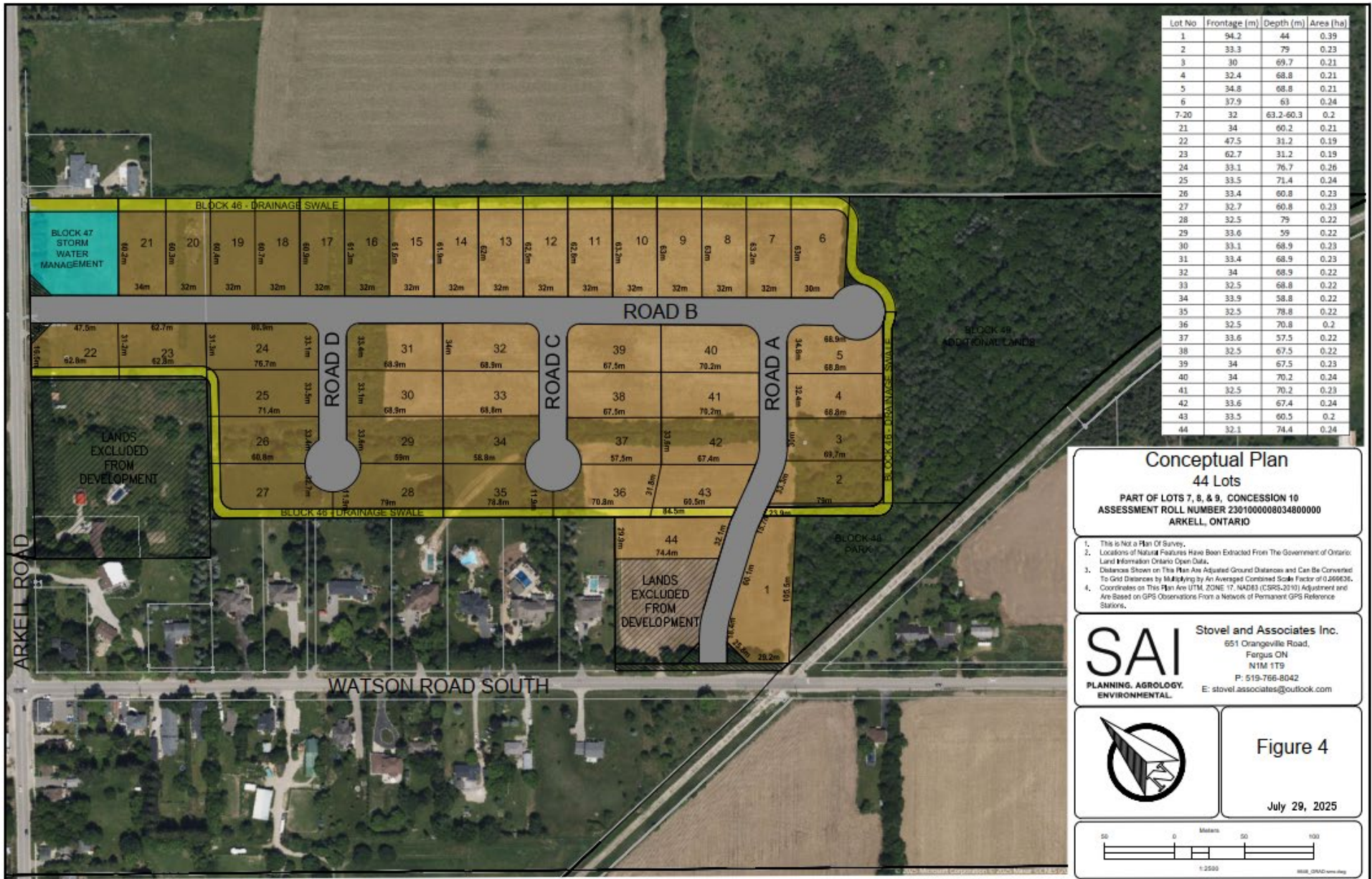
Richardson Foster Ltd. prepared a Traffic Impact Study of the Proposed Subdivision in August, 2006.

The conclusions of the TIS are as follows:

“AADT data, AM and PM peaks, growth factor, and directional split provided by the Engineering Services Department of Wellington County were used to calculate all traffic volumes. All movements at both proposed entrances/exits have been designed to provide an “A” level of service. The location of the entrances/exits provide adequate sight line distances for motorists. There is sufficient sight line distance for the railway crossing on Watson Road.”

The recommendations of the TIS are:

“All traffic exiting from the site should be under stop sign control. Minimum entrance radii should be 9.0m as per Township of Puslinch Standards. Undivided entrance/exit lane widths should be 3.75m wide. Two-way roadways should consist of a minimum 7.5m width and 12.0m centreline radius to allow for adequate movement of emergency vehicles. Changes to the existing Watson and Arkell Road pavement geometry are not required for the proposed development of the subject site into 38 estate residential lots. Signal sight lines to be in accordance with Transport Canada RTD 10 Standards”.



C.F. Crozier & Associates Inc. was retained to complete an updated TIS. This study assessed the transportation impacts of the proposed residential development. The detailed analysis contained within this report has resulted in the following key findings:

- Under 2023 existing traffic conditions, the study intersection of Arkell Road and Watson Road South is operating below capacity with minimal delay during both weekday a.m. and p.m. peak hours.
- The proposed development is expected to generate 40 and 52 two-way primary trips in the a.m. and p.m. peak hours, respectively.
- Under the ultimate 2031 future total conditions:
 - The all-way stop-controlled intersection of Arkell Road and Watson Road South is projected to operate below capacity at a LOS “A” and “B” during the weekday a.m. and p.m. peak hours, respectively. Average intersection control delays of 9.5 and 14.3 seconds in the a.m. and p.m. peak hours, respectively and maximum volume-to- capacity ratios of 0.27 (EB) and 0.54 (NB) are expected in the weekday a.m. and p.m. peak hours, respectively.
 - The proposed site access connection at Watson Road South is forecast to operate at a LOS “A” and “B” during the a.m. and p.m. peak hours respectively.
 - Overall, the nearby road network is projected to operate adequately without any capacity constraints under the ultimate 2031 future total scenario. The nearby road network is expected to operate similarly or better under the 2026 horizon year.
 - These operations are similar to the 2031 and 2026 Future Background traffic operations. Therefore, operations are expected to be similar with or without the proposed development.
- The proposed access connections to Watson Road South and Arkell Road are satisfactory per the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR) with regards to sight distance, access spacing, corner clearance and Transport Canada’s Grade Crossing Standards with regards to access spacing.

Based on the study findings, the development application can be supported from a traffic operations perspective as the boundary road network can accommodate the increase in traffic volumes attributable to the proposed development located on sections of Lots 7, 8 and 9 of Concession 10, in the Township of Puslinch, County of Wellington. Further, the proposed accesses are forecast to be functionally adequate with immaterial impacts to the study intersections.

The detailed analysis contained within this report has resulted in the following key findings:

- *Under 2023 existing traffic conditions, the study intersection of Arkell Road and Watson Road South is operating below capacity with minimal delay during both weekday a.m. and p.m. peak hours.*
- *The proposed development is expected to generate 40 and 52 two-way primary trips in the a.m. and p.m. peak hours, respectively.*
- *Under the ultimate 2031 future total conditions:*

- *The all-way stop-controlled intersection of Arkell Road and Watson Road South is projected to operate below capacity at a LOS “A” and “B” during the weekday a.m. and p.m. peak hours, respectively. Average intersection control delays of 9.5 and 14.3 seconds in the a.m. and p.m. peak hours, respectively and maximum volume-to-capacity ratios of 0.27 (EB) and 0.54 (NB) are expected in the weekday a.m. and p.m. peak hours, respectively.*
- *The proposed site access connection at Watson Road South is forecast to operate at a LOS “A” and “B” during the a.m. and p.m. peak hours respectively.*
- *Overall, the nearby road network is projected to operate adequately without any capacity constraints under the ultimate 2031 future total scenario. The nearby road network is expected to operate similarly or better under the 2026 horizon year.*
- *These operations are similar to the 2031 and 2026 Future Background traffic operations. Therefore, operations are expected to be similar with or without the proposed development.*
- *The proposed access connections to Watson Road South and Arkell Road are satisfactory per the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR) with regards to sight distance, access spacing, corner clearance and Transport Canada’s Grade Crossing Standards with regards to access spacing.*

3.3 Review of Natural Heritage Features and Functions

GWS Ecological & Forestry Services Inc. (“GWS”) conducted a review of the natural environment of the Proposed Subdivision on January 5, 2007. The results of the peer review are summarized below:

“The subject property consists of hay fields bounded by hedgerows, as well as woodland that extends along the railway line. The land gently slopes to the north and run-off flows through a culvert that passes under Arkell Road. It is my understanding that an Environmental Impact Study (EIS) was not required in this case because there are no wetlands or significant woodlands found on or nearby the Kukovica property. The subject lands are currently designated as Primary Agricultural, Secondary Agricultural and Hamlet Area in the Wellington County Official Plan and they have been zoned Agricultural by the Township. As a result, an Amendment is required to the Official Plan and Zoning By-law in order for this development to proceed”.

“In summary, there are no significant natural features on the subject lands that warrant protection or the exclusion of development intrusions. The proposal development therefore seems reasonable from a natural environment perspective. The large lots in conjunction with the gently sloping terrain are favourable for tree preservation and healthy, good quality trees should therefore be retained whenever possible. In order to effectively achieve this objective a tree preservation plan should be prepared for the entire site as a condition of Draft Plan approval. Given the high density of trees within the plantation and the tree health problems which exist in this area, more detailed lot specific tree preservation plans should also be prepared for lots 13, 14, 15, 16, 17, 18, 19 and 20 prior to the issuance of building permits. All trees to be retained on these lots should be clearly identified on a site plan along with appropriate tree protection measures to be implemented during construction”.

The applicant has reviewed the GWS review of natural environment and agrees with the recommendation to prepare a tree preservation plan. This recommendation can be included as a condition of draft plan approval. It is noted, however, that the proposed conceptual plan does not propose development envelopes within the plantation; Lots 1-6 backlot along the edge of the plantation and these lots will be the focus of the tree preservation plan.

In 2023, Colville Consulting completed a breeding bird survey of the subject plantation. No threatened or endangered species were inventoried on the site. One species, Eastern wood-pewee was noted on an edge tree not part of the plantation. This species is listed as of Special Concern.

The proposed development has been designed to minimize residential development within the onsite plantation. The lot fabric does not propose any building envelopes to be included in the onsite plantation. It is recommended that a draft plan condition be drafted to ensure that development will not be permitted in the onsite plantation without further environmental investigations being undertaken to the satisfaction of the Township of Puslinch. It is recognized that the Crozier grading plan proposes to install two drainage channels within the plantation. A technical review of the impacts of this proposal on the plantation will be addressed through a Tree Protection and Maintenance Plan, to be completed as a condition of draft plan approval.

3.4 Geotechnical Assessment

V.A. Wood (Guelph) Incorporated conducted a Geotechnical investigation of the Proposed Subdivision February 2007. The results of the investigation are as follows:

“The boreholes encountered surficial deposits of topsoil underlain by compact to very dense sandy gravel or gravel and sand on very dense silt or gravelly, silty sand till on very dense sand and silt on very dense gravelly, silty sand till on very dense sand or probable boulder or bedrock.

The groundwater table is considered to be located at elevations ranging between El. 333.3m± and 334.9m±.

If storm sewer inverts are located at typical depths of between 3 and 4 metres below grade, excavations will encounter compact to very dense sandy gravel or gravel and sand. These deposits will generally provide adequate support for the pipes and allow the use of normal Class 'B' bedding using Granular 'A' material. Clear crushed stone should not be used as bedding unless it is wrapped with geotextile to prevent undesirable settlements caused from fines migrating into the voids of the stone. Where the exposed subgrade is less competent, the bedding thickness may have to be increased, and it may be necessary to protect the excavation with a skim coat of concrete immediately after it has been exposed.

The excavated materials will be generally suitable for use as trench backfill provided that they are free of topsoil and boulders. If the on-site materials are or become wet, they should be air dried prior to re-use as trench backfill. The trench backfill should be placed in 150 to 200mm thick layers and uniformly compacted to at least 95% of its Standard Proctor maximum dry density. The backfill around manholes should consist of well-graded and well-compacted granular material.

To minimize potential problems and wetting of the subgrade material, backfilling operations should follow closely after excavations, so that only a minimal length of trench is exposed at a time. Should construction be carried out in the winter season, particular attention should be given to make sure no frozen material is used for backfill.

The deposits of topsoil are not considered to be a suitable bearing stratum. The foundations for the proposed residential dwellings should therefore be extended into the native sandy gravel or gravel and sand which will be suitable for supporting footings designed to an allowable bearing pressure of up to 200 kPa (4 ksf).

All exterior footings or footings in unheated areas should be located at least 1.2 metres below finished grade for adequate frost protection.

Elevation differences between adjacent footings should not be more than a half of the horizontal distance between them.

It is estimated that the total and differential settlements of footings designed to these bearing pressures will be less than 25 and 20mm respectively, which are normally considered acceptable for the proposed residential structures.

It is recommended that all foundation excavations be inspected to ensure the founding materials are similar to those identified in the boreholes and that they are capable of supporting the design loads.

No major construction problems due to water are anticipated in excavations above El. 334. 9m±. However, provision should be made for control of surface water run-off and minor seepage by pumping from local sumps on an as and where required basis.

The sides of the excavation to a depth of more than 1.2 metres (and above the water table) should either be cut back at a side slope of 1 to 1 or supported using adequately braced closed sheeting.

All topsoil and any deleterious fill encountered should be stripped from the building areas and the proposed subgrade should be re-compacted from the surface to at least 95% of its Standard Proctor maximum dry density. Any loose/wet material encountered should be sub-excavated and replaced with approved fill.

The fill may consist of approved on-site materials free of cobbles/boulders or approved imported fill. All fill should be placed in 150 to 200mm thick lifts and compacted to at least 95% Standard Proctor maximum dry density. It is recommended the underfloor fill be placed at least one month prior to floor construction in order to minimize settlement.

A layer of well-graded, free-draining material, at least 150mm thick and compacted to at least 98% Standard Proctor maximum density, should be placed under the floor slabs to provide a uniform bearing surface and act as a vapour barrier.

Frequent inspections by geotechnical personnel should be carried out during construction to verify compaction of the subgrade and base courses by in-situ density testing using nuclear gauges.

All topsoil and any deleterious materials encountered should be stripped from the proposed pavement area(s). The underlying subgrade should then be re-compacted from the surface to at least 95% of its Standard Proctor maximum dry density prior to construction of the pavement. Any loose areas which are detected should be sub-excavated and replaced with suitable approved on-site material or approved imported fill. All fill materials should be placed in 150 to 200mm thick lifts and compacted to at least 95% Standard Proctor maximum dry density.

Considering the probable traffic requirements and subsoil conditions, the following pavement designs are recommended:

Table 1: Recommendation of Pavement Designs

Material	Passenger Car Parking (Light Duty) (mm)	Access Road (Medium Duty) (mm)
Asphaltic Concrete	50	90
Granular 'A' Base Course	150	150
Granular 'B' Sub-base Course	200	300

The base and sub-base granular materials should be compacted to at least 100% Standard Proctor maximum dry density. The asphalt should be compacted to OPS Specifications.

Frequent inspections by geotechnical personnel should be carried out during construction to verify the compaction of the subgrade, base courses and asphaltic concrete by in-situ density testing using nuclear gauges”.

The results of the investigation confirmed the findings of the Geotechnical 2006 Study and are included in Appendix D. In 2023, Chung and Vander Dolen Engineering LTD. completed a series of test holes on the subject lands. The purpose of the test hole program was to confirm the character of the subsurface materials. The series of test holes and relevant data are included in Appendix E. The test holes confirmed the subsurface characteristics on the subject property and established the groundwater table over 6 m below the surface.

3.5 Groundwater Supply Assessment

ARL Groundwater Resources Ltd. (“ARL”) completed a Groundwater Supply Assessment to address impacts related to servicing the proposed development. The assessment addresses the requirements of the guideline D-5-5 (Private Wells: Water Supply Assessment), published by the Ontario Ministry of the Environment, Conservation and Parks (MECP). The most recent revision to Guideline D-5-5 is understood to have been made in August 1996, and the MECP has continued to publish the guideline in its current form up until at least December 2018. ARL summarized the geologic setting and workplan as follows:

A review of background information including existing water well record information indicates that a multi-aquifer system exists in the vicinity of the Hamlet of Arkell, including the proposed development property. The multi-aquifer system consists of the following geological units, in descending order:

Guelph Fm. - Upper Aquifer

Eramosa Fm. - Intermediate Aquitard/Aquifer

Gasport Fm. - Lower Aquifer.

It is evident from the water well record information that both the Guelph Fm. and Gasport Fm. aquifers have met the water quantity needs of residences and businesses in the Arkell area for many years.

Three test wells (TW1/2022 - TW3/2022) were constructed and tested as part of a groundwater supply assessment for the proposed development property. The wells were constructed in the lower aquifer (Gasport Fm.) to evaluate whether the lower aquifer alone could meet the water supply requirements of up to 50 new residential lots on the property. The upper aquifer (Guelph Fm.) was not considered in the test well program.

The results from 3 test wells indicate that the Gasport Fm. aquifer (lower aquifer) can meet the water quantity requirements of new individual lots on the proposed development property. Further, interpretation of the test well performance indicates that the aquifer can support the water quantity requirements associated with 50 new residential lots at the site.

Overall, the water quality test results indicate that groundwater produced from the 3 test wells is potable, as most of the parameters tested with an Ontario Drinking Water Standards Maximum Acceptable Concentration (MAC) were within the MAC. The marginally elevated lead concentrations reported at TW2 and TW3 may be related to particulate in the water at the time of sampling. Additional well development, sampling and lab testing could be considered to further assess the levels of arsenic and lead in the well water.

Construction of new supply wells associated with a multi-lot residential development on the property has the potential for interference to occur among individual wells as the development is built out. This interference could come in the form of (a) turbidity interference resulting from the process of well drilling and development and (b) water level interference when the wells are operating. The turbidity interference is a temporary problem that should dissipate after the well drilling and development operations are complete. Notification of adjacent well owners and monitoring when each new well is constructed will help to mitigate potential turbidity interference. Measures to minimize the effects of water level interference include optimizing the pump settings to maximize drawdown in each of the individual wells. Consideration could also be given to implementing an outdoor water use bylaw or similar instrument to manage water use during the warm weather months of the year when water demand is higher.

3.6 Functional Servicing Plan and Stormwater Management

This report was prepared in support of the planning applications for the subject property. The proposed development can be serviced for water, sanitary, and stormwater management in accordance with the Township of Puslinch, Wellington County, and the Grand River Conservation Authority requirements and standards. The conclusions and recommendations are as follows:

Proposed Water and Sanitary Services

- *Municipal servicing infrastructure is not available in the vicinity of the site, and therefore the proposed development will be serviced by individual onsite sewage systems and water supply wells.*
- *The preliminary sewage system design flows are expected to be approximately 4,575 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 104 m². 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 50% nitrate-nitrogen reduction to meet MECP Guideline D-5-4.*
- *Individual lots will be serviced with private drilled wells in accordance with O. Reg. 903 for potable water supply.*

Stormwater Management

1. *A passive stormwater management approach is proposed to preserve and maintain the rural character of the property using bioswale systems to control and infiltrate stormwater runoff.*
2. *Water quality controls, erosion protection, and water balance for the proposed development will be provided by the proposed bioswale systems pretreated by OGS units within the municipal roadway storm system. The bioswale system with OGS pretreatment and dry pond treatment train will provide water quality treatment that exceeds the “Enhanced Protection” criteria by retaining, treating, and infiltrating runoff volume equal to, or greater than, the runoff volume generated during a 25 mm rainfall event. The water quality storage provided in the bioswale system and dry pond provides active storage to simultaneously provide the necessary quantity controls for the Site.*
3. *No additional water quantity storage is required beyond what is provided in the bioswale system and dry pond. The post-development peak flows are less than pre-development peak flows at outlet culvert located at Arkell Road for the 2-year to 100-year design storm events.*
4. *Runoff generated from catchments Ext. 1, Ext. 2, Ext. 3, 202, UC02 will drain uncontrolled overland before being intercepted by the proposed conveyance bypass swale that safely directs*

in towards the outlet culvert located at Arkell Road. This flow routing will maintain the existing drainage conditions of the subject property.

5. *Water balance and erosion control measures will be designed to satisfy all relevant criteria and constraints. The above will be demonstrated and discussed at the detailed design stage.*

3.7 Noise and Vibration Impact

A Rail Noise and Vibration Impact Assessment (“NIA”) was completed by HGC Engineering in 2006. The results of the NIA are as follows:

- Inclusion of a central air conditioning system as an alternative means of ventilation for the identified units near the rail line is required.
- Forced air ventilation systems with the future provision of central air conditioning systems by the occupant for most of the remaining units are required.
- Masonry exterior wall construction is required for the dwellings closest to the rail line.
- The use of warning clauses in the property and tenancy agreements and offers of purchase and sale for the specified lots is required.
- Upgraded wall and window constructions for many of the dwelling units should be provided.

An update of the NIA has not been completed as part of this submission. Once the lot fabric layout and entrances have been finalized, it is recommended that, as a condition of draft plan approval, an update of the NIA be conducted by a qualified Acoustical Engineer.

3.8 Mineral Aggregate Resources

A general description of mineral aggregate resources in the area is provided in the Aggregate Resources Inventory Paper No. 162 – County of Wellington:

“Within Puslinch Township, several aggregate deposits have been selected as sand and gravel resource areas of secondary significance. The first of the outwash deposits is quite thick and extensive and is located south of the Eramosa River, in the northeastern part of the township. Data from water well records and from licenced sand and gravel pits indicate that the deposit is predominantly gravel with a thickness of 6 to 17 m. One licenced sand and gravel pit has been opened in this resource area (Pit No. 175). A 6 to 7 m face exposes poorly sorted, often coarse aggregate consisting of approximately 60 to 70% gravel and 30 to 40% sand. This deposit is currently active and is being expanded. According to Burwasser (1976) the resource area contains large aggregate reserves. The deposit extends through the southern part of the City of Guelph and becomes part of Selected Resource Area 37. Field investigation reveals that the quality of the aggregate in the area selected at the secondary level is much poorer in quality than that in Selected Sand and Gravel Resource Area 37.” (ARIP 162).

Figure 5 illustrates the extent mineral aggregate resources in the Arkell area. There are no existing licensed mineral aggregate operations in proximity to the site. The closest licensed pit is over 1.5 km northwest of the subject property.

The aggregate deposit is recognized as a mineral aggregate deposit of secondary significance. Given the small size of the property (less than 20 ha) and the proximity of the site to the existing Settlement of Arkell, it is the considered opinion of SAI that the prospect of establishing a licensed pit on the subject property is not a commercially viable option and would not be in the public interest. The challenges of operating an industrial facility in such proximity to Arkell, given its small size and the requisite mandatory setbacks and acoustic buffers (amongst other social issues such as truck traffic, concerns related to dust and water) would make the resource use unfeasible.

To ensure effective mineral aggregate resource conservation, the proposed development will utilize (where available) onsite aggregates for the construction of onsite infrastructure.

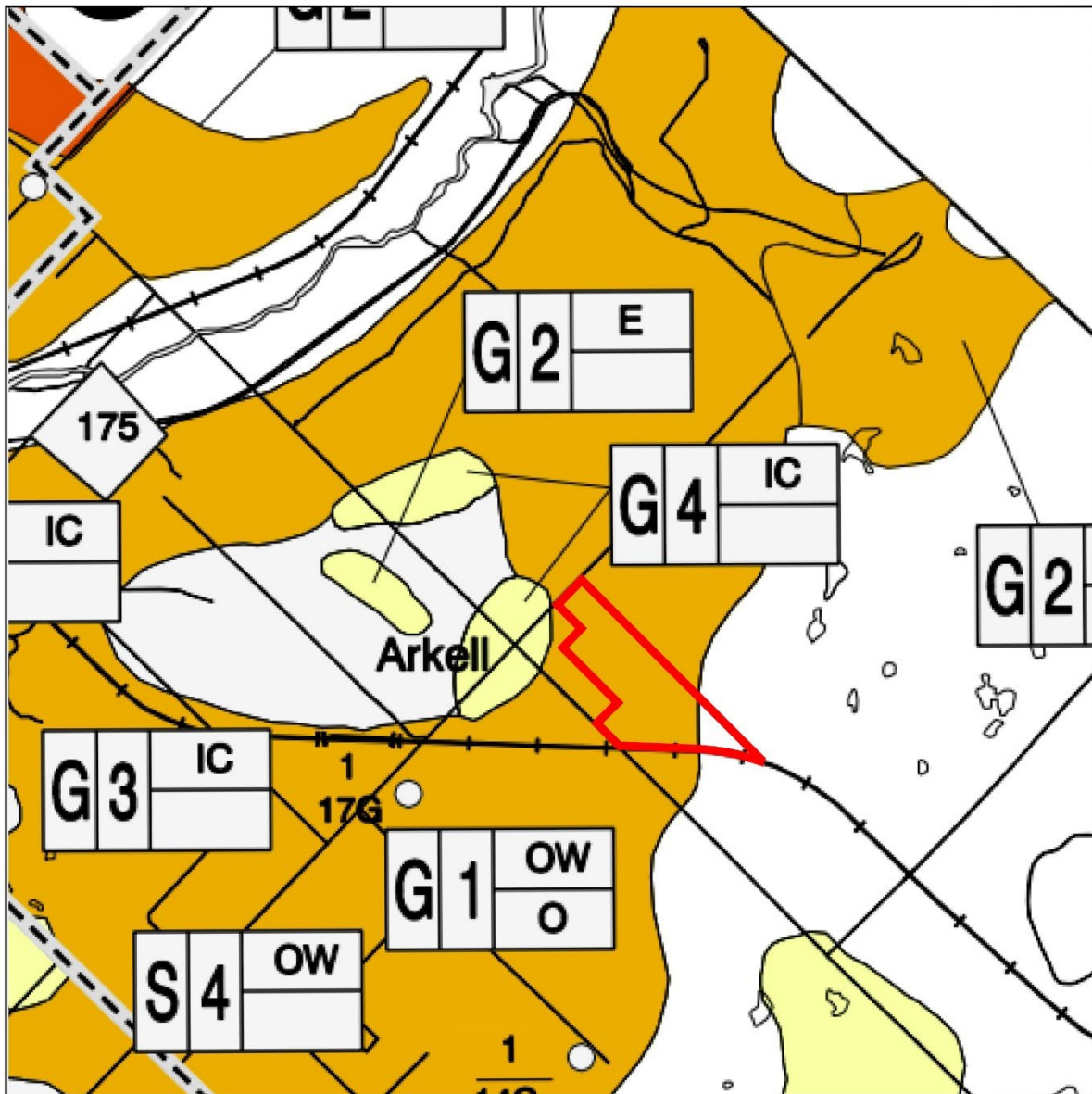
3.9 Agricultural Impact Assessment

An Agricultural Impact Assessment (“AIA”) was completed by SAI. An AIA is required because much of the site is mapped as Prime Agricultural in the County of Wellington Official Plan. The southern portion of the site is mapped as Secondary Agriculture and a portion of the site is included in the Hamlet designation.

