J.H. COHOON ENGINEERING LIMITED

CONSULTING ENGINEERS
440 Hardy Road, Unit #1, Brantford, ON N3T 5L8
Tel: (519) 753-2656 Fax: (519) 753-4263
www.cohooneng.com

12502

February 25, 2021

County of Norfolk
Planning Development and Cultural Services Division
22 Albert Street
Langton, Ontario
N0E 1G0

Attention: Ms. T. Givens, MCIP, RPP
Interim Director of Planning

Re: Proposed Residential Draft Plan of Subdivision
Waterford, Ontario
Nichol Street Development
Norfolk County
Re-zoning Application and Draft Plan of Subdivision (Redline)

Dear Ms. Givens:

Further to our discussions, and on behalf of our client, Mr. Mike Quattrociocchi of Mayberry Homes, please find enclosed the following information regarding our application for a redline revision to the current draft approval and re-zoning on the subject lands for a residential plan of subdivision located in the Waterford, Ontario.

1. Five (5) copies of the "Draft Plan of Subdivision", illustrating the proposed lot confirmation.
2. Three (3) copies of the Application for Draft Approval and Re-Zoning of the lands to allow the proposed development.
3. A cheque in the amount of $ 3,802.00 relating to the rezoning of the lands
4. Five (5) copies of the Concept Plan being our firm's drawing Concept No. 7 illustrating the new proposal.
5. One (1) copy of the geotechnical report prepared by Englobe Inc. dated January 2021, Geotechnical Investigation and Slope Stability.
6. One (1) copy of original approvals relating to this site.
7. Electronic copies of this documentation will be provided to your office.

The proposal is to create a residential plan of subdivision that consists of 41 street townhouses on the property.

The proposal is a modification to the current draft approved residential single-family development that was recently approved to allow for more intensification as requested by the owner through his discussions with the County. The proposal is to construct the proposed development in accordance with the R4 zone whereas a modification to the rear yard setback to a minimum of 6.0m is proposed.

The technical requirements and submissions were made with the original single-family development with the modifications to occur during final engineering design. However, the supplemental geotechnical investigation attached to this correspondence justifies the boundary of the subdivision on the north side and the configuration of Block 17.

With the submission of this information, we would respectfully your prompt circulation of the application to the various departments.

If you require any further details please do not hesitate to contact this office, at your earliest convenience.

Yours truly,

J.H. COHOON ENGINEERING LIMITED

R.W. Phillips, P.Eng.

c.c. Mike Quattrociocchi – Mayberry Homes

Application to Planning Department

Complete Application

A complete development application consists of the following:

1. A properly completed and signed application form (signature must be original in planners file);
2. Supporting information adequate to illustrate your proposal as indicated in **Section H** of this application form (plans are required in paper copy and digital PDF format);
3. Written authorization from the registered owner of the subject lands where the applicant is not the owner as per Section N; and,
4. Cash, debit or cheque payable to Norfolk County in the amount set out in the user fees By-Law.

The above information is required to ensure that your application is given full consideration. An incomplete or improperly prepared application will not be accepted and may result in delays during the processing of the application. This application must be typed or printed in ink and completed in full.

Pre-Consultation

A pre-consultation meeting with staff is required for all applications; however, minor applications may be exempted depending on the nature of the proposal. The purpose of a pre-consultation meeting is to provide the applicant with an opportunity to present the proposed application, discuss potential issues, and identify the required information and materials to be submitted with the application in order for it to be considered complete by staff. The applicant has the opportunity to make revisions to the application prior to submission, without the additional costs of recirculation fees. It may be necessary to seek the assistance of independent professional help (for example, a planning consultant or engineer) for complex applications. If a pre-consultation meeting has been held to discuss your development, please provide a copy of the minutes that addressed the outcomes of the meeting with your completed application. It should be noted that pre-consultation minutes are valid for one year after the meeting date.

Processing the Development Application

Once an application has been deemed complete by a planner, it will be circulated to public agencies and County departments for review and comments. Notice of the application is also provided to adjacent land owners. The comments received assist the planner with the review and recommendation/approval of your application. The time involved in processing an application varies depending upon its complexity and its acceptability to the other agencies.

An additional fee will be required if a review by the Long Point Region Conservation Authority or by the Grand River Conservation Authority is deemed necessary by planning staff and/or by the Authority. A separate cheque payable to the Long Point Region Conservation Authority or the Grand River Conservation Authority is required in accordance with their fee schedule at the same time your application is submitted.

Additional studies required as part of the complete application shall be at the sole expense of the applicant. It should also be noted that in some instances peer reviews may be necessary to review particular studies and that the cost shall be at the expense of the applicant. The company to complete the peer review shall be selected by the County.

If the application is withdrawn prior to the circulation to commenting agencies, the entire original fee will be refunded. If withdrawn after the circulation to agencies, half the original fee will be refunded. If your drawings are required to be recirculated there will be an additional fee. Also, please note that if your engineering drawings require more than three reviews due to revisions by the owner or failure to revise your engineering drawings as requested, an additional fee will be charged. No refund is available after the public meeting and/or after approval of application.

Notification Sign Requirements

For the purpose of public notification and in order for staff to locate your lands for appropriate applications (zoning, subdivision, condominium or official plan) you will be given a sign to indicate the intent and purpose of your development application. It is your responsibility to:

1. Post one sign per frontage in a conspicuous location on the subject lands;
2. Ensure one sign is posted at the front of the subject lands at least three feet above ground level, not on a tree;
3. Notify the Planner when the sign is in place in order to avoid processing delays; and
4. Maintain the sign until the development application is finalized and thereafter removed.

For consent and minor variance applications, Planning Department staff post the sign on the subject lands.

Contact Us

For additional information or assistance in completing this application, please contact a planner at 519-426-5870 or 519-875-4485 extension 1290 or planning@norfolkcounty.ca. Please submit the completed application and fees to:

185 Robinson Street, Suite 200, Simcoe, ON N3Y 5L6
or
22 Albert Street, Langton, ON N0E 1G0

For Office Use Only:

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

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

- [ ] Official Plan Amendment
- [x] Zoning By-Law Amendment
- [ ] Temporary Use By-law
- [x] Draft Plan of Subdivision/Vacant Land Condominium
- [ ] Condominium Exemption
- [ ] Site Plan Application
- [ ] Consent/Severance
- [ ] Minor Variance
- [ ] Easement/Right-of-Way
- [