The AIA reviewed relevant background information, including soils mapping, aerial photography and agricultural statistics. This information was supplemented by mapping of agricultural operations, cropping patterns and non-agricultural land uses for lands within 1.5 km of the subject property. In addition, Farm Data Sheets were circulated to livestock farms within the Secondary Study Area. This information was used to support the assessment of Minimum Distance Separation I setbacks associated with the proposed settlement boundary expansion.

The following conclusions of the AIA are noted:

- the site does not include any significant forms of capital investment related to agriculture;
- there are no livestock barns in the immediate vicinity of the site;
- there are no MDS I impacts with the proposed development. (see Figure 6); and
- There are no alternate locations of lower agricultural capability to Arkell.
- The subject lands represent the preferred location from an agricultural perspective to expand Arkell.



 SUBJECT LANDS

Mineral Aggregate Figure 5

Planning Justification Report

PART OF LOTS 7, 8, & 9 CONCESSION 10
 ASSESSMENT ROLL NUMBER 2301000008034800000
 ARKELL, ONTARIO

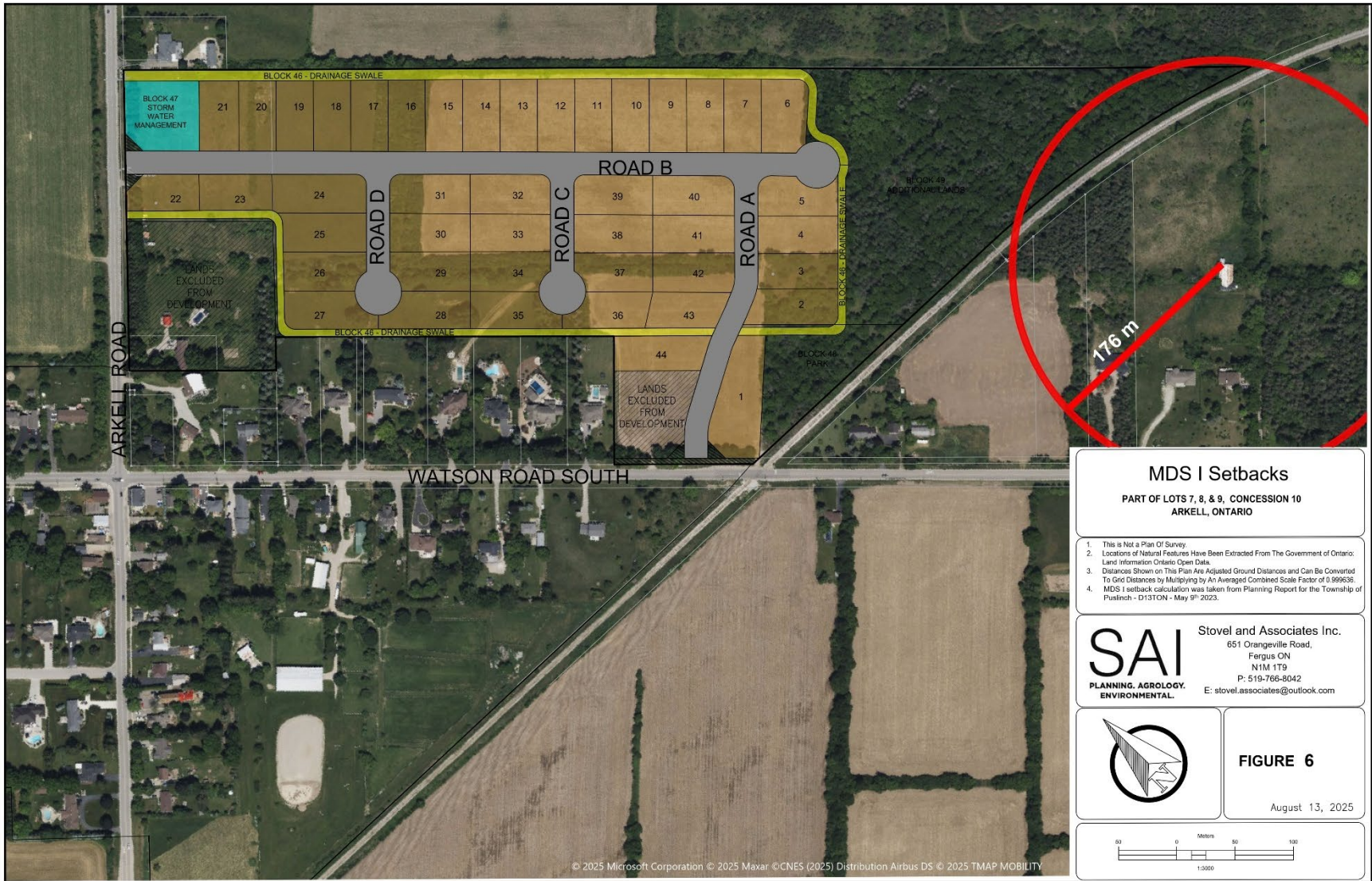
SAI
 PLANNING. AGROLOGY.
 ENVIRONMENTAL.

Stovel and Associates Inc.
 651 Orangeville Road
 Fergus, Ontario
 N1M 1T9
 T: 519-766-8042
 E: stovel.associates@outlook.com



DATE:
 5-Jan-26

Source: Wellington County ARIP 162



4.0 PLANNING FRAMEWORK AND ASSESSMENT OF CONFORMITY

This section of the PJR provides an overview of the legislation, Policy Statements, Official Plan policies, and Zoning Regulations that relate to the proposed development application.

4.1 Ontario Planning Act

The Planning Act, R.S.O. 1990, serves as the foundational legislation for land use planning in Ontario. It sets out the requirements for Official Plans, Zoning By-Laws, Site Plan Approvals, and other planning instruments. Additionally, the Act empowers the Minister of Municipal Affairs and Housing to establish policy statements and plans that guide land use planning and development throughout the province, most notably, the Provincial Planning Statement.

The following sections of this report outline how the Planning Act applies to the proposed development and provide commentary on the ways in which the proposal aligns with the legislative direction established by the Act.

Section 2 of the Planning Act sets out various '*Matters of Provincial Interest*'. In carrying out their responsibilities under the Planning Act, decision-makers must have regard to these Matters of Provincial Interest. Table 2 outlines the Matters of Provincial Interest set out in Section 2 of the Planning Act and commentary regarding how each matter has been considered, where applicable.

Table 2: Matters of Provincial Interest set out in Section 2 of the Planning Act

Provincial Interest	Demonstration of Regard
a) The protection of ecological systems, including natural areas, features, and functions;	No impact on ecological systems as there are no significant natural heritage features onsite. A Tree protection and management plan will be implemented through a condition of draft plan approval.
b) The protection of agricultural resources of the Province;	There are no MDS impacts from the proposed development. From an agricultural perspective, settlement boundary expansion onto the subject lands represents the preferred option for development in Arkell.
c) The conservation and management of natural resources and the mineral resource base;	Mineral aggregate resources conservation will be utilized to ensure that available aggregate resources are used for the proposed development.
d) The conservation of features of significant architectural, cultural, historical, archaeological or scientific interest;	No significant archaeological, cultural or historical features associated with the site. No impacts anticipated.
e) The supply, efficient use, and conservation of energy and water;	Water supply was addressed through a study completed by a Qualified Professional. <i>"The results from 3 test wells indicate that the Gasport Fm. aquifer (lower aquifer) can meet the water quantity requirements of new individual lots on the</i>

	<i>proposed development property. Further, interpretation of the test well performance indicates that the aquifer can support the water quantity requirements associated with 50 new residential lots at the site.” (Groundwater Supply Assessment, 2023, ARL Groundwater Resources Ltd.)</i>
f) The adequate provision and efficient use of communication, transportation, sewage and water services and waste management systems;	Adequate servicing (water and sewage) will be provided by private individual services. Waste management is provided through the County of Wellington. Maintenance of the internal roads will be provided by the Township of Puslinch.
g) The minimization of waste;	Waste management services are through roadside pickup as per scheduling by the County of Wellington.
h) The orderly development of safe and healthy communities;	The proposed development represents an orderly expansion of the settlement of Arkell. Traffic Impact Assessment ensured that the proposed entrances are safe and meet the sight line requirements.
i) The accessibility for persons with disabilities to all facilities, services, and matters to which this Act applies;	The proposed development will have no impact on the accessibility for persons with disabilities to community services and facilities.
j) The adequate provision and distribution of educational, health, and recreation;	The proposed development is not anticipated to impact on the provision and distribution of education and health services. The applicant has proposed a park on the subject lands.
k) The adequate provision of a full range of housing, including affordable housing;	The proposed development will provide housing, including additional residential uses (subject to owner preference) that is appropriate for the Township of Puslinch.
l) The adequate provision of employment opportunities;	The proposed development will result in full-time and part-time employment opportunities related to the construction of the onsite roads/servicing and the development of 44 residential units.
m) The protection of the financial and economic well-being of the Province and its municipalities;	The proposed development will generate development charges, municipal taxes and parkland dedication for the municipality.
n) The co-ordination of planning activities of public bodies	The proposed development is not anticipated to impact on the planning activities of public bodies.
o) The resolution of planning conflicts involving public and private interests;	The proposed development is not anticipated to impact on planning conflicts involving public and private interests.

p) The protection of public health and safety;	The proposed development will ensure that public health and safety is maintained through the completion of relevant engineering reports.
q) The appropriate location of growth and development;	The proposed development represents the preferred location for expansion of the Arkell settlement boundary.
r) The promotion of development that is designed to be sustainable, to support public transit and to be oriented to pedestrians;	The proposed development will not impact on public transit in the municipality, as there is no public transit in the Township of Puslinch.
s) The promotion of built form that, i) is well-designed, ii) encourages a sense of place, and iii) provides for public spaces that are high quality, safe, accessible, attractive, and vibrant.	The proposed development is consistent with the building form and lot sizes found in the Arkell community. The development will be well-screened from existing uses. The urban section for the onsite streets will promote safe pedestrian mobility through the use of street lighting, curbs and sidewalks.
s) The mitigation of greenhouse gas emissions and adaption to a changing climate.	The proposed development is not anticipated to impact on greenhouse gas emissions in the municipality.

Based on the foregoing, it is our opinion that the proposed development has regard for the matters of Provincial interest as set out in the Planning Act.

4.2 Provincial Planning Statement, 2024

The 2024 Provincial Planning Statement (PPS) was issued under Section 3 of the Planning Act and came into effect on October 20, 2024. The PPS establishes the policy foundation for regulating the development and use of land in the province and provides policy directions on matters of provincial interest related to land use planning and development. It provides a vision for land use planning in Ontario that encourages efficient use of land, resources and public investment in infrastructure. The PPS strongly encourages development that would provide long-term prosperity, environmental health, and social well-being. The 2024 PPS applies to planning decisions made on or after the effective date and applies to the consideration of the proposed official plan and zoning bylaw amendment applications. The following is a summary of the PPS policies that are relevant to the proposed development application.

The PPS is to be read in its entirety and applicable policies are to be applied to specific situations/applications. The following table provides a summary of relevant policies of the PPS and describes how the proposed development is consistent with this policy direction.

PPS (2024) policy 2.3.2 provides the following direction regarding settlement boundary expansions:

2.3.2 New Settlement Areas and Settlement Area Boundary Expansions

1. *In identifying a new settlement area or allowing a settlement area boundary expansion, planning authorities shall consider the following:*
 - a. *the need to designate and plan for additional land to accommodate an appropriate range and mix of land uses;*
 - b. *if there is sufficient capacity in existing or planned infrastructure and public service facilities;*

- c. *whether the applicable lands comprise specialty crop areas;*
 - d. *the evaluation of alternative locations which avoid prime agricultural areas and, where avoidance is not possible, consider reasonable alternatives on lower priority agricultural lands in prime agricultural areas;*
 - e. *whether the new or expanded settlement area complies with the minimum distance separation formulae;*
 - f. *whether impacts on the agricultural system are avoided, or where avoidance is not possible, minimized and mitigated to the extent feasible as determined through an agricultural impact assessment or equivalent analysis, based on provincial guidance; and*
 - g. *the new or expanded settlement area provides for the phased progression of urban development.*
2. *Notwithstanding policy 2.3.2.1.b), planning authorities may identify a new settlement area only where it has been demonstrated that the infrastructure and public service facilities to support development are planned or available.*

The following table documents conformity of the proposed development with policy 2.3.2.1 of the PPS, 2024.

Table 3: Conformity Analysis – PPS, 2024 – Settlement Area Boundary Expansions (Policy 2.3.2.1)

Policy 2.3.2.1	Conformity	Analysis
<i>a) the need to designate and plan for additional land to accommodate an appropriate range and mix of land uses</i>	Yes	Land Need Analysis conducted by the County of Wellington sets out the need for 250 units in the Township of Puslinch. The proposed development (44 units) provides approximately 17% of the needed growth.
<i>b) if there is sufficient capacity in existing or planned infrastructure and public service facilities</i>	Yes	There is not existing or planned infrastructure and public services facilities in the municipality. Capacity for private servicing was assessed by a Qualified Professional.
<i>c) whether the applicable lands comprise specialty crop areas</i>	Yes	Development is not comprised of Specialty Crop Areas.
<i>d) the evaluation of alternative locations which avoid prime agricultural areas and, where avoidance is not possible, consider reasonable alternatives on lower priority agricultural lands in prime agricultural areas</i>	Yes	An alternate site location analysis was completed. The settlement of Arkell is surrounded by good agricultural land so avoidance is not possible. The subject lands are deemed to be a reasonable alternative for expansion of the settlement boundary as the lands represent the lowest priority agricultural lands in the local area immediately adjacent to the settlement.
<i>e) whether the new or expanded settlement area complies with the minimum distance separation formulae</i>	Yes	The proposed Development complies with the MDS formulae.

f) whether impacts on the agricultural system are avoided, or where avoidance is not possible, minimized and mitigated to the extent feasible as determined through an agricultural impact assessment or equivalent analysis, based on provincial guidance	Yes	AIA documents that impacts on the agricultural system are minimal.
g) the new or expanded settlement area provides for the phased progression of urban development	Yes	Proposed expansion of settlement represents a logical progression of development.

PPS Policies 3.5.1 and 3.5.2 address land use compatibility with major facilities and sensitive land uses.

1. Major facilities and sensitive land uses shall be planned and developed to avoid, or if avoidance is not possible, minimize and mitigate any potential adverse effects from odour, noise and other contaminants, minimize risk to public health and safety, and to ensure the long-term operational and economic viability of major facilities in accordance with provincial guidelines, standards and procedures.

2. Where avoidance is not possible in accordance with policy 3.5.1, planning authorities shall protect the long-term viability of existing or planned industrial, manufacturing or other major facilities that are vulnerable to encroachment by ensuring that the planning and development of proposed adjacent sensitive land uses is only permitted if potential adverse affects to the proposed sensitive land use are minimized and mitigated, and potential impacts to industrial, manufacturing or other major facilities are minimized and mitigated in accordance with provincial guidelines, standards and procedures.

A Rail Noise and Vibration Impact Assessment (“NIA”) was completed by HGC Engineering in 2006. The results of the NIA are as follows:

- Inclusion of a central air conditioning system as an alternative means of ventilation for the identified units near the rail line is required.
- Forced air ventilation systems with the future provision of central air conditioning systems by the occupant for most of the remaining units are required.
- Masonry exterior wall construction is required for the dwellings closest to the rail line.
- The use of warning clauses in the property and tenancy agreements and offers of purchase and sale for the specified lots is required.
- Upgraded wall and window constructions for many of the dwelling units should be provided.

In addition, buffering solutions (i.e. berms and fencing) were set out in the NIA.

An update of the NIA was not completed in 2025 as the conceptual development plan was still in the process of being refined. Once the lot fabric layout has been finalized, as a condition of draft plan approval, an update of the NIA could be conducted by a qualified Acoustical Engineer.

Sewage and Water

Policy 3.6.4 sets out the consideration of servicing: *“Where municipal sewage services and municipal water services or private communal sewage services and private communal water services are not available,*

planned or feasible, individual on-site sewage services and individual on-site water services may be used provided that site conditions are suitable for the long-term provision of such services with no negative impacts.”

Response:

The Functional Servicing and Stormwater Management Report prepared by Crozier and the Groundwater Supply Assessment prepared by ARL Groundwater address this policy. These studies note that the use of individual on-site water and sewage services are appropriate, and the use of such services will not result in negative impacts, including potential cross-jurisdictional impacts. The studies confirm that the proposed development will be serviced in a manner that is consistent with the existing development in the local area.

Natural Heritage

Policy 4.1 sets out the requirements for protecting natural heritage systems. Of note, the subject lands do not contain any significant natural heritage features including wetlands, valleylands, significant wildlife, areas of natural and scientific interest, fish habitat and habitat of endangered and threatened species.

As documented by the Township’s ecological peer review consultant, an EIS is not required because there are no significant natural heritage features onsite or adjacent to the site. Therefore, the proposed development is consistent with 4.1 of the PPS.

The proposed lot fabric was re-designed to ensure no residential development within the plantation. No impacts on natural heritage features or functions are anticipated. A draft plan condition has been prepared to ensure protection of trees within the plantation.

Mineral Aggregate Resources

Policy 4.5.2.3 sets out the requirement for mineral aggregate resources conservation: “Mineral aggregate resource conservation shall be undertaken, including through the use of accessory aggregate recycling facilities within operations, wherever feasible.”

Mineral aggregate resource conservation: means

a) the recovery and recycling of manufactured materials derived from mineral aggregates (e.g., glass, porcelain, brick, concrete, asphalt, slag, etc.), for re-use in construction, manufacturing, industrial or maintenance projects as a substitute for new mineral aggregates; and

b) the wise use of mineral aggregates including utilization or extraction of on-site mineral aggregate resources prior to development occurring.

Response

The proposed development will be consistent with the requirement for mineral aggregate resource conservation. Available aggregate will be used for road construction at the site. This will reduce the need for aggregate to be trucked in from adjacent pits, thus minimizing the potential for impacts on the adjacent residential community.

Policies 4.5.2.4 and 4.5.2.5 set out the policy to consider and protect existing mineral aggregate operations and mineral aggregate resource areas:

- 4. Mineral aggregate operations shall be protected from development and activities that would preclude or hinder their expansion or continued use or which would be incompatible for reasons of public health, public safety or environmental impact. Existing mineral aggregate operations shall*

be permitted to continue without the need for official plan amendment, rezoning or development permit under the Planning Act. Where the Aggregate Resources Act applies, only processes under the Aggregate Resources Act shall address the depth of extraction of new or existing mineral aggregate operations. When a license for extraction or operation ceases to exist, policy 4.5.2.5 continues to apply.

5. In known deposits of mineral aggregate resources and on adjacent lands, development and activities which would preclude or hinder the establishment of new operations or access to the resources shall only be permitted if:

- a) resource use would not be feasible; or*
- b) the proposed land use or development serves a greater long-term public interest; and*
- c) issues of public health, public safety and environmental impact are addressed.*

Response:

There are no existing licensed mineral aggregate operations located in proximity to the subject lands. Therefore, no impacts on licensed mineral aggregate operations are anticipated.

The subject lands are part of a secondary deposit of mineral aggregate resources. However, given the immediate proximity of existing residential development associated with the Settlement of Arkell, it is concluded that development of the subject lands as a residential subdivision serves a greater long-term interest. Further, the relatively small area of the site would result in portions of the reserve being sterilized due to mandatory setbacks under the ARA and acoustic buffering. This would make resource use unfeasible.

Cultural Heritage and Archaeology

PPS Policies 4.6.1-3 requires the protection of built heritage resources and archaeological resources.

- 1. Protected heritage property, which may contain built heritage resources or cultural heritage landscapes, shall be conserved.*
- 2. Planning authorities shall not permit development and site alteration on lands containing archaeological resources or areas of archaeological potential unless the significant archaeological resources have been conserved.*
- 3. Planning authorities shall not permit development and site alteration on adjacent lands to protected heritage property unless the heritage attributes of the protected heritage property will be conserved.*

There are no built or cultural features on the subject lands.

An Archaeological Study was completed by Lincoln Environmental Consultants (“LEC”). No significant archaeological resources were identified onsite. A draft plan condition has been prepared to ensure protection of archaeological resources.

The northern portion of the site was not assessed by LEC. This area will need to be examined by a licensed archaeologist. It is recommended that this be completed as a condition of draft plan approval.

Provincial Planning Statement Conclusion

The proposed development is consistent with the PPS, providing locally appropriate development that is needed in the Township of Puslinch.

4.3 County of Wellington Official Plan

The County of Wellington Official Plan (“County OP”) was adopted by Wellington County Council on September 24, 1998, approved by the Ministry of Municipal Affairs on April 13, 1998 and came into effect on May 6, 1999. The County Official Plan, as amended, was last revised December, 2025. The proposed development was declared complete in 2006.

As previously noted, the County OP (modified Schedule A-2 of OPA 119, April 12, 2023) designates Arkell as a Hamlet. The County wishes to encourage growth to occur in primary urban centres, secondary urban centres and hamlets. Secondary urban centres and hamlets are expected to be built out with modest expansions. Hamlets are expected to eventually be built-out on existing designated lands, while growth beyond their current boundaries will be limited (6.3). Development will be relatively small-scale given the level of service available in the settlement. The primary residential use will be low-density single detached houses compatible with existing housing in Arkell. Sewage and water services will be provided in accordance with section 11.2 of the County Official Plan. Road access will be via internal roads will be via a local road and a County Road. In all cases, appropriate siting standards will be met and road functions maintained (6.11.2). The proposed development is considered to be a reasonable expansion of the Settlement of Arkell.

Policy 4.9.5 of the County OP sets out policies related to Source Water Protection. Mapping available on the County of Wellington website indicates that the site is part of a WHPA-B protection zone associated with the municipal wells serving the City of Guelph. Vulnerability is scored 8 across the site and the immediate surrounding areas. This means that waste disposal, conventional sewage disposal systems and DNAPLs are all considered significant threats. The proposed development does not include waste disposal facilities or DNAPL storage. On site sewage disposal systems with tertiary treatment is proposed to for wastewater disposal. It is understood that the tertiary treatment systems are not considered significant threats, provided that they receive regular inspections and maintenance. As a result, the need for application of source protection policies should be limited.

Policy 4.9.7 of the County OP sets out policies related to the consideration and protection of the Paris and Galt Moraine. The Paris and Galt Moraines are unique landforms that function as a support for hydrologic processes and features that influence groundwater and surface water resources at regional and local scales. Only the southeast corner of the site is located within the Paris and Galt Moraine Policy Area. This area is mostly not proposed for development. No surface water features or wetlands are located in the immediate vicinity of the property. The area of the property proposed for residential development was observed to be relatively flat with no obvious evidence of the hummocky terrain that characterizes the Paris and Galt Moraines. Land Use planning maps indicate that the nearest greenlands are about 200 - 400 m to the northeast of the site. The nearest surface/groundwater features are the springs at the Arkell Springs property, approximately 500 - 1000 m to the north of the site. The nearest continuous surface water feature is the Eramosa River beyond the Arkell Springs property. ARL Groundwater Resources Ltd. provides the opinion that *“there is little to no opportunity for the development to have a measurable effect on any of these features given the separation distances involved.”*

The following table provides an overview of the responses to technical requirements set out in 4.6.2 of the County OP.

Table 4: Overview of the responses to technical requirements set out in OP Policy 4.6.2

Relevant County Policy (4.6.2)	Response/Analysis
a) Need	<p>The County of Wellington has examined rural residential growth as part of the Official Plan Review (Committee Report prepared by Jameson Pickard, September 12, 2024). This analysis determined that there was a need for 250 rural residential lots in Puslinch.</p> <p>The proposed development would satisfy approximately 17.5% of the anticipated future need for rural residential lots in Puslinch.</p>
b) Appropriateness of site for proposed use (size, shape and ability to accommodate intensity of use)	<p>The site has been long-identified for future expansion option for Arkell (since 2006). The proposal is for single detached homes on private services similar to what is found in Arkell.</p> <p>Lot shape and sizing is similar to what exists in Arkell and generally meets the requirements of the Zoning Bylaw.</p>
c) Adequacy of Servicing	<p>Appropriate engineering studies were completed to address the provision of stormwater, water and sewage treatment. The measures recommended in these technical reports ensures that Ministry guidelines are satisfied.</p>
d) Compatibility	<p>The proposed single detached homes are similar in use, height and density to what currently exists in Arkell. Landscaping recommendations will provide for adequate buffering. Noise warning clauses on specified lots will be implemented. No impacts on adjacent land uses are anticipated.</p>
e) Impact on Natural Resources (Agriculture and Mineral Aggregates)	<p>No impacts on agriculture or mineral aggregates are anticipated. There are no pits in the area and existing livestock operations are well setback from the property. There are no MDS I impacts associated with the proposed expansion lands.</p>
f) Impact on biodiversity and connectivity to natural features.	<p>No impacts on significant natural heritage features or functions (including biodiversity and connectivity) are anticipated. Through tree protection and management for the development, an overall net improvement is anticipated.</p>
g) Exterior design (bulk, scale and layout of buildings and other design elements)	<p>The exterior design will be similar to the existing built-up area of Arkell. Additional tree plantings are proposed to assist in buffering the visual impact of the proposed development.</p>
h) Possibility of site contamination.	<p>No known areas of contamination onsite and no know petroleum deposits of significance in the area.</p>
i) Methods to reduce or eliminate negative impacts.	<p>Technical reports were prepared that include recommendations to reduce or eliminate potential impacts, including noise warning clauses, tree preservation and management plan, landscaping, and sedimentation and erosion control plans.</p>
i) Other planning matters considered important by a Council.	<p>At this stage in the process, no other planning matters have been identified at this time.</p>

A Draft of a site-specific Official Plan Amendment is included in Appendix G. The proposed OPA redesignates lands that are currently designated “Prime Agricultural” and “Secondary Agricultural” to “Hamlet”. Section 10.1.3 of the Official Plan sets out Matters for Consideration when considering lot creation by subdivision:

Table 5: County Consideration (new lot creation by subdivision consent or part lot control)

Consideration	Analysis	Conformity
<i>a) that any new lots will be consistent with official plan policies and zoning regulations;</i>	Lands to be re-zoned to a site-specific Hamlet Residential zone.	Yes
<i>b) that all lots can be adequately serviced with water, sewage disposal, stormwater management or drainage, fire protection, roads, utilities, solid waste disposal to accepted municipal standards and without undue financial burden on the municipality;</i>	Engineering reports (stormwater, grading, sewage systems, water supply assessment) have been prepared. No financial burden to the Township anticipated.	Yes
<i>c) that sufficient reserve water and sewage plant capacity will be available when lots are created in areas to be serviced by central water and sewage systems;</i>	N/A	N/A
<i>d) that all lots will have safe driveway access to an all-season maintained public road and that access to a local road will be preferred over county and provincial roads, where practical;</i>	Traffic study addresses safe access and sight lines.	Yes
<i>e) that public streets, spaces and facilities will be safe, meet the needs of pedestrians, and facilitate pedestrian and non-motorized movement, including, but not limited to, walking and cycling.</i>	Traffic study addresses public streets.	Yes
<i>f) that the topography, soils and drainage of the site are satisfactory for the lot sizes and uses proposed;</i>	Geotechnical and stormwater report address this matter.	Yes
<i>g) that tree loss related to anticipated development be kept to a minimum and, wherever reasonable, be compensated for by new tree planting;</i>	A Tree Protection and Compensation Plan will be prepared as a condition.	Yes
<i>h) that natural heritage features are not affected negatively;</i>	There are no significant natural heritage features in the area proposed for residential uses.	Yes
<i>i) that lots are not created in areas which would pose a threat to public health or safety;</i>	The proposed development will not pose a threat to public health.	Yes
<i>j) that natural resources such as agricultural lands and mineral aggregates would not be affected adversely;</i>	An AIA was prepared to address agricultural impacts. No MDS impacts. No licensed pits in proximity to the site. Mineral aggregate resources conservation will be employed at the site.	Yes
<i>k) that the size and shape of proposed lots is suitable, including frontage, area and the proportion of frontage to depth;</i>	The size of the lots is based on engineering studies.	Yes
<i>l) that the proposed lots and uses are compatible with and designed to minimize adverse impacts on surrounding uses;</i>	The proposed lots are compatible with the surrounding uses. No MDS impacts.	Yes
<i>m) that all new lots shall have logical lot lines given existing lot patterns in the area, natural and human-made features and other appropriate considerations;</i>	The new lots have logical lot lines.	Yes
<i>n) that residential lots will have adequate access to community facilities such as schools, libraries and parks based on reasonable standards for the area;</i>	The new lots will have adequate access.	Yes
<i>o) that the creation of any lot is necessary, timely and in the public interest;</i>	The new lots are in demand and necessary for local employment.	Yes
<i>p) that provincial legislation and policies are met, including the Greenbelt Plan policies set out in Section 9.9 of this Plan.</i>	Growth Plan was replaced by PPS, 2024. The site is not included in the Greenbelt Plan area.	Yes

It is our opinion that the proposed development satisfies these requirements.

4.4 Township of Puslinch Zoning By-Law

The Township of Puslinch Comprehensive Zoning By-law No. 23-18 (“Zoning Bylaw”) sets out the relevant zones and zoning provisions for the municipality. As previously noted, the Site is zoned Agricultural (A) and will require a zoning amendment to permit the establishment of residential land uses on the site. Should Township Council want to establish a park in the area, an Open Space (“OS”) zone could be prepared.

The proposed residential zone is a site-specific Hamlet Residential (HR) Zone. The permitted uses of the HR zone are not proposed to be modified for this development. The following table sets out a zoning conformance chart for specific zoning regulations in the HR – XXX zone. There is one exception to the HR provisions. The minimum lot area is reduced to 0.2 ha. This reduction in lot size is supported by relevant technical reports. A draft of the site-specific zoning amendment is included as Appendix G.

A Holding (H) provision is also included. The holding provision sets out the requirements for the applicant to enter into a subdivision agreement with the Township to satisfy conditions, including financial and servicing, as set out by the Township of Puslinch.

Table 6: Zoning Chart

Hamlet Residential	Required (23-18)	Provided	Compliance
Min. Lot Area	0.4 ha	0.2 ha	No
Min. Lot Frontage	20m	30 m	Yes
Min. Front Yard	3m	3 m	Yes
Min. Interior Side Yard	2 m	2 m	Yes
Min. Exterior Side Yard	3m	3 m	Yes
Min. Rear Yard	6m	6 m	Yes
Max. Lot Coverage	40%	40%	Yes
Max. Building Height	11m	11 m	Yes
Min. Landscaped Open Space	15%	15%	Yes

5.0 CONCLUSIONS

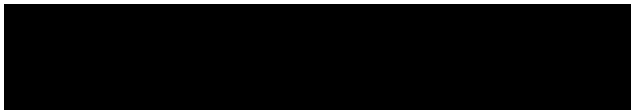
The proposed Official Plan Amendment redesignates lands that are currently designated “Prime Agricultural” and “Secondary Agricultural” to “Hamlet”. The proposed Zoning By-Law Amendment rezones the lands from Agricultural to a site-specific Hamlet Residential zone (with a Holding provision). The Official Plan Amendment and Zoning By-Law Amendment applications are consistent with the PPS and conform to the County of Wellington Official Plan.

The proposed development is a logical expansion of an existing settlement. The proposed development will satisfy, in part, the projected need for residential units in the municipality. The subject lands represent the preferred location from an agricultural perspective to expand the Hamlet of Arkell.

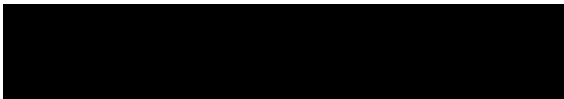
The proposed development will not result in a negative impact on agriculture. There are no MDS I impacts associated with the proposed development.

Engineering studies have been prepared in support of the application. Recommendations have been developed to ensure that the proposed development meets relevant provincial guidelines. These recommendations form the basis of condition of draft plan of subdivision.

Following the approval of the Official Plan Amendment, the proposed Zoning Bylaw Amendment can be considered and approved by the Township of Puslinch. The draft plan of subdivision application will address the details of lot layout and parkland dedication. A revised draft plan of subdivision will be prepared at a future date by the Ontario Land Surveyor.



ROBERT P. STOVEL, MCIP, RPP, P.AG.



ROBERT L. STOVEL, B.Sc.

Appendix A – Summary of Issues – 2006 Application

County of Wellington Planning (FHX)519 823 1694 P.002/004



PLANNING AND DEVELOPMENT DEPARTMENT
GARY A. COUSINS, M.C.I.P., DIRECTOR
TEL: (519) 837-2600
FAX: (519) 823-1694
1-800-863-0750

COUNTY OF WELLINGTON

ADMINISTRATION CENTRE
74 WOOLWICH STREET
GUELPH ONTARIO
N1H 3T8

RECEIVED
Township of Puslinch
NOV 22 2006

cc: Clerk
Bob W.
Stan D
Greg S
Liz Y.

November 21, 2006

Mrs. Colleen Sutton, Secretary
Planning Advisory Committee
Township of Puslinch
R. R. 3 (Aberfoyle)
Guelph, Ontario N1H 6H9

Dear Mrs. Sutton:

**Re: Zoning By-law Amendment Application #P10/2006
Related Applications: Draft Plan of Subdivision File No. 23T-06003 and County
of Wellington Official Plan Amendment File No. OP-2006-06
Part Lots 7, 8 & 9. Concession 10
1648253 Ontario Limited (Tom Kukovica)**

Thank you for circulating the above-noted application to this office for comment. This rezoning application was filed concurrently with applications to the County for consideration of a 38 lot Draft Plan of Subdivision and Official Plan Amendment to expand the hamlet of Arkell. While we have not completed our review of these applications, we wish to provide the Committee with the following preliminary comments.

According to Schedule A7 (Puslinch) of the County of Wellington Official Plan, the majority of the subject land is designated PRIME AGRICULTURAL and SECONDARY AGRICULTURAL. Part of the property with frontage on Watson Road South is designated HAMLET AREA (Arkell). The subject land also falls within the Arkell Water Management Area overlay.

A request for Official Plan amendment to the HAMLET AREA designation requires consideration of several sections of the County Plan, including Section 7.4.5 Hamlet Expansion, of the Urban System policies:

"Where possible, hamlet boundaries should follow existing property lines or recognized physical features. Expansion beyond the identified boundary will require an amendment to this Plan and must be based on an analysis of need under the County's growth strategy and urban expansion policy, alternative locations and potential impacts."

Where expansion to a hamlet is warranted to meet the growth strategy of the County Official Plan, the extent and direction of expansion is to be based on the following:

- up to 20 years of growth;
- the existing development pattern in the community;
- the potential impacts on people;
- servicing opportunities and constraints;
- environmental costs and benefits;
- the need to avoid mineral aggregate areas and prime agricultural areas or where it is unavoidable to use lands of lower quality;
- the impacts on natural resources and the natural environment;
- logical boundaries;
- other planning criteria considered appropriate in the circumstances.

County of Wellington Planning and Development Department
Arkell Hamlet Expansion - Kukovica (P10/2006)

November 21, 2006

2

Servicing

The Ministry of Municipal Affairs and Housing has advised that servicing a new development of more than five lots on individual on-site services within settlement areas such as a hamlet is not consistent with the Provincial Policy Statement (PPS). A 38 lot urban expansion would appear to be a significant issue under the PPS.

Wellington Growth Strategy

The County Growth Strategy places a priority on directing growth to designated Urban Centres. The forecast anticipates that 82% of population growth will take place in the 15 urban centres in the County. The remainder will largely be directed to hamlets and secondary agricultural areas. We anticipate that the Growth Strategy may be reviewed in 2007.

Although the Hamlet of Arkell is within the Urban System for the land use policies, Hamlets are combined with the rural area when considering need under the Growth Strategy. This is due in large part to the difficulty in forecasting growth for smaller settlements. As a result, the monitoring of supply is divided between Aberfoyle and Moriston (the Urban Centres for which individual forecasts are provided) and the remainder of the Township located outside of these Urban Centres. As it stands, the potential supply of housing units outside of Urban Centres in Puslinch is adequate to accommodate the projected household demand (as set out in Table 8 – Puslinch of the County Official Plan), and a hamlet expansion is not currently warranted under the Growth Strategy.

We would note that there are three subdivision applications that would also be considered under the portion of the growth strategy outside of Urban Centres in Puslinch (Audrey Meadows, Geddes and Slater). The County has indicated general support for consideration of some degree of flexibility in applying the Growth Strategy for these applications for the following reasons:

- New country residential and lifestyle communities are no longer permitted by the County Official Plan.
- The oversupply outside of Urban Centres in Puslinch decreased due to the reduction in the anticipated yield for a draft plan of vacant land condominium at the Reid's Heritage Lake site.
- The three applications are not subject to the new Provincial Policy Statement (2005) or the Growth Plan for the Greater Golden Horseshoe.

This request to expand the hamlet of Arkell is being considered under a different policy environment.

Growth Plan

The Growth Plan for the Greater Golden Horseshoe came into effect on June 16, 2006 and applies to the proposed development. Under Section 2.2.8, the Plan provides strict criteria for settlement area boundary expansions, which may only occur as part of a municipal comprehensive review. A municipal comprehensive review means "An official plan review, or an official plan amendment, initiated by a municipality that comprehensively applies the policies and schedules of this Plan." The County of Wellington has initiated, but not yet completed, an urban centre review in Puslinch. If the servicing issue noted above can be resolved, the review could be expanded to include the hamlet of Arkell.

Agricultural Impact

It is not clear from the application materials whether County and Provincial policies have been met with respect to a settlement area expansion in a Prime Agricultural area. An Agricultural Impact Assessment should be provided in accordance with Section 4.6.5 of the County Official Plan and also addressing Section 1.1.3.9 of the Provincial Policy Statement. Of particular concern is the investigation of lower priority agricultural lands in the Township.

County of Wellington Planning and Development Department
Arkel Hamlet Expansion - Kukovica (P10/2006)

November 21, 2006
3

We also require information with respect to Minimum Distance Separation 1 (MDS1). Livestock facilities (barns and manure storage) within 500m should be reflected with surveyed distances relative to the existing and proposed hamlet boundary. In the event that the proposed hamlet boundary will be brought closer to a livestock facility than is currently the case, we require Farm Data Sheets to determine MDS1 compliance. There appear to be livestock facilities to the north (635 Arkel Road) and south (940 Watson Road South) where this would be the case, but this should be verified as part of the Agricultural Impact Assessment. The applicant is responsible for collecting the relevant information regarding adjacent livestock facilities and providing that information to this office in order to calculate the required separation distances. The County Farm Data Sheet is available on our website and it should be provided by the applicant to the owner of the livestock facility. If there are livestock facilities, we will complete necessary calculations to determine appropriate setbacks.

Protection of Natural Features

Although there are no significant natural heritage features on the property that are protected by the County Greenlands System, there is a woodlot adjacent to the railway corridor. According to Section 5.5.4 of the County Official Plan "Smaller woodlots may also have local significance and, where practical, these smaller woodlots should be protected." The Township may wish to have their peer review consultant assess the woodlot in this regard.

Summary

This 38 lot urban expansion appears to be inconsistent with the Provincial Policy Statement which seems to impose a restriction on new development of more than 5 lots on individual on-site services within settlement areas. In addition, the Growth Plan for the Greater Golden Horseshoe requires a Township-wide assessment of growth, which has not been completed.

We trust that these preliminary comments are of assistance to the Committee. We will attend the Planning Advisory Committee meeting to hear the proponent's presentation.

Yours truly,



Sarah Wilhelm, B.E.S., MCIP, RPP
Planner

c. Astrid Clos, Astrid J. Clos Planning Consultants

Appendix B – GWS Peer Review - 2007



CC Colleen
Alan
Bob
Diz
Astrid

File: 2619
By: Fax & Mail

January 5, 2007

Township of Puslinch
7404 Wellington Rd. 34
RR #3
Guelph, ON
N1H 6H9

RECEIVED
Township of Puslinch
JAN 09 2007

Attention: Mrs. Brenda Law, A.M.C.T.
Clerk-Treasurer

Dear Mrs. Law:

Re: Natural Environment Review of the Proposed Kukovica Subdivision

As requested, I have reviewed the Draft Plan of Subdivision for the proposed Kukovica estate residential development that was prepared by Van Harten Surveying Inc. I also reviewed the accompanying Hydrogeological Report prepared by R.J. Burnside & Associates Limited and the Preliminary Stormwater Management Report and Grading Plan prepared by Richardson Foster Ltd. The proposed Draft Plan of Subdivision would create 38 single family lots ranging in size from 1 acre to 2.9 acres. These lots would be individually serviced with septic systems and private water supply wells.

The 21.68 ha (53.57 acres) Kukovica property is located in Part Lots 7, 8, & 9, Concession 10, Puslinch Township. The site lies within and adjacent to the hamlet of Arkell, being south of Arkell Road, east of Watson Road and north of the Guelph Junction railway line. Surrounding land uses are mainly agricultural and rural residential.

The subject property consists of hay fields bounded by hedgerows, as well as woodland that extends along the railway line. The land gently slopes to the north and run-off flows through a culvert that passes under Arkell Road. It is my understanding that an Environmental Impact Study (EIS) was not required in this case because there are no wetlands or significant woodlands (i.e. woodland 10ha and larger in size) found on or nearby the Kukovica property. The subject lands are currently designated as Primary Agricultural, Secondary Agricultural and Hamlet Area in the Wellington County Official Plan and they have been zoned Agricultural by the Township. As a result, an Amendment is required to the Official Plan and Zoning By-law in order for this development to proceed.

Subsequent to my review of the available documentation I conducted a site inspection on November 24, 2006 for the purpose of evaluating the woodland and hedgerows found on the property. These natural features were not described in any of the consultants reports submitted in support of the proposed development and the Grading Plan indicated that the majority of this treed area would be lost due to the construction of roads, houses, septic systems, berms and stormwater management facilities. Based upon this information and my field observations I offer the following comments on the proposed residential subdivision.

GWS Ecological & Forestry Services Inc.
4670 Townline Road, Cambridge, ON. N3C 2V1

Tel.: (519) 651-2224 Fax: (519) 651-2002
Email: gwsefs@sympatico.ca

1. An immature mixedwood plantation occupies approximately 11 acres at the south end of the site. The species composition is estimated to be white pine – 40%, white spruce – 20%, black walnut – 20% and black locust – 20%. These trees are about 25 years old and mostly of poletimber size being 4 to 9 inches in diameter at breast height (dbh). Tree growth has generally been good as the white pine and deciduous trees are 25 to 50 feet tall while the spruce are 20 to 35 feet tall. However, where pine and spruce are growing in close proximity to black walnut there has been much dieback and mortality to the conifers due to juglone poisoning from the walnut. In spite of this mortality the overstory is still fully stocked with living trees. The understory consists of a low to moderately dense shrub layer of common buckthorn, red elderberry and raspberry. Common buckthorn is a very aggressive alien species that is undesirable in woodlands due to its high reproductive potential, shade tolerance and rapid growth under a wide variety of site conditions. Garlic mustard, another non-native invasive species, is also abundant throughout the woodland area. No rare or unusual plants were noted and none are expected in this man-made forest. To date, no thinning has been carried out in this plantation. Common wildlife species were observed utilizing this woodland habitat, including white-tailed deer, black squirrel, red squirrel, cottontail rabbit, Blue Jay, Black-capped Chickadee and American Crow. Other common woodland birds and mammals likely inhabit this area. Given the above characteristics there is insufficient justification to consider this plantation as locally significant within Puslinch Township. Development intrusions into this woodland are therefore considered acceptable.
2. The hedgerows bordering most agricultural fields are mainly dominated by hawthorn common buckthorn and Manitoba maple. Immature hard maple, black cherry, white ash and black walnut trees are also interspersed along these shrubby hedgerows. Since the major species found in these hedgerows are generally considered undesirable the preservation of these areas only warrants a low priority.
3. Most trees growing along Arkell Road, Watson Road and around the margins of existing housing lots were planted. The major species found in these locations are Norway spruce, white spruce, Colorado blue spruce and white cedar. These trees are immature in age/size being 6 to 16 inches dbh and they are generally in good health. Given their location around the perimeter of the proposed development it should be feasible to save many of these trees on housing lots.

In summary, there are no significant natural features on the subject lands that warrant protection or the exclusion of development intrusions. The proposal development therefore seems reasonable from a natural environment perspective. The large lots in conjunction with the gently sloping terrain are favourable for tree preservation and healthy, good quality trees should therefore be retained whenever possible. In order to effectively achieve this objective a tree preservation plan should be prepared for the entire site as a condition of Draft Plan approval. Given the high density of trees within the plantation and the tree health problems which exist in this area, more detailed lot specific tree preservation plans should also be prepared for lots 13, 14, 15, 16, 17, 18, 19 and 20 prior to the issuance of building permits. All trees to be retained on these lots should be clearly identified on a site plan along with appropriate tree protection measures to be implemented during construction.

I trust the information contained herein assists the Township in their deliberations about his planning application. Please do not hesitate to contact me if you require further clarification on this matter.

Yours truly,

GWS Ecological & Forestry Services Inc.



Greg W. Scheifele, M. A., R.P.F.
Principal Ecologist/Forester

c.c. Aldo Salls, County of Wellington

Appendix C – Colville Consulting – Breeding Bird



September 19, 2023

Mr. Rob Stovel
Stovel and Associates Inc.
Delivered Via Email

RE: **Results of Breeding Bird Surveys – 890 Watson Road, Arkell**

Thank you for contacting Colville Consulting Inc. regarding the completion of breeding bird surveys on the 890 Watson Road property, Arkell (Township of Puslinch). This letter report is intended to present the results of surveys completed on this property.

Study Area

The Subject Property for these surveys is located south of Arkell Road and east of Watson Road, in Arkell (see Figure 1). This property measures approximately 17.4ha (43.1 acres) in size and has been assigned the address of 890 Watson Road. A majority of the property is currently in agricultural production, with a woodland and thicket community on the southern portion of the property.

Results

Breeding bird surveys were conducted on May 23, June 10 and June 25, 2023. Surveys were completed at least a week apart, under suitable weather conditions with little to no wind or precipitation. A thorough search of the Subject Property was completed during all 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 44 species of birds were observed or heard on or above the Subject Property and two additional species were observed on adjacent lands (see Table 1). According to Ontario conservation status ranks (S-rank) designations, with the exception of two non-native species, all 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.

Several Barn Swallows were observed flying, foraging and calling over the agricultural portions of the property on the first and second site visits. This species is listed as Special Concern in Ontario, and also designated as Special Concern federally. No buildings or structures suitable for nesting are present on the property, and therefore this property is considered to be providing incidental foraging opportunities.

An Eastern Wood-pewee was heard calling in the woodland at the south end of the property during all three site visits. An individual was also observed frequenting a nest site on the second site visit. The approximate location of observations is illustrated in Figure 1. This species is designated as Special Concern in Ontario and Canada.

Although not detected on the property, an Eastern Meadowlark was heard calling from lands east of the property during the second and third site visits. This species is designated as Threatened in Ontario and is also considered to be Threatened in Canada. The estimated location

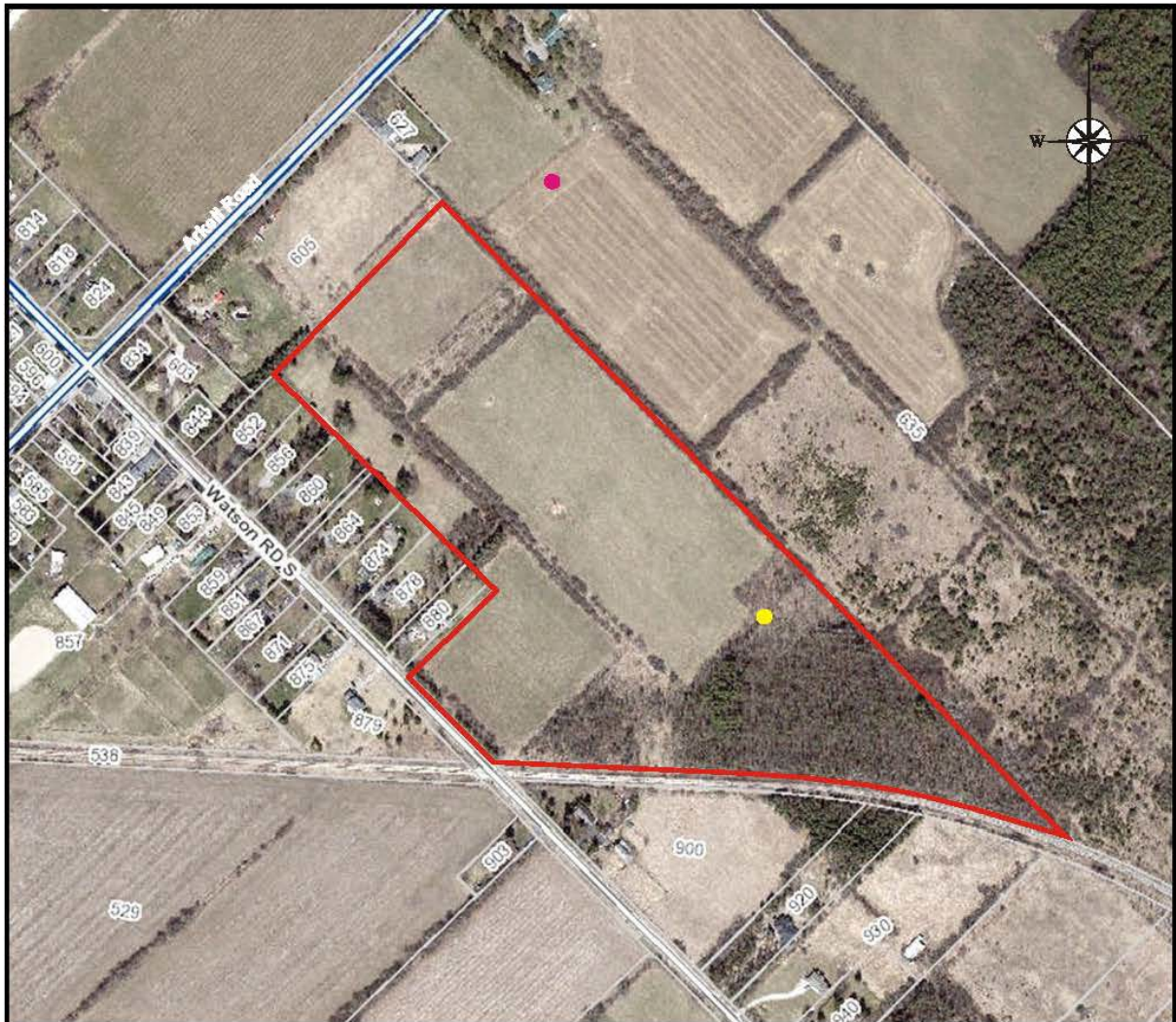


Table 1. List of bird species documented within and adjacent to the Study Area.

Species	S Rank	Agricultural Lands	Hedgerow	Woodland	Adjacent Lands	Highest Breeding Evidence*	Breeding Code**
American Crow	S5B		X	X		PO	H
American Goldfinch	S5B		X	X		PO	H
American Robin	S5B		X	X		PO	S
Baltimore Oriole	S4B		X	X		PO	S
Barn Swallow	S4B	X				OBS	
Black-billed Cuckoo	S4S5B			X		PO	S
Black-capped	S5		X	X		PO	S
Blue Jay	S5			X		PO	H
Blue-winged Warbler	S4B			X		CO	CF
Brown-headed	S4B		X	X		PO	
Canada Goose	S5	X				OBS	X
Cedar Waxwing	S5B		X	X		PO	H
Chipping Sparrow	S5B		X	X		PO	S
Common Grackle	S5B		X	X		PO	H
Common Raven	S5				X	PO	H
Common Yellowthroat	S5B		X	X		PO	S
Downy Woodpecker	S5			X		CO	NY
Eastern Bluebird	S5B,S4N			X	X	PO	S
Eastern Kingbird	S4B			X		PO	S
Eastern Meadowlark	S4B,S3N				X	PO	S
Eastern Towhee	S4B		X	X		PO	S
Eastern Wood-pewee	S4B			X		CO	AE
European Starling	SNA			X		PO	H
Field Sparrow	S4B,S3N		X	X	X	PO	S
Gray Catbird	S4B		X	X		PO	S
Great Blue Heron	S4	X				OBS	X
Great Crested	S4B			X		PO	S
Horned Lark	S4	X	X			PO	S
House Finch	SNA			X	X	PO	S
House Wren	S5B		X	X		CO	FY
Indigo Bunting	S5B		X	X		PR	A
Killdeer	S5B	X			X	PO	H
Mallard	S5	X				OBS	X
Mourning Dove	S5		X	X		PO	S
Mourning Warbler	S5B			X		PR	T
Northern Cardinal	S5		X	X		PO	S
Northern Flicker	S4B		X	X		PO	S
Red-eyed Vireo	S5B			X		PR	A
Red-winged Blackbird	S4			X		PO	S
Ring-billed Gull	S5	X				OBS	X
Rose-breasted	S4B			X		PO	S
Ruby-throated	S5B			X		PO	H
Savannah Sparrow	S5B,S3N	X	X		X	PO	S
Sharp-shinned Hawk	S5		X			PO	H
Song Sparrow	S5B		X	X		PO	S
Wild Turkey	S5			X	X	PO	S

COLVILLE CONSULTING INC.

Table 1 Legend

* 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
N – nest building or excavation of nest hole FY – recently fledged young
CF – adult carrying food for young NY – nest with young

of this individual is illustrated in Figure 1, however it should be noted that access to this property was not available and no nests were confirmed on the adjacent lands.

Summary and Recommendations

As indicated in Table 1, a majority of the bird species documented on this property were observed in and adjacent to the woodland and hedgerow. All bird species documented using these habitats are considered to be common and secure in the province of Ontario, with one of these species (Eastern Wood-pewee) considered to be a Species of Special Concern. Eastern Wood-pewee were documented in the woodland during each of the breeding bird surveys and this species is considered to be breeding in this woodland.

One meadow species (Savannah Sparrow) was documented using the agricultural portions of the property and Eastern Meadowlark was documented east of this parcel. No use of the property by Eastern Meadowlark was documented during our surveys and no active nests were verified on the adjacent lands. It is therefore our observation that the Subject Property is not providing significant habitat for this species.

Several Barn Swallows were observed flying, foraging and calling over the agricultural portions of the property on the first and second site visits. As no buildings or structures suitable for nesting are present on the property, use of this property by Barn Swallows is considered to be opportunistic.

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

Respectively submitted by:



Ian Barrett, M.Sc.
Colville Consulting Inc.

Appendix D – V.A. Wood Geotechnical Investigation (2006)



V. A. WOOD (GUELPH) INCORPORATED
CONSULTING GEOTECHNICAL ENGINEERS

405 YORK ROAD, GUELPH, ONTARIO N1E 3H3
TELEPHONE: (519) 763-3101

PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
PART LOTS 7, 8 & 9, CONCESSION 10
TOWNSHIP OF PUSLINCH (ARKELL), ONTARIO

Ref. No. G2547-6-2
February, 2006

Prepared for:

1648253 Ontario Inc.
c/o Mr. Tom Kukovica
794 Watson Road South
RR #1
Puslinch, Ontario

Distribution:

- (4) Copies – 1648253 Ontario Inc.
- (1) Copy – Van Harten Surveying Inc.
- (1) Copies – R.J. Burnside & Associates Ltd.
- (2) Copies – V.A. Wood (Guelph) Inc.



1.0 INTRODUCTION:

V.A. Wood (Guelph) Inc. was retained by 1648253 Ontario Inc. to carry out a preliminary geotechnical investigation for the proposed residential development on Part Lots 7, 8 & 9, Concession 10 in the Village of Arkell in the Township of Puslinch, Ontario.

The purpose of the investigation was to reveal the subsurface conditions and to determine the relevant soil properties for preliminary recommendations for the design and construction of the site services, residences, pavement areas and storm water management systems.

2.0 FIELD WORK:

The fieldwork was carried out on January 12, 13 and 16, and consisted of ten (10) boreholes at the locations shown on Enclosure 1. The boreholes were advanced to the sampling depths by means of a track-mounted, power auger machine, equipped for soil sampling. Standard Penetration tests were carried out at frequent intervals of depth and the results are shown on the Borehole Logs as N-values.

Engineering staff from V.A. Wood (Guelph) Inc. supervised the fieldwork. Geodetic ground elevations at Boreholes 1 to 8, inclusive were provided by Van Harten Surveying Inc. Elevations at Boreholes 9 and 10 were extrapolated from the Van Harten Surveying Inc. topographic survey.

3.0 SUBSURFACE CONDITIONS:

Full details of the soils encountered in each borehole are given on the Borehole Logs, Enclosures 2 to 11, inclusive and the following notes are intended to summarize this data.

A surficial deposit of **topsoil** was encountered at all the boreholes. The thickness varied from 200 to 1500mm in thickness. A Standard Penetration test in the topsoil at Borehole 7 gave an N-value of 6 blows/300mm and the natural moisture content was found to be about 18%.

The topsoil at Boreholes 1 to 5, inclusive and 8 was underlain by a deposit of brown **sandy gravel**, which extended to a depth of 7.7 metres below grade and to the full depth of the investigation (i.e. 5.2 to 6.6 metres below grade). This material generally consisted of a sandy gravel matrix with a trace of silt and occasional cobble and boulder. Standard Penetration tests in this material gave N-values ranging between 17 and greater than 100 blows/300mm and the natural moisture content was found to range from 2 to 5%. Typical grain size distribution curves for this material can be found on Enclosures 12 and 13.

Based on the test results, the deposit of sandy gravel is considered to be in a generally compact to very dense condition. It should be noted that the presence of gravel, cobble and boulder in the deposits may have resulted in high N-values and these may not accurately represent the relative density of the soils.

The topsoil at Boreholes 6, 7, 9 and 10 was underlain by a deposit of brown **gravel and sand**, which extended to depths ranging between 6.9 and 7.2 metres below grade and to the full depth of the investigation (i.e. 3.3 to 6.2 metres below grade). This material generally consisted of a gravel and sand matrix with some silt and occasional cobble and boulder. Standard Penetration tests in this material gave N-values ranging between 18 and greater than 100 blows/300mm and the natural moisture content was found to range from 2 to 8%. Typical grain size distribution curves for this material can be found on Enclosures 14 and 15.

Based on the test results, the deposit of gravel and sand is considered to be in a generally compact to very dense condition. It should be noted that the presence of gravel, cobble and boulder in the deposits may have resulted in high N-values and these may not accurately represent the relative density of the soils.

A deposit of brown **silt** was encountered below the sandy gravel at Borehole 1 to a depth of 9.4 metres below grade. This material generally consisted of a silt matrix with some clay and sand, a trace of gravel and occasional cobble and boulder. A Standard Penetration test in this material gave an N-value of 79 blows/300mm and the natural moisture content was found to be about 15%. A typical grain size distribution curve for this material can be found on Enclosure 16.

Based on the test results, the deposit of silt is considered to be in a generally very dense condition.

*The gravel and sand at Borehole 10 was underlain by a deposit of brown, **gravelly, silty sand till**, which extended to a depth of 10.1 metres below grade. This material generally consisted of a gravelly, silty sand matrix. Standard Penetration tests in this material gave N-values ranging between 74 and 91 blows/300mm and the natural moisture content was found to be about 6%. A typical grain size distribution curve for this material can be found on Enclosure 17.*

Based on the test results, the deposit of gravelly, silty sand till is considered to be in a generally very dense condition. It should be noted that the presence of gravel in the deposits may have resulted in high N-values and these may not accurately represent the relative density of the soils.

*A deposit of brown **sand and silt** was encountered below the gravelly, silty sand till at Borehole 10 to a depth of 11.0 metres below grade. This material generally consisted of a sand and silt matrix with a trace of clay and gravel. The natural moisture content was found to be about 16%. A typical grain size distribution curve for this material can be found on Enclosure 18.*

Based on the test results, the deposit of sand and silt is considered to be in a generally very dense condition.

*The sand and silt at Borehole 10 was underlain by a deposit of brown, **gravelly, silty sand till**, which extended to a depth of 11.7 metres below grade. This material generally consisted of a gravelly, silty sand matrix. A Standard Penetration test in this material gave an N-value of 68 blows/300mm. It should be noted that the presence of gravel in the deposits may have resulted in high N-values and these may not accurately represent the relative density of the soils.*

Based on the test results, the deposit of gravelly, silty sand till is considered to be in a generally very dense condition.

*A deposit of brown **sand** was encountered below the gravelly, silty sand till at Borehole 10. This deposit extended to the full depth of the investigation (i.e. 12.6 metres below grade) and generally consisted of a sand matrix with some silt and a trace of gravel. A Standard Penetration test in this material gave an N-value of greater than 100 blows/300mm. A typical grain size distribution curve for this material can be found on Enclosure 19.*

Based on the test results, the deposit of sand is considered to be in a generally very dense condition.

The silt at Borehole 1 and the gravel and sand at Borehole 7 were underlain by grey dolostone rock fragments, which extended to the full depth of the investigation (i.e. 7.3 to 9.5 metres below grade). Standard Penetration tests in this material gave N-values of 100 blows/300mm and the natural moisture content was found to be about 1%.

Auger refusal on probable boulder or bedrock was encountered at Boreholes 1, 6, 7 and 8 at depths of 9.5, 3.3, 7.3 and 9.5 metres below grade, respectively.

4.0 GROUNDWATER CONDITIONS:

Boreholes 2 to 9, inclusive were dry to the full depth of the investigation on completion of the fieldwork programs on January 12, 13 and 16, 2004, respectively. Dry cave-ins were encountered at Boreholes 2, 4, 5, 8 and 9 at depths ranging between 4.0 and 5.0 metres below grade (i.e. El. 335.4m± to 340.3m±). Boreholes 1 and 10 encountered a free water surface at depths ranging between 9.1 and 10.1 metres below grade (El. 331.4m± to 334.8m±) on completion of the fieldwork program on January 12 and 16, 2006 respectively.

Monitoring wells were installed in Boreholes 1 and 10 on January 12 and 16, 2006, respectively for future groundwater level monitoring. A free water surface was encountered in Boreholes 1 and 10 at depths of 7.2 and 10.0 metres below grade (i.e. El. 333.3m± and 334.9m±), respectively on February 2, 2006.

An examination of the soil samples indicated that they were generally dry to saturated.

It is noted that no sub-artesian water pressures were encountered in any of the boreholes.

Based on the foregoing, the groundwater table is considered to be located at elevations between El. 333.3m± and 334.9m±.

5.0 DISCUSSION AND RECOMMENDATIONS:

5.1 General:

The boreholes encountered surficial deposits of topsoil underlain by compact to very dense sandy gravel or gravel and sand on very dense silt or gravelly, silty sand till on very dense sand and silt on very dense gravelly, silty sand till on very dense sand or probable boulder or bedrock.

The groundwater table is considered to be located at elevations ranging between El. 333.3m± and 334.9m±.

Details concerning the proposed development were not available at the time of this report and therefore the following discussion should be considered preliminary and should be reviewed when more details are available.

5.2 Sewers:

If storm sewer inverts are located at typical depths of between 3 and 4 metres below grade, excavations will encounter compact to very dense sandy gravel or gravel and sand. These deposits will generally provide adequate support for the pipes and allow the use of normal Class 'B' bedding using Granular 'A' material. Clear crushed stone should not be used as bedding unless it is wrapped with geotextile to prevent undesirable settlements caused from fines migrating into the voids of the stone. Where the exposed subgrade is less competent, the bedding thickness may have to be increased and it may be necessary to protect the excavation with a skim coat of concrete immediately after it has been exposed.

The excavated materials will be generally suitable for use as trench backfill provided that they are free of topsoil and boulders. If the on-site materials are or become wet, they should be air dried prior to re-use as trench backfill. The trench backfill should be placed in 150 to 200mm thick layers and uniformly compacted to at least 95% of its Standard Proctor maximum dry density. The backfill around manholes should consist of well-graded and well-compacted granular material.

To minimize potential problems and wetting of the subgrade material, backfilling operations should follow closely after excavations, so that only a minimal length of trench is exposed at a time. Should construction be carried out in the winter season, particular attention should be given to make sure no frozen material is used for backfill.

5.3 Foundations:

The deposits of topsoil are not considered to be a suitable bearing stratum. The foundations for the proposed residential dwellings should therefore be extended into the native sandy gravel or gravel and sand which will be suitable for supporting footings designed to an allowable bearing pressure of up to 200 kPa (4 ksf).

All exterior footings or footings in unheated areas should be located at least 1.2 metres below finished grade for adequate frost protection.

Elevation differences between adjacent footings should not be more than a half of the horizontal distance between them.

It is estimated that the total and differential settlements of footings designed to these bearing pressures will be less than 25 and 20mm respectively, which are normally considered acceptable for the proposed residential structures.

It is recommended that all foundation excavations be inspected by geotechnical personnel from V.A. Wood (Guelph) Inc. to ensure the founding materials are similar to those identified in the boreholes and that they are capable of supporting the design loads.

5.4 Excavation and Groundwater Control:

No major construction problems due to water are anticipated in excavations above El. 334.9m±. However, provision should be made for control of surface water run-off and minor seepage by pumping from local sumps on an as and where required basis.

The sides of the excavation to a depth of more than 1.2 metres (and above the water table) should either be cut back at a side slope of 1 to 1 or supported using adequately braced closed sheeting.

5.5 Floor Slabs:

All topsoil and any deleterious fill encountered should be stripped from the building areas and the proposed subgrade should be re-compacted from the surface to at least 95% of its Standard Proctor maximum dry density. Any loose/wet material encountered should be sub-excavated and replaced with approved fill.

The fill may consist of approved on-site materials free of cobbles/boulders or approved imported fill. All fill should be placed in 150 to 200mm thick lifts and compacted to at least 95% Standard Proctor maximum dry density. It is recommended the underfloor fill be placed at least one month prior to floor construction in order to minimize settlement.

A layer of well-graded, free-draining material, at least 150mm thick and compacted to at least 98% Standard Proctor maximum density, should be placed under the floor slabs to provide a uniform bearing surface and act as a vapour barrier.

Frequent inspections by geotechnical personnel from V.A. Wood (Guelph) Inc. should be carried out during construction to verify compaction of the subgrade and base courses by in-situ density testing using nuclear gauges.

5.6 Pavement Designs:

All topsoil and any deleterious materials encountered should be stripped from the proposed pavement area(s). The underlying subgrade should then be re-compacted from the surface to at least 95% of its Standard Proctor maximum dry density prior to construction of the pavement. Any loose areas which are detected should be sub-excavated and replaced with suitable approved on-site material or approved imported fill. All fill materials should be placed in 150 to 200mm thick lifts and compacted to at least 95% Standard Proctor maximum dry density.

Considering the probable traffic requirements and subsoil conditions, the following pavement designs are recommended:

<i>Material</i>	<i>Passenger Car Parking (Light Duty) (mm)</i>	<i>Access Road (Medium Duty) (mm)</i>
<i>Asphaltic Concrete</i>	<i>50</i>	<i>90</i>
<i>Granular 'A' Base Course</i>	<i>150</i>	<i>150</i>
<i>Granular 'B' Sub-base Course</i>	<i>200</i>	<i>300</i>

The base and sub-base granular materials should be compacted to at least 100% Standard Proctor maximum dry density. The asphalt should be compacted to OPS Specifications.

Frequent inspections by geotechnical personnel from V.A. Wood (Guelph) Inc. should be carried out during construction to verify the compaction of the subgrade, base courses and asphaltic concrete by in-situ density testing using nuclear gauges.

5.7 Storm Water Management:

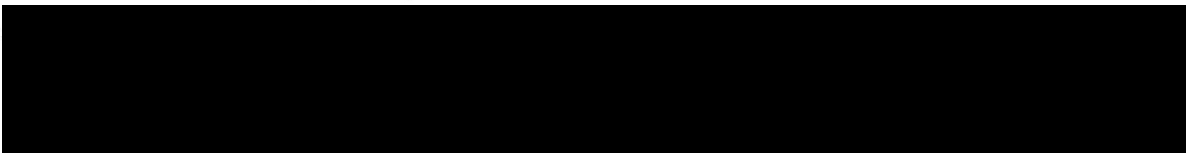
The grain size distribution curves prepared for the samples obtained from the boreholes were compared to the family of curves presented in the Supplementary Guidelines to the Ontario Building Code 1997. Based on the Unified Soils Classification System, the soils are considered to have the following properties:

Material	Unified Soils Classification Group	Estimated Co-efficient of Permeability (k) (cm/sec)
Sandy Gravel, trace silt	(GW-GM)	10^{-1} to 10^{-4}
Sandy Gravel, trace silt	(GP-GM)	10^{-1} to 10^{-3}
Gravel and Sand, some silt	(GM)	10^{-2} to 10^{-4}
Silt, some clay, some sand, trace gravel	(ML)	10^{-5} to 10^{-6}
Gravelly, Silty Sand Till	(SM)	10^{-3} to 10^{-5}
Sand and Silt, trace clay, trace gravel	(SM)	10^{-3} to 10^{-5}
Sand, some silt, trace gravel	(SM)	10^{-3} to 10^{-5}

6.0 STATEMENT OF LIMITATIONS:

The Statement of Limitations presented on Appendix 'A' is an integral part of this report.

V.A. WOOD (GUELPH) INC.



Mikko Nyysönen, M.Eng., P.Eng.
Senior Engineer



J. Broad, BA
General Manager

MN:sm

Encls.

4 copies

Appendix E – Chung and Vanderdolen Test Hole Data



FILE No: 1669

TEST PIT No. 1

Enclosure No.: 1
Sheet 1 of 1



Client: **Timberworx Custom Homes**
Project: **Arkell Subdivision**
Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA
Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak \otimes Rem. \times LAB TEST: Unc. \blacksquare P.P. \square 50 100 150 200				PENETRATION RESISTANCE STANDARD \bullet DYN. CONE \circ				
	Ground Elevation: 250 mm TOPSOIL														
0.25	trace topsoil	0.5													
	compact, brown SAND AND GRAVEL trace silt	1.0													minor collapsing of sidewalls during test pit advancement
	occ. to frequent cobbles and boulders	1.5													
	damp to moist	2.0													
	dense	2.5		1	BS										
3.00	End of Test Pit	3.0													test pit dry at completion
		3.5													
		4.0													
		4.5													
		5.0													
		5.5													
		6.0													

PROJECT MANAGER: **RVD**

CHUNG & VANDER DOELEN ENGINEERING LTD.
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CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPJ CVD_ENG.GDT 24-1-5

FILE No: 1669

TEST PIT No. 3

Enclosure No.: 3
Sheet 1 of 1



Client: **Timberworx Custom Homes**
Project: **Arkell Subdivision**
Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA
Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation:															
0.33	330 mm TOPSOIL															
	trace topsoil	0.5														occasional to frequent collapsing of sidewalls during test pit advancement
	compact, brown SAND AND GRAVEL trace silt	1.0		1	BS											
	occ. cobbles damp to moist	1.5														
	dense occ. boulders	2.0														
		2.5														
		3.0														
		3.5														
		4.0		2	BS											
4.30	End of Borehole	4.5														test pit dry at completion
		5.0														
		5.5														
		6.0														

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPJ CVD_BNG.GDT 241-5

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FILE No: 1669

TEST PIT No. 4

Enclosure No.: 4
Sheet 1 of 1



Client: **Timberworx Custom Homes**

Project: **Arkell Subdivision**

Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA

Machine: **Excavator**

Method: **Excavator**

Size:

Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation:															
0.33	330 mm TOPSOIL															
	trace topsoil	0.5														
	compact, brown SAND AND GRAVEL trace silt	1.0														
	occ. cobbles	1.5														
	damp to moist	2.0														
	occ. boulders	2.5														
	silt seam	3.0														
		3.5														
		4.0														
		4.5														
		5.0														
		5.5														
		6.0														
6.10	End of Borchole															

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPI_CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

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FILE No: 1669

TEST PIT No. 5

Enclosure No.: 5
Sheet 1 of 1



Client: **Timberworx Custom Homes**

Project: **Arkell Subdivision**

Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA

Machine: **Excavator**

Method: **Excavator**

Size:

Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation:															
0.30	300 mm TOPSOIL															
0.50	loose, brown SILT, some sand, trace clay moist	0.5		1	BS											
0.60	compact to dense brown SAND AND GRAVEL trace silt	1.0		2	BS											
	occ. to frequent cobbles and boulders	1.5														
	damp to moist	2.0														
		2.5														
		3.0														
		3.5														
		4.0														
		4.5														
		5.0														
		5.5														
6.10	End of Test Pit	6.0														test pit dry at completion

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPI CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

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FILE No: 1669

TEST PIT No. 6

Enclosure No.: 6
Sheet 1 of 1



Client: **Timberworx Custom Homes**
Project: **Arkell Subdivision**
Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA
Machine: **Excavator**
Method: **Excavator**
Size:
Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation:															
0.35	350 mm TOPSOIL			1	BS											
	compact to dense brown	0.5														
	SAND AND GRAVEL trace silt															
	occ. cobbles	-1.0		2	BS											
	damp to moist															
	----- silt seam	-2.0														
	----- occ. boulders															
		2.5														
		3.0														
		3.5														
		4.0		3	BS											
		4.5														
		5.0														
		5.5														
6.10	End of Borchole	6.0														test pit dry at completion

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPI CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

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FILE No: 1669

TEST PIT No. 7

Enclosure No.: 7
Sheet 1 of 1



Client: **Timberworx Custom Homes**

Project: **Arkell Subdivision**

Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA

Machine: **Excavator**

Method: **Excavator**

Size:

Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation:															
0.30	300 mm TOPSOIL															
	trace topsoil	0.5		1	BS											
	compact, brown SAND AND GRAVEL trace to some silt	1.0		2	BS											
	frequent cobbles and boulders damp to moist	1.5														
		2.0														
		2.5		3	BS											
		3.0														
		3.5														
		4.0														
		4.5														
		5.0														
		5.5														
		6.0														
6.10	End of Test Pit															test pit dry at completion

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPJ CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

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FILE No: 1669

TEST PIT No. 8

Enclosure No.: 8
Sheet 1 of 1



Client: **Timberworx Custom Homes**

Project: **Arkell Subdivision**

Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA

Machine: **Excavator**

Method: **Excavator**

Size:

Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation:															
0.30	300 mm TOPSOIL															
	some silt to silty trace topsoil	0.5		1	BS											
	compact, brown SAND AND GRAVEL trace silt	1.0		2	BS											
	frequent cobbles and boulders	1.5														
	damp to moist	2.0														
		2.5														
		3.0														
		3.5														
	dense	4.0														
		4.5														
		5.0														
		5.5														
		6.0														
6.10	End of Test Pit															test pit dry at completion

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPI_CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

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FILE No: 1669

TEST PIT No. 9

Enclosure No.: 9
Sheet 1 of 1



Client: **Timberworx Custom Homes**

Project: **Arkell Subdivision**

Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA

Machine: **Excavator**

Method: **Excavator**

Size:

Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation: 250 mm TOPSOIL															
0.25	some silt to silty trace topsoil	0.5		1	BS											
	compact to dense brown															
	SAND AND GRAVEL trace silt	1.0		2	BS											
	occ. cobbles and boulders damp to moist	1.5														
		2.0		3	BS											
		2.5														
		3.0														
		3.5														
		4.0														
		4.5														
		5.0														
		5.5														
		6.0														
6.10	End of Test Pit															test pit dry at completion

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPJ CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

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FILE No: 1669

TEST PIT No. 10

Enclosure No.: 10
Sheet 1 of 1



Client: **Timberworx Custom Homes**

Project: **Arkell Subdivision**

Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA

Machine: **Excavator**

Method: **Excavator**

Size:

Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation:															
0.30	300 mm TOPSOIL															
	some silt to silty, trace topsoil	0.5		1	BS											
	compact to dense brown															occasional collapsing of sidewalls during test pit advancement
	SAND AND GRAVEL trace silt	1.0		2	BS											
	occ. to frequent cobbles and boulders															
	damp to moist	1.5														
		2.0														
		2.5														
		3.0														
		3.5														
		4.0														
		4.5														
		5.0														
		5.5														
		6.0														test pit dry at completion
6.10	End of Test Pit															

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPI_CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

CHUNG & VANDER DOELEN ENGINEERING LTD.

311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 1669

TEST PIT No. 11

Enclosure No.: 11
Sheet 1 of 1



Client: **Timberworx Custom Homes**

Project: **Arkell Subdivision**

Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA

Machine: **Excavator**

Method: **Excavator**

Size:

Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY		SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS		
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80				W _p	W
	Ground Elevation:															
0.30	300 mm TOPSOIL															
	some silt to silty trace topsoil/rootlets	0.5		1	BS											
	compact, brown SAND AND GRAVEL trace silt	1.0														
	occ. cobbles and boulders damp to moist	1.5		2	BS										occasional collapsing of sidewalls during test pit advancement	
		2.0														
		2.5														
		3.0														
		3.5														
		4.0		3	BS											
		4.5														
		5.0														
		5.5														
		6.0													test pit dry at completion	
6.10	End of Test Pit															

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPI CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

CHUNG & VANDER DOELEN ENGINEERING LTD.

311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 1669

TEST PIT No. 12

Enclosure No.: 12
Sheet 1 of 1



Client: **Timberworx Custom Homes**

Project: **Arkell Subdivision**

Location: **Pt of Lots 7, 8 and 9, Conc. 10, Arkell, Ontario**

EQUIPMENT DATA

Machine: **Excavator**

Method: **Excavator**

Size:

Date: **Dec 19 23 TO Dec 19 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p
	Ground Elevation:															
0.45	450 mm TOPSOIL	0.5		1	BS											
	trace topsoil/rootlets															occasional collapsing of sidewalls during test pit advancement
	compact to dense brown	1.0		2	BS											
	SAND AND GRAVEL trace silt occ. to frequent cobbles and boulders damp to moist	1.5														
		2.0														
		2.5														
		3.0														
		3.5														
		4.0		3	BS											
		4.5														
		5.0														
		5.5														
6.10	End of Test Pit	6.0														test pit dry at completion

CVD TEST PIT 1669 ARKELL SUBDIVISION - TEST PITS.GPI CVD_BNG.GDT 241-5

PROJECT MANAGER: **RVD**

**CHUNG & VANDER DOELEN
ENGINEERING LTD.**

311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

Appendix F – Proposed Draft Plan Conditions

No.	Condition
1	THAT this draft approval applies to the draft plan, County of Wellington File No. 23T-, as dated by boundary certified by, OLS Van Harten Surveying Inc., showing Lots 1-44 single detached residential lots (14.51 ha); Blocks 49 and 50 Road Widening (0.05 ha); Block 51 Stormwater Management (0.40 ha); Block 52 Roads (2.28 ha); Block 53 Secondary Access (0.25 ha); and Block 54 Area remaining as agriculture (1.74 ha), being a site total of 18.8 hectares of land.
2	THAT prior to final approval by the County of Wellington, the proposed final plan be given review and acceptance by the Township of Puslinch.
3	THAT prior to final approval by the County of Wellington, the County is to be advised by the Township of Puslinch that appropriate zoning is in effect for this proposed subdivision.
4	THAT any dead ends, day-lighting triangles at street intersections and open sides of road allowances created by this draft plan shall be terminated in 0.3 metre reserves to be conveyed to, and held in trust, by the Township of Puslinch.
5	THAT the Owner enter into a written subdivision agreement with the Township of Puslinch and that the subdivision agreement be registered by the Township of Puslinch against the lands to which it applies; and further, that a copy of the subdivision agreement as registered be forwarded to the County of Wellington.
6	THAT prior to any grading or construction on the site and prior to registration of the plan, the owners or their agents submit the following plans and reports to the satisfaction of the Township of Puslinch. <ul style="list-style-type: none"> a) A Final Stormwater Management Report in accordance with the 2003 Ministry of Environment Report entitled, "Stormwater Management Practices Planning and Design Manual" and in keeping with the Functional Servicing Report (CF Crozier & Associates Inc., 2025). b) Detailed Lot Grading and Drainage Plans showing existing and proposed grades. c) An Erosion and Siltation Control Plan for sediment and erosion control, indicating the means whereby erosion will be minimized and silt maintained on-site throughout all phases of grading and construction.
7	THAT the Subdivision Agreement between the Owner and the Township of Puslinch contain provisions acceptable to the Township of Puslinch for the completion and maintenance of the works in accordance with the approved plans and reports noted in the condition <i>above</i> throughout all phases of grading and construction.
8	THAT the Subdivision Agreement between the Owner and the Township of Puslinch contain provisions acceptable to the Township of Puslinch that the Purchase and Sale Agreement contain a clause to advise purchasers that lots will be serviced by private individual potable water and tertiary sewage disposal systems, and to identify the maintenance requirements of these systems.
9	THAT the Subdivision Agreement between the Owner and the Township of Puslinch shall contain provisions acceptable to the Township of Puslinch to ensure that final design of each onsite sewage system shall be completed by a licensed contractor certified by the Province of Ontario for design of such systems. An OBC-approved tertiary septic system which has the capability of removing nitrate concentrations to a maximum of 20 mg/L is required for each lot. All septic systems shall be placed in the rear yards and water supply wells shall be placed in front yards, or as specified by the design for each lot.
10	THAT the Subdivision Agreement between the Owner and the Township of Puslinch shall contain provisions acceptable to the Township of Puslinch to ensure that the private wells constructed on each lot meet the requirements of Ontario Regulation 903 and must provide a minimum well yield of 4 IGPM without storage or provide supplemental storage for wells yielding less than 4 IGPM.
11	THAT the Subdivision Agreement between the Owner and the Township of Puslinch shall contain provisions acceptable to the Township of Puslinch to ensure that unused wells on the property shall be decommissioned according to the requirements of Ontario Regulation 903.

12	THAT the Owner agrees in writing to satisfy all the requirements, financial and otherwise, of the Township of Puslinch concerning the provision of roads and street signs, installation of services and drainage.
13	THAT the road allowances included in this draft plan shall be shown and dedicated as public highways.
14	THAT the streets within the subdivision shall be named to the satisfaction of the Township of Puslinch and those street names shall not be a duplicate in spelling or phonetic sounding of street names elsewhere in the County of Wellington.
15	THAT Blocks xxx and xxxx on the draft plan of subdivision shall be conveyed to the Corporation of the Township of Puslinch.
16	THAT the Owner satisfies the requirements of the Township of Puslinch for parkland dedication as provided for under the Planning Act, R.S.O. 1990, as amended.
17	THAT prior to the commencement of any grading, site alteration or construction, a Tree Maintenance and Preservation Plan be prepared to the satisfaction of the Township.
18	THAT the subdivision agreement between the Township and the Owner shall incorporate provisions requiring that all purchase and sale, lease or reservation agreements shall include the following statement: "That land abutting the subdivision may be farmland and may be used for the growing of crops and housing of livestock and normal farm practices are to be anticipated."
19	THAT such easements, conveyances, and/or agreements as may be required for servicing access, utility or drainage purposes shall be granted to the appropriate authority.
20	THAT the subdivision agreement between the Township and the Owner shall incorporate provisions requiring an update of the Noise Impact Study prepared by HCG Engineering (2006) shall be implemented. In the event that the Noise Impact Study is updated prior to final approval, any further recommendations or modified recommendations shall be implemented to the satisfaction of the Township.
21	THAT Education Development Charges shall be collected prior to the issuance of a building permit(s).

Appendix G – Draft Official Plan Amendment

The Corporation of the County of Wellington

BY-LAW NO. ____

To adopt:

Official Plan Amendment No. ____ to the County of Wellington Official Plan

WHEREAS subsection 22(1) of the Planning Act, R.S.O. 1990 c.P.13, as amended, permits a person or public body to request a council of a municipality to amend its Official Plan, and Section 17, 21 and 22 applies to any such amendment; and,

WHEREAS it is deemed appropriate to adopt an amendment to the Wellington County Official Plan to incorporate certain modifications to the text of Part 9, Local Planning Policy, regarding the Arkell Subdivision;

WHEREAS it is deemed appropriate to adopt an amendment to the Wellington County Official Plan to redesignate lands mapped as “Prime Agricultural” and “Secondary Agricultural” to “Hamlet Area”;

COUNCIL ENACTS AS FOLLOWS:

1. The attached Amendment No. _ to the Wellington County Official Plan, is hereby adopted.
2. Pursuant to subsection 17(27) of the Planning Act, R.S.O. 1990, c.P.13 as amended, this Official Plan Amendment comes into effect upon the day after the last day for filing a notice of appeal, if no appeal is filed pursuant to subsection 17(24) and (25). Where one or more appeals have been filed under subsection 17(24) and (25) of the said Act, as amended, this Official Plan Amendment comes into effect when all such appeals have been withdrawn or finally disposed of in accordance with the direction of the Ontario Land Tribunal.

Passed this __ day of __, 20__.

Mayor _____

Clerk _____

**Official Plan Amendment Number ____
To the County of Wellington's Official Plan**

Constitutional Statement

The details of the Amendment, as contained in Part 2 of this text, constitute Amendment Number ____ to the County of Wellington Official Plan.

Part 1 – The Preamble

1.0 Location:

The lands affected by this Amendment are the lands located on the northern side of Watson Road, east of Arkell Road (County Road 37), described as Part of Lots 7, 8 and 9, Concession 10, Township of Puslinch, County of Wellington.

The proposed development is approximately 18.8 hectares in size.

2.0 Basis

These lands may be developed for residential dwellings. The dwellings shall be serviced by individual private water and wastewater services. This development is deemed to be residential infilling and rounding out of an existing settlement. This development contributes to the fulfillment of the local municipality growth strategy. This development shall be implemented through a rezoning and plan of subdivision or plan of condominium.

3.0 Other Approvals:

In addition to the proposed County Official Plan amendment, the proponent has also applied to the Township of Puslinch requesting an amendment to the Zoning By-law. The purpose of the By-law is to implement site specific OPA _ to permit infilling and rounding out of an existing settlement.

4.0 Supporting Information

In support of the proposed amendments to the planning documents, the proponent has prepared an Water Supply Assessment, Functioning Servicing and Stormwater Management Report, Traffic Impact Assessment an Agricultural Impact Assessment and Planning Justification Report.

Part 2 – The Amendment

All of this part of the document entitled **Part 2 – The Amendment**, consisting of the following text constitutes Amendment No. ___ to the County of Wellington Official Plan.

1.0 Details Of The Amendment

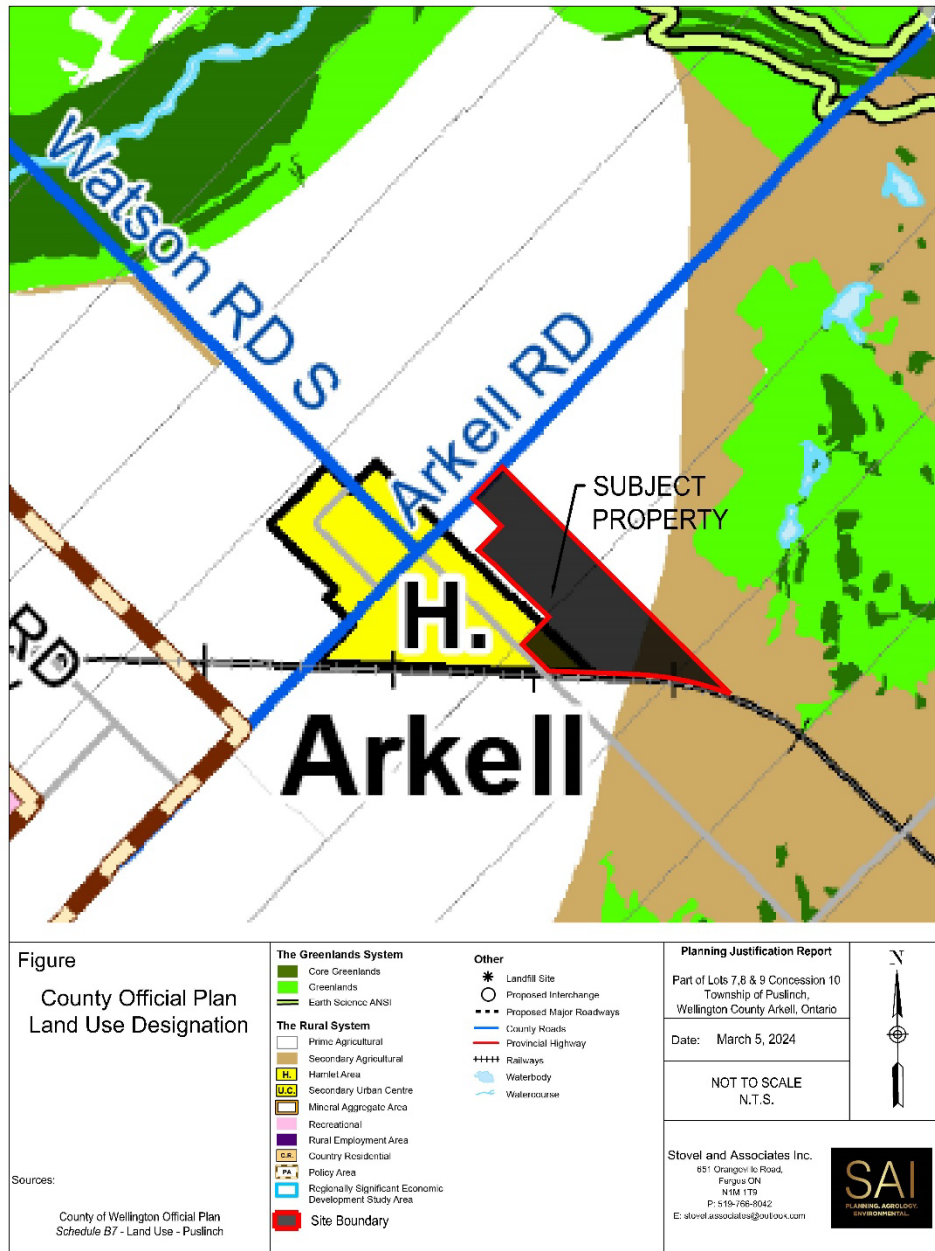
The Official Plan of the County of Wellington is hereby amended as follows:

1. THAT **Schedule B-7 (Puslinch)** is amended by changing a portion of the subject land to the Hamlet designation as illustrated on the attached Schedule "A".

Part 3 - Map Changes

The Site designated as "Prime Agricultural" and "Secondary Agricultural" to be redesignated to "Hamlet Area", as demonstrated on "Schedule A".

SCHEDULE A



Source: Wellington County Official Plan, Schedule B7 Puslinch (2024)

Appendix H – Draft Zoning By-Law Amendment

THE CORPORATION OF THE TOWNSHIP OF PUSLINCH

BY-LAW NUMBER _____-2026

Being a by-law to amend By-law 023/18, as amended being the Zoning By-law for the Township of Puslinch

WHEREAS, the Council of the Corporation of the Township of Puslinch deem it appropriate and in the public interest to amend By-law Number 023/18 pursuant to Section 34 of the Planning Act, R.S.O. 1990 as amended;

NOW THEREFORE THE COUNCIL OF THE CORPORATION OF THE TOWNSHIP OF PUSLINCH HEREBY ENACT AS THE FOLLOWS:

1. THAT Table 2.1 a. Residential is hereby amended by adding the following to the first column: “Hamlet Residential”, to the second column the short form: “HR” and to the third column the following description, which pursuant to section 2.1 b of Bylaw 023/18 as amended, does not form part of the Zoning By-law.
2. THAT Schedule “A” of the By-law 023/18 is hereby amended by rezoning a portion of Part of Lots 7, 8, and 9, Concession 10, within the Township of Puslinch from Agriculture (A) Zone to Hamlet Residential Zone – Holding (HR-xxx-“H”) as shown on Schedule “A” of this By-law;
3. THAT the subject land as shown on Schedule “A” to this By-law shall be subject to the following site-specific provisions for the Hamlet Residential (HR-xxx-“H”) Zone:

Zone Standard	Hamlet Residential (HR-xxx)
Minimum Lot Area (ha)	0.2
Min. Lot Frontage (m)	20
Minimum Front Yard (m)	3
Minimum Interior Side Yard (m)	2
Minimum Required Exterior Side Yard (m)	3
Minimum Rear Yard (m)	6

Maximum Permitted Lot Coverage	40
Maximum Permitted Building Height (m)	11
Minimum Required Landscaped Open Space	15
Permitted Uses	Accessory Apartment, Bed and Breakfast, Community Garden, Dwelling-Duplex, Dwelling-Single Detached, Dwelling-Semi Detached, Home Business, Private home day care, Public Park.

4. THAT the subject land as shown on Schedule “A” to this By-law shall be subject a **HOLDING PROVISION**, as set out below:

i) A Holding (H) Provision is hereby established and identified on Schedule ‘A’ attached hereto, by the letter “H” in parentheses following a zoning symbol established in this By-law.

ii) Where a zoning symbol is followed by the letter “H” in parentheses, the provisions of the By-law applicable to the zone symbol shall only apply upon the removal of the letter “H” by an Amendment By-law as approved by Council in accordance with the provisions of Section 36 of the Planning Act.

iii) Until the removal of the letter “H”:

a) No land, building or structure shall be used for any purpose other than that for which it was lawfully used prior to the passing of this By-law with the exception of a use by a public authority or existing agricultural use once the specific items listed in section iv) (a) has been satisfied;

iv) The (H) Holding Provision shall only be lifted for all other uses when the Township of Puslinch is satisfied that the following items have been addressed:

a) A subdivision agreement(s) (or condominium agreement(s)) between the Owner and the Township of Puslinch has been executed in accordance with the terms of the subdivision agreement(s) (or condominium agreement(s)) to satisfy all requirements, including financial, servicing, environmental and other requirements to the satisfaction of the Township.

5. In all other respects, the provisions of Zoning By-law 023/18, as amended shall apply.

6. Upon approval of the site-specific Official Plan Amendment by the County of Wellington, this by-law shall take effect from date of passing thereof, providing no appeal has been filed. Where appeals to the by-law are received in accordance with provisions of the Planning Act, the by-law shall come into effect upon approval of the Ontario Land Tribunal.

**READ A FIRST, SECOND A THIRD TIME AND FINALLY PASSED THIS __ DAY OF
_____, 2026**

James Seeley, Mayor

Courtney Hoytfox, Clerk

THE CORPORATION OF THE TOWNSHIP OF PUSLINCH

BY-LAW NUMBER _____

SCHEDULE "A"

THE CORPORATION OF THE TOWNSHIP OF PUSLINCH ZONING BY-LAW
SCHEDULE 'A'



**THE CORPORATION OF THE TOWNSHIP OF
PUSLINCH EXPLANATION OF BY-LAW NO.-____2026**

By-law Number _ - 2026 amends the Township of Puslinch Zoning By-law 23/18 by rezoning a portion of Lots 7, 8, and 9, Concession 10, within the Township of Puslinch, from a site specific AGRICUTLURAL (A) ZONE to the HAMLET RESIDENTIAL (HR) ZONE to permit the future development of a residential subdivision.

A HOLDING (H) ZONE provision has been attached to the zone to ensure that Township requirements, financial and otherwise, have been satisfied. The Holding – H zone provisions will be set out as following:

Prior to the removal of the holding symbol, draft plan approval for a plan of subdivision on the Subject Lands shall be required to be granted, together with the entering of a subdivision agreement with the Township to satisfy all requirements, including financial, servicing, environmental and other requirements to the satisfaction of the Township.

Appendix I – Curriculum Vitae of Report Authors

ROBERT P. STOVEL, M.Sc., RPP, MCIP, P.Ag.

EDUCATION

M.Sc, Rural Planning, University School of Rural Planning and Development, University of Guelph, 1988.

B.A. Geography, Wilfrid Laurier University, 1986.

MEMBERSHIPS

Member of the Ontario Professional Planners Institute.

Member of the Canadian Institute of Planners.

Member of the Ontario Institute of Agrologists.

POSITIONS HELD

1995 - Present: Stovel and Associates Inc., Fergus, Ontario - President.

1993 - 1995: Ecological Services Group, Guelph, Ontario - Senior Project Manager.

1988 - 1992: Ecological Services For Planning Ltd., Guelph, Ontario - Planner.

EXPERIENCE

Extensive project experience on public sector and private sector developments. Planning assignments include site plan preparation, official plan amendments, zoning by-law amendments, consent applications, plan of subdivision and plan of condominium applications and peer review. These projects have required considerable government and non-government agency liaison, interdisciplinary team coordination and the integration of a variety of disciplines. I have been qualified to provide evidence at both the Ontario Municipal Board and Joint Board.

Hydroelectric and natural gas Environmental Assessment and Planning projects include: Union Gas 12 " Route Selection and Corridor Study (Orillia) and Lennox to Bowmanville 500 Kv Environmental Study and Monitoring Program.

Selected projects in planning projects include the following: selected plan review for the Town of Halton Hills planning department, testimony at the OMB related to the Hoddinott Plan of Condominium development, environmental planning evaluation in support of proposed residential severance in Ballinafad, planning opinion report for the Van Ryn application, and environmental and agricultural planning justification reports relating to estate residential development applications in the Town of Milton and the Town of Halton Hills.

Public sector projects include the following: planning/resources management review for the Town of Halton Hills (residential development), County of Grey (agricultural) and the Township of North Dumfries (aggregate); input to provincial highway expansion in the County of Peterborough (MTO Class EA of Highway 7) and the County of Essex (MTO Class EA of Highway 3); municipal landfill site searches and site expansions in the County of Victoria, County of Peterborough, County of Essex, and Regional Municipality of Haldimand-Norfolk; municipal road widening project in the Region of York (Weston Road); municipal bridge project in the Township of Mono (County of Dufferin); YDSS expansion project in the Town of Markham and Town of Pickering; and municipal water and sewage works EA in the City of Stratford.

- Coordinated private sector pit and quarry licence applications include: Flamboro Quarries Licence Expansion, Cox Construction's Puslinch Pit Expansion, Ospringe Pit Expansion, Lockhart Pit Expansion (Woolwich Township), and Shoemaker Pit (TMGL - Pilkington Township), Dufferin Construction - Wayside Borrow Pit (Hamilton Airport), Greenwood Construction (East Garafraxa Pit Expansion), MTO Highway 8 Bridge and Road Development in the City of Kitchener (MTO/Seegmiller), MTO 406 Aggregate Permit Project (Niagara).
 - Prepared Planning Impact Assessment for the proposed Audrey Meadows development (48 lots).
 - Prepared Planning Impact Assessment reports for Redi-Mix plant, and three mineral aggregate operations in the Chatsworth Township.
 - Prepared Planning Justification Report for the Trafalgar Road Sports Complex.
 - Prepared Planning Impact Studies for: Inverhaugh Pit, Puslinch Pit and Roszell Pit applications.
 - Prepared planning report for the Eisen Stone Yard project in the former Township of Nichol.
 - Prepared consent applications in both rural and urban settings in the County of Wellington.
 - Prepared Planning reports for the justification of golf course expansion and limited residential lot development adjacent to recreational uses in the County of Wellington.
 - Provided rural planning and agricultural examination of near urban area development in the Glen Williams and Glen Lamond area.
 - Examined the potential for agricultural conflicts for the proposed urban boundary adjustments in the urban areas of Fergus and Elora.
- Provided opinion evidence at Joint Board hearing on behalf of Town of Milton (Central Milton Holdings Limited).
- Completed Environmental Impact Study for proposed Audrey Meadows Estate Residential Subdivision in the Township of Puslinch.
- Completed Level 1 and/or Level 2 Natural Environment Reports for the following pit licence applications: Bosomworth Pit (Pilkington), Whitelaw Pit (Pilkington), Darrington Pit (Pilkington), Hale Farm (Minto), I-ON-X Acres Pit (Southwest Oxford), Schwartz Pit Expansion (Sullivan), Greenwood Pit (East Garafraxa), Palen Pit Expansion (Hibbert), Kraemer Pit (Huron East), Martin Pit (Huron East), and the Hartung Pit (North Perth).
- Completed the required seminar on the Ontario Wetland Evaluation System (3rd Edition), and the Wetland Environmental Impact Study, Technical Manual.
- Designed and implemented wetland monitoring programs for aggregate developments and estate residential developments.
- Completed wetland surveys in the following wetland complexes: Orangeville Reservoir, Hayesland-Christie, Dalrymple Lake, Star Wetland, Eramosa River Blue-Springs Creek, Philips Lake, Mossington Park, Cranberry/Oil Well bog, Humber River Marshes, Speed River, Beaverton River, Mill Creek, and Irish Creek.
- Completed forestry evaluations for woodlands in Puslinch Township, Centre Wellington, City of Hamilton, Woolwich Township, Southwest Oxford, Peel Region and Region of York.

CURRICULUM VITAE

Robert L. Stovel, B.Sc.

PROFESSIONAL PROFILE

Robert L. Stovel is a Planner with Stovel and Associates Inc. with professional experience in statutory land use planning, aggregate resource management, and agricultural land use planning across Ontario. His work involves the application and interpretation of provincial and municipal planning policy, including the Planning Act, Provincial Planning Statement, and the Aggregate Resources Act, in support of public and private-sector development applications.

Mr. Stovel works under the supervision of Registered Professional Planners and is progressively assuming increased responsibility in the preparation and coordination of planning materials, agency consultation, and policy analysis. He regularly liaises with municipal planning staff, conservation authorities, and provincial agencies, and contributes to interdisciplinary consultant teams addressing land use compatibility, agricultural protection, and resource management.

PROFESSIONAL EXPERIENCE

Planner

Stovel and Associates Inc., Fergus, Ontario, 2021 – Present

Mr. Stovel has worked on a range of public-sector and private-sector planning assignments involving aggregate resource development, agricultural land use planning, and rural development.

His responsibilities include:

- Preparation of Planning Justification Reports in support of Official Plan Amendments, Zoning By-Law Amendments, consents, and subdivision applications.
- Interpretation and analysis of provincial and municipal planning policy under the supervision of senior planners.
- Coordination with municipal planning staff, conservation authorities, and Provincial agencies.
- Participation in interdisciplinary consultant teams involving engineering, environmental, and agricultural specialists.

PLANNING COMPETENCIES & PROFESSIONAL EXPERIENCE

Preparation and evaluation of Planning Justification Reports for Official Plan Amendments, Zoning By-Law Amendments, consents, and plans of subdivision Application and interpretation of the Provincial Planning Statement and municipal Official Plans. Planning support for Aggregate Resources Act licence applications,

including land use compatibility and rehabilitation planning. Agricultural land use planning within Prime Agricultural Areas, including Agricultural Impact Assessments (AIAs) and Minimum Distance Separation (MDS I) analysis. Coordination with municipal staff, conservation authorities, and provincial agencies in support of planning approvals. Contribution to interdisciplinary planning teams addressing environmental, agricultural, and engineering considerations.

SELECTED AGGREGATE RESOURCE PROJECT EXPERIENCE

- Lockhart Pit Expansion (D & J Lockhart Excavators Ltd.), Township of Woolwich (Planning approvals and Aggregate Resources Act Licence Application), 2021-Present.
- Lichty Pit (James Thome Construction Ltd.), Township of Centre Wellington (Planning approvals and Aggregate Resources Act Licence Application), 2021-Present.
- Innes Line Pit (SAMI), Township of South-West Oxford (Planning approvals and Aggregate Resources Act Licence Application), 2021-Present.
- Leslie Expansion Pit (Leslie Sand and Gravel Inc.), Township of Guelph-Eramosa (Planning Approvals and Aggregate Resources Act Licence Application), 2024-Present.
- Township of Puslinch, Peer Review of Application, CBM Lanci Pit Expansion and Aberfoyle South Pit Expansion, 2023-Present.
- Town of Caledon, Peer Review of Agricultural Impact Assessment, CBM Caledon Quarry, 2024-Present.
- Town of Caledon, Assistance in preparing Site Plan Section, Caledon Aggregate Standards Manual, 2025-Present.
- Township of Melancthon, Peer Review of AIA and Site Plans, Strada Aggregates Inc., Strada Pit & Quarry, 2025-Present.
- Preparation of annual Compliance Assessment Reports (CARs) for active gravel pits across Ontario.
- Preparation and Peer Review of site plan amendments and partial surrender amendments for municipal and private-sector pit operations.

SELECTED MUNICIPAL & AGRICULTURAL PLANNING EXPERIENCE

- Preparation of Agricultural Impact Assessments (AIAs) for development proposals within Prime Agricultural Areas.
- Peer review of AIAs and Minimum Distance Separation (MDS I) calculations under senior planner supervision.
- Preparation of agricultural rehabilitation plans for disturbed and post-extraction landscapes.
- Background policy research for the County of Middlesex addressing minimum farm parcel size in the Prime Agricultural Area.
- Planning support for rural consents, severances, and subdivision applications in the County of Wellington.

EDUCATION

Bachelor of Science (B.Sc.)
Providence College, 2020

PROFESSIONAL OBJECTIVE

Actively working toward eligibility for the Registered Professional Planner (RPP) designation through progressive professional experience under the supervision of Registered Professional Planners.

Draft Official Plan Amendment

The Corporation of the County of Wellington

BY-LAW NO. ____

To adopt:

Official Plan Amendment No. ____ to the County of Wellington Official Plan

WHEREAS subsection 22(1) of the Planning Act, R.S.O. 1990 c.P.13, as amended, permits a person or public body to request a council of a municipality to amend its Official Plan, and Section 17, 21 and 22 applies to any such amendment; and,

WHEREAS it is deemed appropriate to adopt an amendment to the Wellington County Official Plan to incorporate certain modifications to the text of Part 9, Local Planning Policy, regarding the Arkell Subdivision;

WHEREAS it is deemed appropriate to adopt an amendment to the Wellington County Official Plan to redesignate lands mapped as "Prime Agricultural" and "Secondary Agricultural" to "Hamlet Area";

COUNCIL ENACTS AS FOLLOWS:

1. The attached Amendment No. _ to the Wellington County Official Plan, is hereby adopted.
2. Pursuant to subsection 17(27) of the Planning Act, R.S.O. 1990, c.P.13 as amended, this Official Plan Amendment comes into effect upon the day after the last day for filing a notice of appeal, if no appeal is filed pursuant to subsection 17(24) and (25). Where one or more appeals have been filed under subsection 17(24) and (25) of the said Act, as amended, this Official Plan Amendment comes into effect when all such appeals have been withdrawn or finally disposed of in accordance with the direction of the Ontario Land Tribunal.

Passed this __ day of __, 20__.

Mayor _____

Clerk _____

Official Plan Amendment Number ____
To the County of Wellington's Official Plan

Constitutional Statement

The details of the Amendment, as contained in Part 2 of this text, constitute Amendment Number ____ to the County of Wellington Official Plan.

Part 1 – The Preamble

1.0 Location:

The lands affected by this Amendment are the lands located on the northern side of Watson Road, east of Arkell Road (County Road 37), described as Part of Lots 7, 8 and 9, Concession 10, Township of Puslinch, County of Wellington.

The proposed development is approximately 18.8 hectares in size.

2.0 Basis

These lands may be developed for residential dwellings. The dwellings shall be serviced by individual private water and wastewater services. This development is deemed to be residential infilling and rounding out of an existing settlement. This development contributes to the fulfillment of the local municipality growth strategy. This development shall be implemented through a rezoning and plan of subdivision or plan of condominium.

3.0 Other Approvals:

In addition to the proposed County Official Plan amendment, the proponent has also applied to the Township of Puslinch requesting an amendment to the Zoning By-law. The purpose of the By-law is to implement site specific OPA _ to permit infilling and rounding out of an existing settlement.

4.0 Supporting Information

In support of the proposed amendments to the planning documents, the proponent has prepared an Water Supply Assessment, Functioning Servicing and Stormwater Management Report, Traffic Impact Assessment an Agricultural Impact Assessment and Planning Justification Report.

Part 2 – The Amendment

All of this part of the document entitled **Part 2 – The Amendment**, consisting of the following text constitutes Amendment No. ___ to the County of Wellington Official Plan.

1.0 Details Of The Amendment

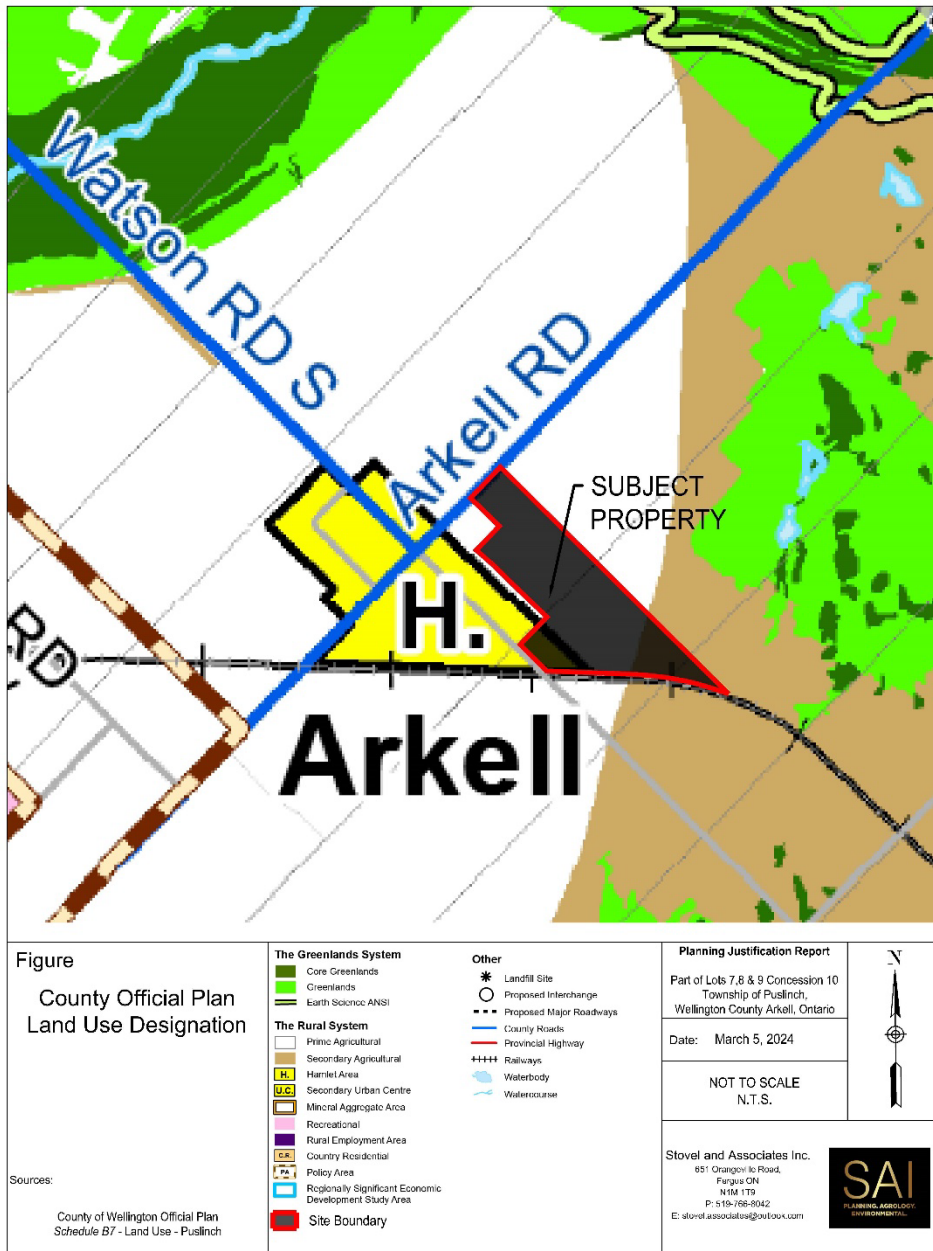
The Official Plan of the County of Wellington is hereby amended as follows:

1. THAT **Schedule B-7 (Puslinch)** is amended by changing a portion of the subject land to the Hamlet designation as illustrated on the attached Schedule "A".

Part 3 - Map Changes

The Site designated as "Prime Agricultural" and "Secondary Agricultural" to be redesignated to "Hamlet Area", as demonstrated on "Schedule A".

SCHEDULE A



Source: Wellington County Official Plan, Schedule B7 Puslinch (2024)

Draft Zoning By-Law Amendment

THE CORPORATION OF THE TOWNSHIP OF PUSLINCH

BY-LAW NUMBER _____-2026

Being a by-law to amend By-law 023/18, as amended being the Zoning By-law for the Township of Puslinch

WHEREAS, the Council of the Corporation of the Township of Puslinch deem it appropriate and in the public interest to amend By-law Number 023/18 pursuant to Section 34 of the Planning Act, R.S.O. 1990 as amended;

NOW THEREFORE THE COUNCIL OF THE CORPORATION OF THE TOWNSHIP OF PUSLINCH HEREBY ENACT AS THE FOLLOWS:

1. THAT Table 2.1 a. Residential is hereby amended by adding the following to the first column: "Hamlet Residential", to the second column the short form: "HR" and to the third column the following description, which pursuant to section 2.1 b of Bylaw 023/18 as amended, does not form part of the Zoning By-law.
2. THAT Schedule "A" of the By-law 023/18 is hereby amended by rezoning a portion of Part of Lots 7, 8, and 9, Concession 10, within the Township of Puslinch from Agriculture (A) Zone to Hamlet Residential Zone – Holding (HR-xxx-"H") as shown on Schedule "A" of this By-law;
3. THAT the subject land as shown on Schedule "A" to this By-law shall be subject to the following site-specific provisions for the Hamlet Residential (HR-xxx-"H") Zone:

Zone Standard	Hamlet Residential (HR-xxx)
Minimum Lot Area (ha)	0.2
Min. Lot Frontage (m)	20
Minimum Front Yard (m)	3
Minimum Interior Side Yard (m)	2
Minimum Required Exterior Side Yard (m)	3
Minimum Rear Yard (m)	6

Maximum Permitted Lot Coverage	40
Maximum Permitted Building Height (m)	11
Minimum Required Landscaped Open Space	15
Permitted Uses	Accessory Apartment, Bed and Breakfast, Community Garden, Dwelling-Duplex, Dwelling-Single Detached, Dwelling-Semi Detached, Home Business, Private home day care, Public Park.

4. THAT the subject land as shown on Schedule "A" to this By-law shall be subject a **HOLDING PROVISION**, as set out below:

i) A Holding (H) Provision is hereby established and identified on Schedule 'A' attached hereto, by the letter "H" in parentheses following a zoning symbol established in this By-law.

ii) Where a zoning symbol is followed by the letter "H" in parentheses, the provisions of the By-law applicable to the zone symbol shall only apply upon the removal of the letter "H" by an Amendment By-law as approved by Council in accordance with the provisions of Section 36 of the Planning Act.

iii) Until the removal of the letter "H":

a) No land, building or structure shall be used for any purpose other than that for which it was lawfully used prior to the passing of this By-law with the exception of a use by a public authority or existing agricultural use once the specific items listed in section iv) (a) has been satisfied;

iv) The (H) Holding Provision shall only be lifted for all other uses when the Township of Puslinch is satisfied that the following items have been addressed:

a) A subdivision agreement(s) (or condominium agreement(s)) between the Owner and the Township of Puslinch has been executed in accordance with the terms of the subdivision agreement(s) (or condominium agreement(s)) to satisfy all requirements, including financial, servicing, environmental and other requirements to the satisfaction of the Township.

5. In all other respects, the provisions of Zoning By-law 023/18, as amended shall apply.

6. Upon approval of the site-specific Official Plan Amendment by the County of Wellington, this by-law shall take effect from date of passing thereof, providing no appeal has been filed. Where appeals to the by-law are received in accordance with provisions of the Planning Act, the by-law shall come into effect upon approval of the Ontario Land Tribunal.

**READ A FIRST, SECOND A THIRD TIME AND FINALLY PASSED THIS __ DAY OF
_____, 2026**

James Seeley, Mayor

Courtney Hoytfox, Clerk

THE CORPORATION OF THE TOWNSHIP OF PUSLINCH

BY-LAW NUMBER _____

SCHEDULE "A"

THE CORPORATION OF THE TOWNSHIP OF PUSLINCH ZONING BY-LAW
SCHEDULE 'A'



**THE CORPORATION OF THE TOWNSHIP OF
PUSLINCH EXPLANATION OF BY-LAW NO.-____2026**

By-law Number _ - 2026 amends the Township of Puslinch Zoning By-law 23/18 by rezoning a portion of Lots 7, 8, and 9, Concession 10, within the Township of Puslinch, from a site specific AGRICUTLURAL (A) ZONE to the HAMLET RESIDENTIAL (HR) ZONE to permit the future development of a residential subdivision.

A HOLDING (H) ZONE provision has been attached to the zone to ensure that Township requirements, financial and otherwise, have been satisfied. The Holding – H zone provisions will be set out as following:

Prior to the removal of the holding symbol, draft plan approval for a plan of subdivision on the Subject Lands shall be required to be granted, together with the entering of a subdivision agreement with the Township to satisfy all requirements, including financial, servicing, environmental and other requirements to the satisfaction of the Township.

LAND
 REGISTRY
 OFFICE #61

71188-0006 (LT)

* CERTIFIED IN ACCORDANCE WITH THE LAND TITLES ACT * SUBJECT TO RESERVATIONS IN CROWN GRANT *

PROPERTY DESCRIPTION: PT LOT 7, CONCESSION 10 , TOWNSHIP OF PUSLINCH, PT 1, 61R6487 ; TOWNSHIP OF PUSLINCH

PROPERTY REMARKS:

ESTATE/QUALIFIER:

FEE SIMPLE
 LT CONVERSION QUALIFIED

RECENTLY:

FIRST CONVERSION FROM BOOK

PIN CREATION DATE:

1998/11/09

OWNERS' NAMES

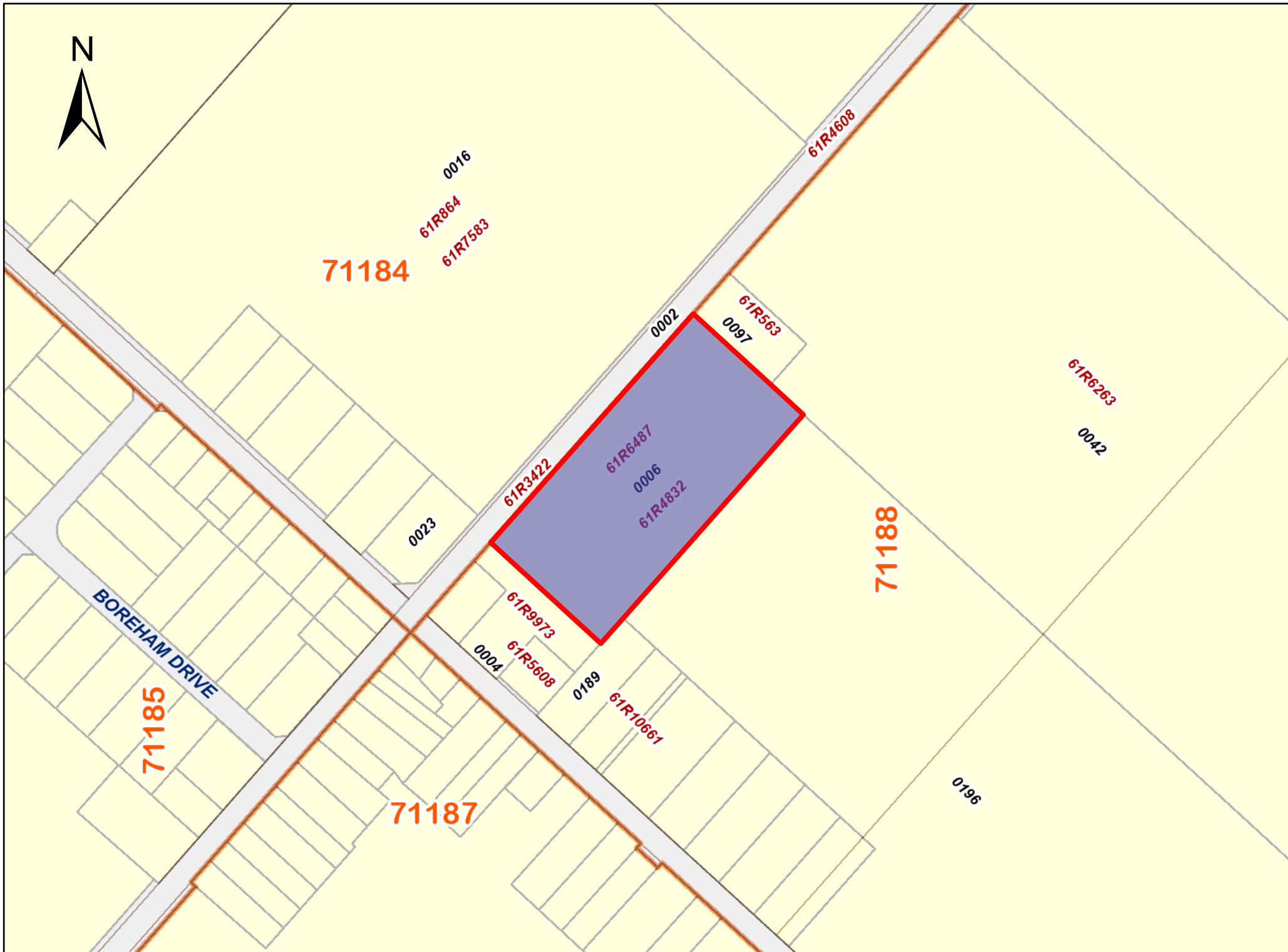
SATZEWICH, VICTOR NICHOLAS
 MAHOOD, LINDA LEA

CAPACITY SHARE

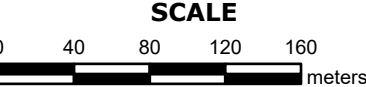
JTEN
 JTEN

REG. NUM.	DATE	INSTRUMENT TYPE	AMOUNT	PARTIES FROM	PARTIES TO	CERT/CHKD
<p>**EFFECTIVE 2000/07/29 THE NOTATION OF THE "BLOCK IMPLEMENTATION DATE" OF 1998/11/09 ON THIS PIN**</p> <p>**WAS REPLACED WITH THE "PIN CREATION DATE" OF 1998/11/09**</p> <p>** PRINTOUT INCLUDES ALL DOCUMENT TYPES (DELETED INSTRUMENTS NOT INCLUDED) **</p> <p>**SUBJECT, ON FIRST REGISTRATION UNDER THE LAND TITLES ACT, TO:</p> <p>** SUBSECTION 44(1) OF THE LAND TITLES ACT, EXCEPT PARAGRAPH 11, PARAGRAPH 14, PROVINCIAL SUCCESSION DUTIES *</p> <p>** AND ESCHEATS OR FORFEITURE TO THE CROWN.</p> <p>** THE RIGHTS OF ANY PERSON WHO WOULD, BUT FOR THE LAND TITLES ACT, BE ENTITLED TO THE LAND OR ANY PART OF</p> <p>** IT THROUGH LENGTH OF ADVERSE POSSESSION, PRESCRIPTION, MISDESCRIPTION OR BOUNDARIES SETTLED BY</p> <p>** CONVENTION.</p> <p>** ANY LEASE TO WHICH THE SUBSECTION 70(2) OF THE REGISTRY ACT APPLIES.</p> <p>**DATE OF CONVERSION TO LAND TITLES: 1998/11/09 **</p>						
61R4832	1989/09/05	PLAN REFERENCE				C
61R6487	1994/06/10	PLAN REFERENCE				C
RO792582	1998/03/30	TRANSFER			SATZEWICH, VICTOR NICHOLAS MAHOOD, LINDA LEA	C
WC680525	2022/07/28	CHARGE		SATZEWICH, VICTOR NICHOLAS MAHOOD, LINDA LEA	BANK OF MONTREAL	C

NOTE: ADJOINING PROPERTIES SHOULD BE INVESTIGATED TO ASCERTAIN DESCRIPTIVE INCONSISTENCIES, IF ANY, WITH DESCRIPTION REPRESENTED FOR THIS PROPERTY.
 NOTE: ENSURE THAT YOUR PRINTOUT STATES THE TOTAL NUMBER OF PAGES AND THAT YOU HAVE PICKED THEM ALL UP.



PRINTED ON 27 JAN, 2026 AT 15:20:53
FOR ROB STOVEL



PROPERTY INDEX MAP
WELLINGTON(No. 61)

LEGEND

FREEHOLD PROPERTY	
LEASEHOLD PROPERTY	
LIMITED INTEREST PROPERTY	
CONDOMINIUM PROPERTY	
RETIRED PIN (MAP UPDATE PENDING)	
PROPERTY NUMBER	0449
BLOCK NUMBER	08050
GEOGRAPHIC FABRIC	
EASEMENT	

THIS IS NOT A PLAN OF SURVEY

NOTES

REVIEW THE TITLE RECORDS FOR COMPLETE PROPERTY INFORMATION AS THIS MAP MAY NOT REFLECT RECENT REGISTRATIONS

THIS MAP WAS COMPILED FROM PLANS AND DOCUMENTS RECORDED IN THE LAND REGISTRATION SYSTEM AND HAS BEEN PREPARED FOR PROPERTY INDEXING PURPOSES ONLY

FOR DIMENSIONS OF PROPERTIES BOUNDARIES SEE RECORDED PLANS AND DOCUMENTS

ONLY MAJOR EASEMENTS ARE SHOWN

REFERENCE PLANS UNDERLYING MORE RECENT REFERENCE PLANS ARE NOT ILLUSTRATED



LAND
 REGISTRY
 OFFICE #61

71188-0196 (LT)

* CERTIFIED IN ACCORDANCE WITH THE LAND TITLES ACT * SUBJECT TO RESERVATIONS IN CROWN GRANT *

PROPERTY DESCRIPTION: PT LTS 7, 8 & 9 CON 10 PUSLINCH AS IN MS78803 EXCEPT PTS 1-3 61R5608, PT 1 61R6487, PTS 1-4 61R9992, PT 1, 2 & 5, 61R10661; PUSLINCH

PROPERTY REMARKS:

ESTATE/QUALIFIER:

FEE SIMPLE
 LT CONVERSION QUALIFIED

RECENTLY:

DIVISION FROM 71188-0190

PIN CREATION DATE:

2008/05/08

OWNERS' NAMES

SLOOT CONSTRUCTION LTD.
 JOHN SLOOT INVESTMENTS LIMITED
 TIMBERWORX CUSTOM HOMES INC.

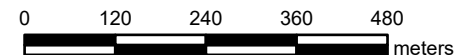
CAPACITY SHARE

TCOM
 TCOM
 TCOM

REG. NUM.	DATE	INSTRUMENT TYPE	AMOUNT	PARTIES FROM	PARTIES TO	CERT/CHKD
** PRINTOUT INCLUDES ALL DOCUMENT TYPES (DELETED INSTRUMENTS NOT INCLUDED) **						
**SUBJECT, ON FIRST REGISTRATION UNDER THE LAND TITLES ACT, TO:						
** SUBSECTION 44(1) OF THE LAND TITLES ACT, EXCEPT PARAGRAPH 11, PARAGRAPH 14, PROVINCIAL SUCCESSION DUTIES *						
** AND ESCHEATS OR FORFEITURE TO THE CROWN.						
** THE RIGHTS OF ANY PERSON WHO WOULD, BUT FOR THE LAND TITLES ACT, BE ENTITLED TO THE LAND OR ANY PART OF						
** IT THROUGH LENGTH OF ADVERSE POSSESSION, PRESCRIPTION, MISDESCRIPTION OR BOUNDARIES SETTLED BY						
** CONVENTION.						
** ANY LEASE TO WHICH THE SUBSECTION 70(2) OF THE REGISTRY ACT APPLIES.						
**DATE OF CONVERSION TO LAND TITLES: 1998/11/09 **						
WC101723	2005/06/08	NOTICE		KUKOVICA, LUKE MICHAEL KUKOVICA, THOMAS LAWRENCE	GUELPH JUNCTION RAILWAY COMPANY	C
WC103318	2005/06/23	NOTICE		KUKOVICA, LUKE MICHAEL KUKOVICA, THOMAS LAWRENCE	THE CORPORATION OF THE TOWNSHIP OF PUSLINCH	C
WC396247	2014/02/07	LR'S ORDER		LAND REGISTRAR, WELLINGTON LAND REGISTRY OFFICE		C
REMARKS: TO AMEND PROPERTY DESCRIPTION TYPO'S FROM "PT LTS 7, 8 & 8" TO "PT LTS 7, 8 & 9" AND "EXCEPT PTS 1-4 61R9992" TO "EXCEPT PTS 1-4 61R9992".						
WC522664	2017/11/09	TRANSFER		1648253 ONTARIO INC.	SLOOT CONSTRUCTION LTD. JOHN SLOOT INVESTMENTS LIMITED	C
REMARKS: PLANNING ACT STATEMENTS.						
WC676227	2022/06/15	TRANSFER		SLOOT CONSTRUCTION LTD. JOHN SLOOT INVESTMENTS LIMITED	TIMBERWORX CUSTOM HOMES INC.	C
REMARKS: PLANNING ACT STATEMENTS.						

NOTE: ADJOINING PROPERTIES SHOULD BE INVESTIGATED TO ASCERTAIN DESCRIPTIVE INCONSISTENCIES, IF ANY, WITH DESCRIPTION REPRESENTED FOR THIS PROPERTY.
 NOTE: ENSURE THAT YOUR PRINTOUT STATES THE TOTAL NUMBER OF PAGES AND THAT YOU HAVE PICKED THEM ALL UP.

SCALE



PROPERTY INDEX MAP

WELLINGTON(No. 61)

LEGEND

FREEHOLD PROPERTY	
LEASEHOLD PROPERTY	
LIMITED INTEREST PROPERTY	
CONDOMINIUM PROPERTY	
RETIRED PIN (MAP UPDATE PENDING)	
PROPERTY NUMBER	0449
BLOCK NUMBER	08050
GEOGRAPHIC FABRIC	
EASEMENT	

THIS IS NOT A PLAN OF SURVEY

NOTES

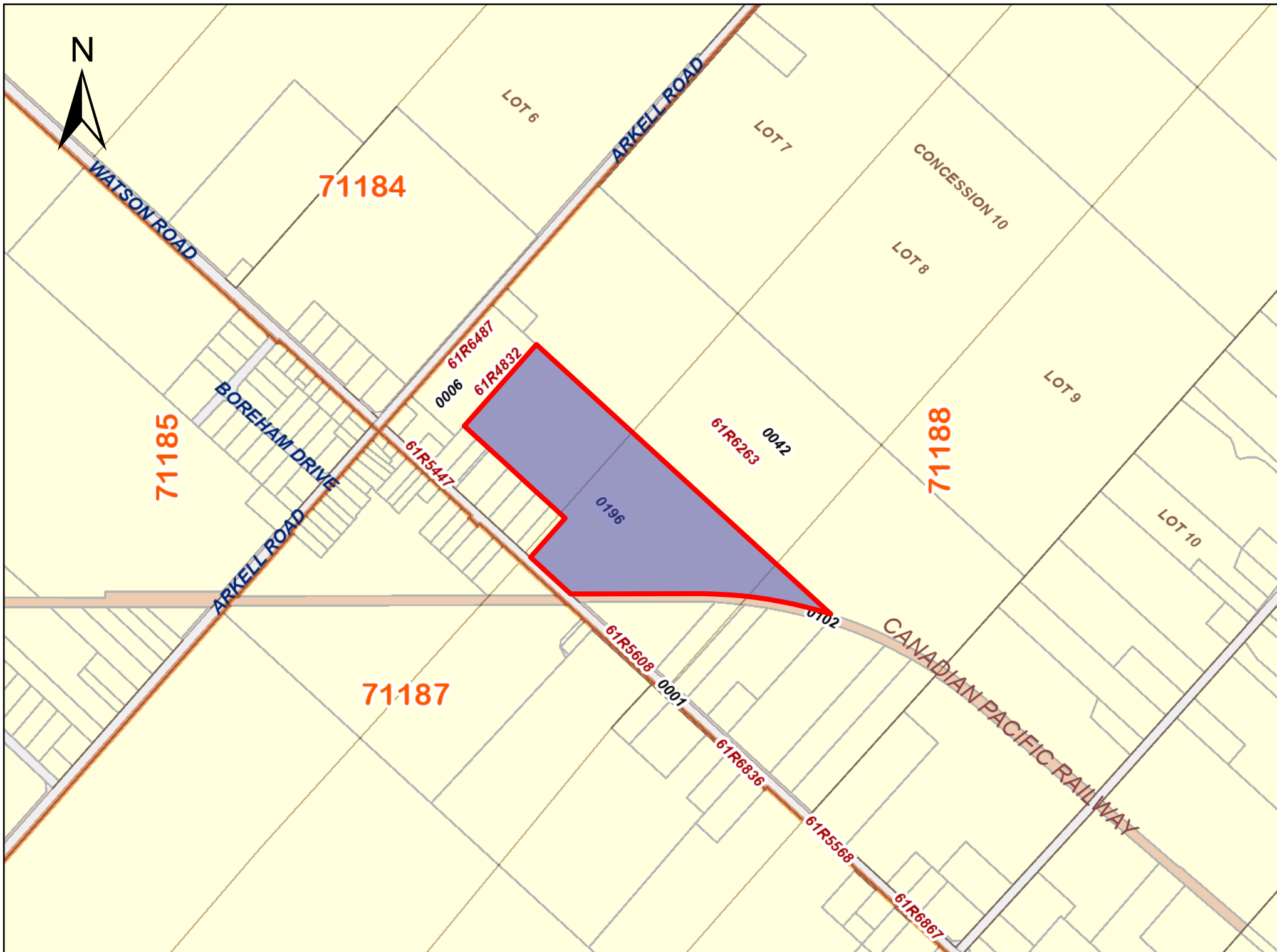
REVIEW THE TITLE RECORDS FOR COMPLETE
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ONLY MAJOR EASEMENTS ARE SHOWN

REFERENCE PLANS UNDERLYING MORE RECENT
REFERENCE PLANS ARE NOT ILLUSTRATED



Comment Summary – D14-KUK – 3rd Submission

Consultant	Comments
Township Planner - NPG Planning	See attached letter
GEI	See attached letter
Source Water	See attached letter
Township Traffic Consultant	See attached letter
Township Noise Consultant	The proposed residential development is adjacent to the Guelph Junction Railway. In addition, County Roads 37 and 41 are in close proximity to the site. Due to the proximity of the site to these noise sources, a noise study demonstrating compliance with the MECP NPC-300 noise guidelines is required. The study should address the impact of transportation and stationary noise sources on the proposed residential development. The Planning Justification Report refers to a 2006 noise study prepared by HGC. This study is not provided with the submittals. It must be updated due to the age of the report. A rail vibration study is also needed due to the proximity of the site to the rail line.
Guelph Junction Railway	<p>GJR said their same comments apply to this circulation. Please reach out to them directly to discuss any outstanding items.</p> <p>Traffic Impact Study</p> <ul style="list-style-type: none"> • Possibility of additional signals required for new driveway entrance to the development. <p>39 Residential Lots</p> <ul style="list-style-type: none"> • Fire pond preferred at lot 11 closer to tree canopy • No planting of tree canopies lots adjacent to the GJR within 8 meters of the railway property for fire safety reason <p>46 Residential Lots</p> <ul style="list-style-type: none"> • Fire pond preferred 3.1 ha open lot near tree canopy • No planting of tree canopies lots adjacent

to the GJR within 8 meters of the railway property for fire safety reason

Fencing Type

- No gates permitted homes developed adjacent to access GJR lands

Noise and vibration study

- May 17, 2006. Report is obsolete. Development standards adjacent to railways have changed. Up to date test 2024 required. The GJR has grown the business considerably since this report was completed. There is no By-Law in place to eliminate train horn use on approaching railway crossing at Watson Rd. Railway gates would be required to even consider the cessation By-Law. This By-Law would need to be approved by Puslinch counsel, insurance coverage increased to list GJR and City of Guelph and its railway operator as additional insured. Warning clauses need to be updated to today's standards, In no way or form can residents/owners of the development oppose or form complaints against the GJR, City of Guelph and its operator regarding the operations or planned growth projects within the GJR ROW. Letter from GJR dated March 29, 2005 is obsolete and no longer valid.

Traffic Site Lines

- No planting of tree canopies lots adjacent to GJR within 8 meters of the railway property for fire safety reason
- Possibility of additional signals required for new driveway entrance to the development.

No further comments from GJR

Minimum setback 15 meters from GJR property line

Warning clause registered on title

<p>Township Hydrogeologist – Harden</p>	<p>We have reviewed the January 2026 Functional Servicing Report and are satisfied with the report.</p> <p>The FSR includes a summary of the required nitrate treatment for septic systems at the site and concludes that a Level IV treatment unit will be required to reduce the nitrate-nitrogen concentration by 50%. We concur with this finding.</p> <p>The FSR summarizes that there is adequate water supply for the development. We concur with this finding.</p> <p>We have no further comments.</p>
<p>County of Wellington Planning</p>	<p>As previously mentioned there are two County applications under the Planning Act from 2006 as it relates to the subject lands - an Official Plan Amendment to facilitate the expansion to the Hamlet of Arkell and a Draft Plan of Subdivision. These applications have not yet been revived and recirculated and will be necessary to consider any development on this site. The applicant is working towards a revived submission and I provided additional feedback on January 29th about what an updated submission to the County is required to entail. I suspect the interest remains to deal with the OPA first; however, there is still some ambiguity with respects to that at this time.</p>
<p>Township Ecologist – Azimuth</p>	<p>See attached letter</p>



February 13, 2025

Monika Farncombe
7404 Wellington Road 34,
Puslinch, Ontario

Dear Monika Farncombe,

RE: **NPG Comments**
605 Arkell Road & Part of Lots 7,8,9 and Concession 10
RE: Application for Zoning By-law Amendment – Determination if Required
Information and Materials Have Been Provided

NPG Planning Solutions Inc. (NPG) has been retained to provide comments on whether required information and materials have been provided regarding a Zoning By-law Amendment Application on lands known as Part of Lots 7, 8, 9 and Concession 10 and part of the lands municipally known as 605 Arkell Road (“Subject Lands”).

The applicant is proposing a residential subdivision consisting of 44 single detached dwelling lots, a park and a stormwater management block on The Subject Lands. The Subject Lands are approximately 20.57 hectares in size and have 260 meters of frontage along Arkell Road and 118 meters of frontage along Watson Road South. The Subject Lands contain a single detached dwelling and an accessory structure on the 605 Arkell Road Property, the rest of the Subject Lands are vacant. Surrounding uses consist of agricultural and rural residential uses. In addition, the southwestern portion of the Subject Lands abut the Guelph Junction Railway.

The Subject Lands are located outside of the Grand River Conservation Authority’s (GRCA) regulation limit, however, there appear to be woodland features on the Subject Lands in accordance with the GRCA’s mapping.

This is the second submission for a Zoning By-law Amendment (ZBA) application. As part of the submission, NPG has reviewed the following documents:

- Addendum Traffic Impact Study prepared by C.F Crozier & Associates Inc., dated January 2026;
- Agricultural Impact Assessment prepared by Stovel and Associates Inc., dated January 2026;
- Draft Official Plan Amendment;
- Draft Zoning By-law Amendment;

- Functional Servicing and Stormwater Management Report prepared by C.F Crozier & Associates Inc., dated January 2026;
- Pin Maps and Parcel Registers;
- Onsite Sewage Servicing Schematic prepared by C.F Crozier & Associates Inc., dated January 16, 2026;
- Planning Justification Report prepared by Stovel and Associates Inc., dated January 2026;
- Preliminary Grading and Servicing Plan prepared by C.F Crozier & Associates Inc., dated January 16, 2026; and
- Zoning By-law Amendment Application dated October 23, 2006.

We understand that there are two (2) *Planning Act* applications with the County of Wellington as it relates to the Subject Lands - an Official Plan Amendment to facilitate the expansion to the Hamlet of Arkell and a Draft Plan of Subdivision. Once the Official Plan Amendment application and/or Draft Plan of Subdivision application are circulated by the County, we will provide comments for those applications accordingly. The comments provided in this comment's letter pertain solely to the ZBA application.

1. Determination of Completeness:

- a. The application for Zoning By-law Amendment should be deemed incomplete until the items outlined in #2 are provided.

2. Additional Requirements:

- a. Updated Noise/Vibration Study – the applicant has indicated that this can be provided as a condition of Draft Plan of Subdivision approval. The 2006 Rail Noise and Vibration Impact Assessment evaluates the previous concept plan against the former Ministry of Environment (MOE) publication LU-131 “Noise Assessment Criteria in Land Use Planning”, which has since been replaced by the Environmental Noise Guideline - Stationary and Transportation Sources - Approval and Planning (NPC-300) published by the Ministry of the Environment and Climate Change (MOECC). The 2006 Rail Noise and Vibration Impact Assessment evaluated the noise and vibration data in 2006 and projected noise level in 2016. Considering that the application is being reviewed in 2026, the data reviewed in the 2016 assessment are obsolete considering Guelph Junction Railway (GJR) has expanded their operations significantly since. We are of the opinion that an Updated Noise/Vibration Study is required for the Zoning By-law Amendment application, subject to further inputs from the Township's Noise Consultant.
- b. An Environmental Impact Study/Environmental Impact Assessment (EIS) was identified as still required by the Township's ecologist in their comment's dated October 14, 2025.

3. Comments:

- a. Once the ZBA application has been deemed complete, we will conduct a detailed review of the submitted materials for consistency with the PPS and conformity with the County Official Plan.
- b. Please advise the timeline of the other applications in relation to the ZBA application. Without the approval of an expansion to the Hamlet boundary through the Official Plan Amendment, the ZBA application would not be consistent with the PPS nor conform with the County of Wellington Official Plan (County Official Plan).
- c. Additionally, it is our opinion that the Draft Plan of Subdivision application should proceed concurrently with the ZBA application to ensure the proposed subdivision does not require further relief from the Township Comprehensive Zoning By-law No. 023-18 (“Puslinch Zoning By-law”) in the future.
- d. The proposal involves a portion of the lands municipally known as 605 Arkeil Road. Please advise the timing and proposed process to sever this portion. We note that the retained portion of this property is not proposed to be part of the hamlet expansion.
- e. Please provide a zoning matrix for the retained portion of 605 Arkeil Road and the lands identified as “Lands excluded from development” to verify compliance with the Agricultural Zone (A) and the Hamlet Residential Zone (HR), respectively.
- f. Please confirm if the applicant intends to retain ownership of Blocks 46 and 47.
- g. With respect to the Concept Plan, we offer the following high-level comments:
 - i. Please provide dimensions and areas of all future lots, including Blocks 46, 47, 48, 49, the retained portion of 605 Arkeil Road and the lands immediately to the south of Block 44.
 - ii. Block 46 appears to straddle across some proposed residential lots. Please confirm that the dimensions and areas of the residential lots are not inclusive of Block 46.
 - iii. We note that there is no Block 45 on the Concept Plan and Block 46 may need to be in two contiguous blocks as it is divided by Road A.
 - iv. The Concept Plan should demonstrate the current uses of adjacent lands and the width of abutting roads.
 - v. Please clarify the purpose of the strip of lands immediately abutting Watson Road South as illustrated on the Concept Plan.
 - vi. Following the submission of the EIS and the updated Noise & Vibration Study, the Concept Plan may need to be updated to address the findings and recommendations of these studies.

- vii. For information, Section 4.26.1 of the Puslinch Zoning By-law prohibits building, structure, parked vehicles, grading or landscaping (exceeding 0.6 meters in height) within sight triangles. Section 4.26.2 outlines the dimension requirements of sight triangles. In particular, the extent of sight triangles where a street intersects a railway right-of-way at grade is 46 meters.
- h. With respect to the draft Zoning By-law, we offer the following high-level comments:
 - i. The applicant is proposing to rezone the entire Subject Lands, including areas that have been identified as “Lands excluded from development” (immediately south of Block 44) and Block 49, to a Hamlet Residential Site-Specific Zone (HR(spXX)). As these portions are proposed to be rezoned, their intended uses should be clearly identified on the concept plan and relevant supporting studies should be revised to assess these additional uses. Otherwise, the Schedule A of the draft Zoning By-law should be revised to reflect the extent of the lands to be rezoned.
 - ii. Following the submission of the EIS and the updated Noise & Vibration Study, the draft Zoning By-law including Schedule A may also need to be revised to address the findings and recommendations of these studies.
 - iii. The GJR also provided their Standards regarding Development Adjacent to the GJR Right of Way. We will coordinate with the GJR to ensure their requirements are properly reflected in the draft Zoning By-law.
 - iv. The draft Zoning By-law proposes a range of uses which are not illustrated on the Concept Plan, which includes semi-detached dwellings, duplex dwellings, home businesses, and bed and breakfast establishments. If applicant seeks to permit these uses, the Concept Plan should be updated to reflect where they are proposed and relevant supporting studies should be updated to confirm they can be accommodated. Otherwise, the proposed permitted uses in the draft Zoning By-law should be revised accordingly.
 - v. We note that Clause 6 of the draft Zoning By-law may not be necessary as it is our understanding that the ZBA application and the amending By-law are contingent on the Official Plan Amendment application being approved by the County of Wellington.
- i. Regarding the Planning Justification Report, we offer the following high-level comments:
 - i. If applicant seeks to permit all land uses proposed in the current draft Zoning By-law, the PJR should be updated to justify why all of them are appropriate.

- ii. Following the preparation of the EIS and the updated Noise & Vibration Study, the PJR may need to be updated to address relevant natural heritage and land use compatibility policies of the PPS and the County Official Plan, if applicable.
- j. With respect to the Minimum Distance Separation analysis, we offer the following high-level comments:
 - i. Guideline #36 establishes that MDS is not required for proposed land use changes within Settlement Areas. Accordingly, compliance with MDS is not required for the portion of the Subject Lands currently located within the settlement area of Arkell Hamlet that is proposed to be rezoned. MDS I Setback is still required for the balance of the lands proposed for rezoning in accordance with Guideline #10.
 - ii. The applicant should provide further analysis on how the conditions of Guideline #12 are met for each of the applicable livestock facility, including providing a map demonstrating the 120° field of view and the four or more non-agricultural uses, residential uses and/or dwellings closer to the livestock facility and the reduced MDS I Setback.
 - iii. The Applicant should confirm that all factors used to calculate the MDS 1 setback for the proposal from Farm 3 (930 Watson Road South) are identical with the factors used to calculate the required setback for the severed lands in application D13-TON. The calculation, which results in a MDS I Setback of 176 metres from Farm 3, should be provided.
 - iv. The MDS I setback required for Farm 3 appears to impact the Subject Lands. Please provide relevant dimensions of the affected portion and the extent of the rezoned areas in the draft Zoning By-law schedule should be updated to reflect this constraint.
- k. Parkland dedication and Development Charges may be required in accordance with the prevailing Township's by-laws. Please confirm if the applicant intends to convey Block 48 to the Township to satisfy the requirement for parkland dedication as per Section 42 of the *Planning Act*. We note that this Block does not have access to any existing or proposed public road and its proximity to the GJR's railway may impact its appropriateness as a public park.
- l. The following information is available to assist with a submission:
 - i. Site Plan and Drawing Requirements - https://puslinch.ca/wp-content/uploads/2020/09/Site-Plan-and-Drawing_Guidelines.pdf
 - ii. Municipal Development Standards - https://puslinch.ca/wp-content/uploads/2022/07/117006-3-Puslinch-Standards_FINAL-September-2019.pdf

6

Sincerely,



Jeremy Tran, MCIP, RPP
Manager, Urban Design & Development Planning
NPG Planning Solutions Inc.
Jtran@npgsolutions.ca

February 13, 2026

GEI Project No. 2402581 – 123006-013

VIA CLOUDPERMIT: Township of Puslinch
Township Application No. D14-KUK

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

**Re: ZBA 2nd Formal Submission
Arkell Subdivision
Puslinch, ON**

Dear Ms. Farncombe:

GEI Consultants Canada Ltd. (GEI) have reviewed second submission documents for a Zoning By-Law Amendment (ZBA) application in support of a proposed residential development on the subject lands located at Part of Lots 7, 8 & 9, Concession 10, in Arkell, Township of Puslinch. The second ZBA submission was received from the Township on January 28, 2026.

It is our understanding that the proposed development includes 44 single-detached residential lots with access from Watson Road South and Arkell Road.

A pre-consultation meeting was held in May 2023, and an initial submission was received in March 2024 based on our (formerly GM BluePlan Engineering Ltd) review letter dated May 15, 2024. A first formal submission for zoning bylaw amendment was reviewed on October 14, 2025.

1. Documents Received

All plans and studies required from an engineering perspective have been submitted.

The following documents were received and reviewed as part of this submission:

- Functional Servicing and Stormwater Management Report, prepared by Crozier Consulting Engineers, dated January 2026.
- Preliminary Grading and Servicing Plan, Drawing C101, Revision 2, prepared by Crozier Consulting Engineers, dated January 16, 2026.

- Onsite Sewage Servicing Schematic, Drawing C102, Revision 2,, prepared by Crozier Consulting Engineers, dated January 16, 2026.

We defer detailed review of the following documents to Township staff and other consultants:

- Addendum Traffic Impact Study, prepared by Crozier, dated January 2026.
- Agricultural impact assessment for Arkell subdivision, prepared by Stovel and Associates, dated January 2026.
- Planning justification report for Arkell subdivision, prepared by Stovel and Associates, dated January 2026.
- Zoning By-Law Amendment Application Information Package, dated October 23, 2006.
- Draft Official Plan Amendment
- Draft Zoning By-Law Amendment
- LRO 61 - Parcel Register (PIN 71188-0006)
- LRO 61 - Parcel Register (PIN 71188-0196)

2. Additional Documents Required

All plans and studies required from an engineering perspective have been submitted and additional documents are not required to support the zoning bylaw amendment application.

3. Technical Comments

Based on our previous submission comments and review of documents identified in Section 1, we provide the following technical comments.

3.1. Deficiencies/Outstanding Matters

The following comments must be addressed to support the application.

No.	Matter	Document	Comment
10.	Pond Outlet	Grading and Servicing Plan	<p><u>GEI Comment (October 14, 2025)</u> The FSSWM report includes an orifice outlet and emergency weir for the dry pond – please show these on the drawings. Additionally, the calculations indicate the top of the pond is 339.90 m while the drawings show top of pond as 340.00 m.</p> <p>Please add additional details to Section 7.3 of the FSSWM Report discussing adequacy of the freeboard for the dry pond and anticipated drawdown time for the dry pond.</p> <p><u>Updated GEI Comment (February 13, 2026)</u> The drawing has been updated with required and consistent information. Freeboard is discussed briefly in Section 7.3, however beyond this one sentence, ponding elevations are</p>

No.	Matter	Document	Comment
			<p>not explicitly discussed in the report or shown on the drawing. Please provide ponding elevations for each storm in Table 10 and show the 100-year pond elevation on the drawing. Please provide modelling for the regional storm. Please discuss pond drawdown times in the report.</p>
11.	Minor Errors	FSSWM Report	<p><u>GEI Comment (October 14, 2025)</u></p> <ul style="list-style-type: none"> a. In Table 2, and associated table in the appendices, the additional flow for fixture units should be 2100 L/day, which results in a total flow per unit of 4600 L/day. b. Please ensure consistency throughout the report when referring to the two swales. In general, the northern swale seems to be referred to as the northern bioswale, and the southern swale seems to be referred to as the southern bypass swale, but there are sections where the terms bioswale and bypass swale are used interchangeably, and the directions are inconsistent. For example, when describing Catchment Ext. 3 in Section 6.2.1 runoff is said to be conveyed to the bioswale along the southwest property line. c. Table 9 should be updated with the correct MOE Table 3.2 requirements (343 m³) and the correct provided treatment volume (672 m³). d. The fourth column of The Dry Pond Facility table (Depth above PP/ED Orifice) in the appendices does not appear to be correct/relevant. e. The Type A dispersal bed footprint described in Section 9.0 is not correct (368 m² rather than 104 m²). <p><u>Updated GEI Comment (February 13, 2026)</u></p> <ul style="list-style-type: none"> a. Clarified. No further comment. b. In general references to the two swales are updated and much more clear/consistent. The description of External Catchment 3 still describes the swale being along the southwest property line rather than the western property line flowing south to north as described for other catchments. c. Updated. No further comment. d. Column 4 has been updated but still seems to be incorrect or irrelevant. e. Updated. No further comment. f. Section 4.2 refers to the Groundwater supply Assessment Report complete by ARL with the wrong date (2003 rather than 2023). g. Text could be added to Section 6.1 to discuss catchment Ext. 3. It is shown in the tables and on the drainage plan but not described in the fifth paragraph along with the other pre-development catchments.

No.	Matter	Document	Comment
			<p>h. Please add the new post-development catchment 202 to Table 8. It is modelled and shown on the drainage plan and described elsewhere in the report but is missing from Table 8.</p> <p>i. The outlet column of Table 7 should be updated with the two proposed 300 mm diameter culverts, as shown on the updated drawing.</p> <p>j. Note 2 under Table 10 should be updated to include catchments 202 and Ext. 4.</p>

3.2. Completed/Approved Matters

The following previous comments have been addressed.

No.	Matter	Document	Comment
1.	Secondary Access and Adjacent Lands	Grading and Servicing Plan	<p><u>GEI Comment (May 21, 2024)</u> Please confirm inclusion of the secondary access road. If the secondary access is not to be included, a cul-de-sac may be required per the latest Township of Puslinch Municipal Development Standards.</p> <p>Additionally, please confirm ownership of the lands adjacent to the possible secondary access (lots 922 and 923). An easement may be required for the proposed bypass swale through these lands.</p> <p><u>Applicant Response (August 15, 2025)</u> The revised Site Plan illustrates a secondary access, although we understand that one is not required.</p> <p><u>GEI Comment (October 14, 2025)</u> Acknowledged. No further comment.</p>
2.	Culverts	Grading and Servicing Plan	<p><u>GEI Comment (May 21, 2024)</u> The Functional Servicing and Stormwater Management Report mentions existing culverts at the Guelph Junction Railway and Arkell Road as part of the proposed stormwater management strategy. Please indicate the location, size and grade of the existing culverts.</p> <p><u>Applicant Response (August 15, 2025)</u> Existing culverts were observed on-site by Van Haarten. Crozier drawings updated with the information observed by Van Harten.</p> <p><u>GEI Comment (October 14, 2025)</u> Based on the labelled inverts, the existing culvert at the Guelph Junction Railway appears to drain away from the site</p>

No.	Matter	Document	Comment
			<p>whereas the report suggests that it drains towards the site. Please label the size and shape of this culvert.</p> <p>Based on the topographical information shown, the existing culvert at Arkell Road appears to be 400 mm in diameter while the report states it is 300 mm – please clarify and label this culvert on the drawings as it is identified as the drainage outlet.</p> <p>We assume that new culverts will be needed at the Road A and Watson Road South connection and at the Road B and Arkell Road connection. Can these be preliminarily sized and shown on the drawings?</p> <p><u>Updated GEI Comment (February 13, 2026)</u> Inverts and sizing have been provided for the GJR culvert. Sizing of the existing Arkell Road culvert has been clarified and sizing for proposed Arkell Road culverts provided – please update Table 7. Preliminary sizing for Watson Road and Road A culverts has been provided. No further comment at this time. Culvert sizing will be discussed further at detailed design to ensure compliance with the Township’s updated development standards.</p>
3.	Rainfall Parameters	FSSWM Report	<p><u>GEI Comment (May 21, 2024)</u> The Functional Servicing and Stormwater Management Report appears to use outdated rainfall parameters. Please use IDF data from the latest City of Guelph Development Engineering Manual (October 2023).</p> <p><u>Applicant Response (August 15, 2025)</u> FSSWM Report has been revised to use the IDF data from the latest City of Guelph Development Engineering Manual.</p> <p><u>GEI Comment (October 14, 2025)</u> Acknowledged. No further comment.</p>
4.	Stormwater Quality Control	FSSWM Report	<p><u>GEI Comment (May 21, 2024)</u> The proposed treatment train includes bioswales and a dry pond. However, a significant portion of the road network appears to drain directly to the pond. Please consider inclusion of an oil-grit separator at the end of the internal storm sewer network, prior to the dry pond, for treatment of road runoff and easy maintenance / clean-out.</p> <p>The FSSWM report states that the bioswale system falls short of the volume required for 80% TSS removal, and the outstanding treatment capacity will be provided by the dry pond. Furthermore, in addition to providing quality and quantity control for the site, the swales convey drainage from large external areas. Please provide additional</p>

No.	Matter	Document	Comment
			<p>discussion on stormwater quantity and quality control, ensuring that Enhanced level of protection is met (detention time, % TSS removal calculations, etc.).</p> <p><u>Applicant Response (August 15, 2025)</u> An OGS unit is proposed at each outlet into the dry pond and bioswale.</p> <p><u>GEI Comment (October 14, 2025)</u> Acknowledged. No further comment.</p>
5.	Bypass Swales Maintenance	Grading and Servicing Plan	<p><u>GEI Comment (May 21, 2024)</u> Given that the proposed roads drain to the bypass swales, the Township would own and maintain the swales. Also, the bypass swales appear to be part of the proposed lots. Please indicate easements for the swales and access roads on the drawings for maintenance purposes.</p> <p><u>Applicant Response (August 15, 2025)</u> Both the north swale and south swale are intended to promote infiltration. The north swale will have a shallow grade and will receive pre-treatment of runoff from the future municipal roads through an OGS system. We expect that any inspection/maintenance can be conducted via easements which are proposed for each storm sewer outlet.</p> <p>Similarly, the south (by-pass) swale will promote infiltration, but its primary function is to convey clean runoff from upstream lands safely through the subject property. The by-pass channel will be heavily vegetated and is not expected to erode due to its very shallow longitudinal slope.</p> <p>As such, construction of maintenance access roads should not be required. Our experience with trying to dry sediment is that it can take weeks and a lot of machine effort. Rather than a dedicated drying area, our preferred method is to use a vac truck with hoses that can reach remote locations. The sediment is then transported in a sealed unit to avoid any spillage.</p> <p><u>GEI Comment (October 14, 2025)</u> Acknowledged. Given that the Township will own the swales, we defer detailed review of maintenance requirements to Township Public Works staff (maintenance method, access locations and width, etc.). Please add an Inspection and Maintenance Section to the FSSWM Report detailing anticipated ongoing inspection and maintenance requirements for the SWM facilities including dry pond, swales and OGSs. This should include details about access, frequency, methods etc. In order to do this, it may be necessary to preliminarily size the OGS units and provide manufacturer information about operations and</p>

No.	Matter	Document	Comment
			<p>maintenance. This will be helpful to Township Staff to inform them about anticipated future workload and responsibilities.</p> <p>Fencing for SWM facilities will need to be discussed further at detailed design.</p> <p><u>Updated GEI Comment (February 13, 2026)</u> Inspection and Maintenance Section added to report and OGS units preliminarily sized and information for the units provided. Fencing for SWM facilities will need to be discussed further at detailed design. For future detailed design submissions, it would also be helpful to calculate anticipated dry pond cleanout frequency.</p>
6.	Sediment Control Pond	FSSWM Report	<p><u>GEI Comment (May 21, 2024)</u> Given the large area of the site, please include a pond as one of the erosion and sediment controls, to be sized per the Erosion and Sediment Control Guideline for Urban Construction.</p> <p><u>Applicant Response (August 15, 2025)</u> A detailed ESC plan, including temporary sediment ponds, can be provided as the detailed design progresses.</p> <p><u>GEI Comment (October 14, 2025)</u> Acknowledged. Given the size of the development, a sediment control pond shall be considered during the detailed design stage.</p>
7.	Fire Water Storage	Grading and Servicing Plan	<p><u>GEI Comment (May 21, 2024)</u> Please indicate the proposed location of fire water storage on the engineering drawings.</p> <p><u>Applicant Response (August 15, 2025)</u> Fire Storage tanks have been identified on the servicing plan. Tanks are to be located within the future ROW.</p> <p><u>GEI Comment (October 14, 2025)</u> Acknowledged. We defer any further fire water storage requirements to the Township fire department. Further refinement of the fire water supply design can be completed at detailed design.</p>
8.	Noise and Vibration Study	N/A	<p><u>GEI Comment (May 21, 2024)</u> Per our review letter dated May 15, 2023, please provide an updated Noise and Vibration Study to reflect the revised development concept, current rail volume data and to confirm berm and setback requirements from the existing railway.</p> <p><u>Applicant Response (August 15, 2025)</u></p>

No.	Matter	Document	Comment
			<p>An updated Noise and Vibration Study can be provided as a condition of approval. It is important to get the lot layout finalized before this study is completed as the recommendations will apply to the closest proposed receptors.</p> <p><u>GEI Comment (October 14, 2025)</u> Acknowledged. We defer noise study requirements to Township and County planners.</p>
9.	Post-Development Catchment Areas	FSSWM Report	<p><u>GEI Comment (October 14, 2025)</u> Catchment UC02 appears to include Lot 2. The percent imperviousness of this catchment should be updated accordingly.</p> <p>It appears that some of Catchment UC01 may flow to the northern bioswale, as opposed to the southern bypass swale as described in the FSSWM Report. Please confirm.</p> <p>Per the preliminary grading plan, Lots 27, 28, 35, 36 and 43 appear to drain to the southern bypass swale. Is this the intent? If so, please update the report and modelling accordingly.</p> <p><u>Updated GEI Comment (February 13, 2026)</u> UC02 has been updated. UC01 is now described/modeled as flowing to the northern bypass swale. Catchment 202 has been added to show drainage from rear and side yards to the south bypass swale.</p> <p>We have noted that, per the preliminary grading plan, a small portion of Road B, which is part of catchment 201, may flow uncontrolled to Arkell Road. These flows would bypass the OGS, northern bioswale and dry pond. This should be addressed at detailed design.</p>
12.	Hydrologic Modelling and SWM Calculations	FSSWM Report	<p><u>GEI Comment (October 14, 2025)</u></p> <ol style="list-style-type: none"> a. Please ensure that a Guelph Permeameter Test is completed prior to detailed design to confirm the in-situ hydraulic conductivity in the areas of the site where LID facilities will be installed. b. The bioswale calculations in the appendices are based on 17 control weir ponding areas, whereas the drawings show only 11 weirs. Please confirm. There also appears to be some discrepancy between the slopes used for some sections in the calculations and those shown on the drawings. c. Is it possible to describe anticipated depths of flows in the bioswale for the various design storms?

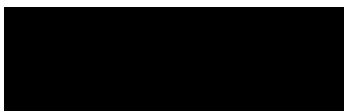
No.	Matter	Document	Comment
			<p>d. The SSD Table used in the model for the dry pond does not include the weir outflows. However, this likely won't impact the design or results provided</p> <p><u>Updated GEI Comment (February 13, 2026)</u></p> <p>a. This comment has been acknowledged in the report text. No further comment.</p> <p>b. Updated. No further comment.</p> <p>c. 100-year flow depths provided in the report appendices. No further comment.</p> <p>d. Updated. No further comment.</p>
13.	Water Balance	FSSWM Report	<p><u>GEI Comment (October 14, 2025)</u> A Water Balance was provided under separate cover. Could a section be added to the FSSWM Report to discuss the findings of the water balance and how the proposed LID facilities will mitigate the identified deficit?</p> <p><u>Updated GEI Comment (February 13, 2026)</u> Section added to report. Low impact development design should be demonstrated and discussed further at detailed design. At detailed design information should be provided on the drawings for the bioswale, including location(s) and depth of underground storage (486 m long, 1.5 m wide, 0.4 m depth per the report), distance from bottom of infiltration feature(s) to seasonal high groundwater elevation, plantings, etc.</p>

As previously noted, the Township is currently in the process of applying for a CLI-ECA for stormwater infrastructure. The Township is also in the process of updating their Development Standards. Prior to the commencement of detailed design, Township Staff and Consultants will meet with the Developer's consultants to discuss any design details that should be incorporated where possible to meet any new/updated requirements.

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

Sincerely,

GEI Consultants Canada Ltd.



Andrea Reed, P.Eng.
 Project Engineer



02/11/2026

Memorandum

To: Monika Farncombe - Planning and Corporate Services Coordinator

From: Keira Martinson - Source Protection Coordinator, Wellington Source Water Protection

**RE: Concession 10 Pt Lt 7,8,9, Arkell Subdivison, Township of Puslinch
Zoning By-law Amendment (P10/2006)**

Wellington Source Water Protection (WSWP) staff have had the opportunity to review the submitted documents in support of the above noted application. This property is located within a vulnerable area and our review was completed to ensure the activities at this property meet the requirements of relevant Source Protection Plan and County of Wellington Official Plan policies.

Clean Water Act Section 59 Notice & Risk Management Plan:

A Section 59 Notice and Risk Management Plan are not required for this proposal. If the nature of the development changes, Notices may apply and Risk Management Plan may be required.

Land Use Planning:

Proposed Zoning Bylaw Amendment:

1. WSWP has no further comments in regards to the Zoning By-law Amendment. Further comments will be provided during the Draft Plan of Subdivision stage.

For more information, please contact sourcewater@centrewellington.ca.

Sincerely,

Handwritten signature of Keira Martinson.

Feb 11, 2026

Keira Martinson
Source Protection Coordinator
519-846-9691 ext 283
kmartinson@centrewellington.ca



SALVINI
CONSULTING
Transportation Engineering and Planning

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185 Deer Ridge Drive
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519-591-0426
julia@salviniconsulting.com

February 13, 2026

Monika Farncombe
Planning and Corporate Services Coordinator
Township of Puslinch
7404 Wellington Road 34
Puslinch, ON · N0B 2J0

Re: Arkell Subdivison, D14-KUK, Roll Number - 2301000008034800000
Traffic Impact Study, January 2026, Crozier
Peer Review Comments, January 2026 ZBA Application

Dear Monika,

I've reviewed the Addendum Traffic Impact Study (TIS) prepared by Crozier for the Zoning By-law amendment application for the lands identified above near the intersection of Watson Road South and Arkell Road and dated January 2026.

I had reviewed and commented on two previous versions of the TIS. This version has been modified to include both a new roadway connection to Arkell Road and Watson Road South, but generally the technical assumptions are unchanged. I previously commented that the number of units was conservative (50 versus the 44 now being proposed) and that I thought the distribution of the traffic should be different, but that neither of those considerations would change the conclusions and recommendations of the report. That continues to be my opinion.

The two items that I asked for additional information/confirmation on are the sight distance assessment at the Watson Road South connection and confirmation from Guelph Junction Railway that they will support the location of the new road connection to Watson Road South adjacent to the at-grade railway crossing. After reviewing the updated January 2026 study, I provide the following comments:

1. The sightline assessment has not addressed my previous comment. The applicant's consultant is encouraged to reach out to me for a discussion of what is needed. Sightline analysis at the new road connection on Watson Road South requires confirmation that left turn from stop intersection sight distance (in accordance with the Transportation Association of Canada Geometric Design Guide for Canadian Roads) is available in both directions based on the horizontal and vertical geometry of the road in the vicinity of the proposed new road connection. This should be done by illustrating on a plan how/if the required sight distance can be achieved both in plan and in profile. For the Arkell Road connection, the County has their own requirements for sight distance that the

consultant should review and use for the assessment; although the parameters are slightly different in the County's requirements, the assessment process is the same and diagrams illustrating how the sight distance can be met are required both in plan and in profile to address the vertical and horizontal geometry of the road.

2. Guelph Junction Railway provided comments indicating that additional signals may be required for the new driveway entrance. The consultant team has indicated that traffic signals will not be required at the new road connection to Watson Road, but it's possible that GJR was referring to railway signals or other technical requirements at the rail/road crossing. I would like to receive a copy of any further comments provided by GJR when and if they become available to understand if they are in agreement with the new road location and what additional infrastructure requirements they have.

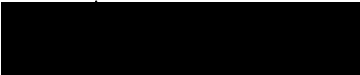
The County and their consultant may have additional comments based on their review of the proposed road connection to Arkell Road and the Watson/Arkell intersection.

In response to the Township's request, I offer the following feedback:

1. The Zoning By-law Amendment application can be deemed complete from a transportation perspective and I am in support of the application.
2. Conditions of approval should include:
 - a. updated sight distance assessment for the new road connection on Watson Road South, and
 - b. confirmation from Guelph Junction Railway that they will support the location of the new road connection to Watson Road South adjacent to the at-grade railway crossing.
3. n/a
4. Technical requirements are described in point 2 above.
5. No additional requirements beyond those identified in point 2 above.

Let me know if there is anything further you would like to discuss with respect to this application.

Sincerely,


Julia Salvini, MEng, PEng, FITE
President

Cc: Mike Fowler, Township of Puslinch
Pasquale Costanzo, Wellington County





Environmental Assessments & Approvals

February 12, 2026

AEC 21-130

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

Attention: Monika Farncombe, Planning and Corporate Services Coordinator

Re: **Natural Heritage Review of Application for a Proposed Residential Development (2nd Review), Part of Lots 7-9, Concession 10 (Arkell), Township of Puslinch, County of Wellington**

Monika Farncombe:

Azimuth Environmental Consulting, Inc. (Azimuth) is pleased to provide this second natural heritage review letter regarding application for a Proposed Settlement Boundary Expansion, updated Site Plan and related relevant materials on Part of Lots 7-9, Concession 10 (Arkell) in the Township of Puslinch ("Township"), County of Wellington ("County"). It is noted that applications for an Official Plan Amendment (OP-2006-06), Zoning By-law Amendment (P10/2006), and Draft Plan of Subdivision (23T-06003) were previously submitted in 2006.

Azimuth completed a Pre-consultation Ecology Peer Review for the proposed development (File #D00/KUK) on May 11, 2023 that provided a preliminary background review of natural heritage features and functions associated with the property and adjacent lands, and recommended that an Environmental Impact Study (EIS) be prepared including a suite of vegetation and wildlife surveys. It is noted that in the applicant's comment/response matrix updated August 14, 2025, the applicant has indicated an EIS would not be prepared as the property is not mapped as Greenland and the plantation on the property "*is not a significant natural heritage feature*" that is "*in poor condition*".

Azimuth subsequently reviewed the below documents and issued comments as part of a natural heritage peer review letter dated October 14, 2025 as part of the initial submission package, on behalf of the Township:



- Cover letter RE: Proposed Settlement Boundary Expansion – Arkell and Residential Development;
- Arkell Development Matrix;
- Conceptual Plan (44 Lots) Par of Lots 7, 8 & 9, Concession 10, Arkell, Ontario;
- Preliminary Grading and Servicing Plan; and,
- Results of Breeding Bird Surveys – 890 Watson Road, Arkell (September 19, 2023; Colville Consulting Inc. “Colville”).

The initial submission natural heritage review letter reiterated the pre-consultation recommendation that an Environmental Impact Study/Environmental Impact Assessment (EIS/EIA) be prepared in accordance with Section 4.6.3 of the Wellington OP and the recommended field program initially described in the May 2023 pre-consultation peer review letter and updated in the October 2025 letter. In the initial submission natural heritage review it was noted that the Results of Breeding Bird Surveys memo (Colville) is generally acceptable and can be incorporated into a future EIS/EIA report.

Since completion of the initial natural heritage review, subsequent materials have been received through the Township and are hereafter referred to as the “2nd Review”. As part of the 2nd Review, Azimuth reviewed the following additional documents of potential relevance to natural heritage matters, on behalf of the Township:

- Functional Servicing and Stormwater Management Report – Arkell Subdivision Residential Development (January 2026; Crozier Consulting Engineers);
- Preliminary Grading and Servicing Plan (Crozier Consulting Engineers);
- Onsite Sewage Servicing Schematic (Crozier Consulting Engineers);
- Agricultural Impact Assessment for Arkell Subdivision (January 2026; Stovel and Associates Inc.); and,
- Planning Justification Report for Arkell Subdivision (January 2026; Stovel and Associates Inc.).

It is noted that additional materials submitted January 2026 did not include an EIS/EIA or similar documentation.

Section 2.1 (Site Description) of the Planning Justification Report (PJR) describes and appends a letter titled Natural Environment Review of the Proposed Kukovica Subdivision prepared by GWS Ecological & Forestry Services Inc. (“GWS”), dated January 5, 2007, along with the previously-reviewed Results of Breeding Bird Surveys prepared by Colville. The GWS letter describes the overall vegetative composition of the plantation on the property, noting its approximate age of ~25 years (in 2007;



therefore approximately 45 years of age in 2026). The letter provides a conclusion that “... *there are no significant natural features on the subject lands that warrant protection or the exclusion of development intrusions. The proposal development therefore seems reasonable from a natural environment perspective.*” The letter also states “...*an Environmental Impact Study (EIS) was not required in this case because there are no wetlands or significant woodlands (i.e. woodland 10ha and larger in size) found on or nearby the Kukovica property.*” The opinions and conclusions stated in the GWS letter are reiterated in the main body (Section 2.1, Site Description & Section 3.3, Review of Natural Heritage Features and Functions) of the PJR. It is noted the statements “*The proposed residential development has been kept out of the plantation*” and “*The lot fabric does not propose any building envelopes to be included in the onsite plantation.*” in Section 2.1 and Section 3.3 of the PJR (respectively) do not appear to be accurate, noting direct encroachment into the wooded/natural areas is evident within Lot 2 and Lot 3 on the proposed Conceptual Plan (Figure 4 of PJR, and others).

With regard for the Natural Environment Review letter prepared by GWS in January 2007, it is standard practice that environmental data and associated conclusions are generally accepted by review agencies for a period of **five (5) years** after data are collected. As the GWS letter refers to an environmental review conducted nearly 20 years ago, information presented therein should be considered outdated, although may be referenced as a background resource as a component of a future EIS/EIA report. It should also be acknowledged that federal, provincial, and municipal environmental legislation and policy has evolved significantly since 2007, including the up-listing of various species to Endangered or Threatened statuses that would not likely have been considered during the 2007 assessment. Those with potential relevance to the property include Butternut trees and Endangered bat species, potentially among others. The GWS letter was also published before release of improved technical guidance for other sensitive environmental features with potential relevance to the property such as the province’s Natural Heritage Reference Manual (2010) and Significant Wildlife Habitat Technical Guide: Criteria Schedules for Ecoregion 6E (2015).

The GWS letter refers to there being no requirement to prepare an EIS based on absence of wetlands or Significant Woodlands (defined in the letter as those exceeding 10ha) located in proximity to the property. As outlined in Azimuth’s October 2025 natural heritage review letter, although the plantation is 7.0-7.5ha in size, if the feature has naturalized (now approximately 45 years of age) to the extent it is considered “woodland”, it would likely qualify as Significant Woodland in accordance with the Wellington OP, as woodlands exceeding 4ha in size in the Rural system are significant. Such analysis is recommended within an EIS/EIA, particularly as the proposed development includes direct encroachment within the woodland feature.



Previous comments outlined in Azimuth's October 2025 related to appropriate screenings for Significant Wildlife Habitat should also be considered, notably the Eastern Wood-pewee identified along the plantation/woodland edge during Colville's breeding bird survey program. The PJR notes "*One species, Eastern wood-pewee was noted on an edge tree not part of the plantation.*", potentially implying the species was not utilizing the plantation to carry out its life processes. This species is reliant on woodland ecosystems and therefore it can be inferred the species was utilizing the plantation/woodland for some portion of its life cycle. An EIS/EIA would provide further clarification of whether this observation constitutes Habitat for Rare and Special Concern Wildlife Species as described in the Significant Wildlife Habitat Technical Guide: Criteria Schedules for Ecoregion 6E.


As outlined in Azimuth's pre-consultation review and initial natural heritage review letter, the requirement for an EIS/EIA is triggered by presence a woodlot on the property that may meet the definition of Significant Woodland as outlined in Section 5.5.4 of the Wellington OP, and proposed direct encroachment within lands potentially providing potential habitat for Endangered and Threatened Species as outlined in Section 5.4.2 of the Wellington OP. Portions of the woodlot may also provide Significant Wildlife Habitat (SWH) for Eastern Wood-pewee (Habitat for Special Concern and Rare Wildlife Species) requiring consideration under Section 5.5.1 of the Wellington OP, and possibly other SWH categories. As such, it is recommended an EIS/EIA be prepared in accordance with Section 4.6.3 of the Wellington OP for the proposed development application to demonstrate conformity with the above OP policies, and parallel policies of the PPS.

Previous natural heritage review and conclusions presented in the January 2007 GWS letter and supported in the PJR rely on outdated field data and environmental policy framework, and therefore require updating as part of an EIS/EIA report that should accommodate the field program presented in Azimuth's previous letters and the breeding bird survey program undertaken by Colville.

Closure

We trust that this peer review is helpful regarding natural heritage requirements associated with the proposed undertaking. If you have any questions, please do not hesitate to contact the undersigned.

Yours truly,
AZIMUTH ENVIRONMENTAL CONSULTING, INC.


Dan Stuart, M.Env.Sc.
Ecology Lead/Partner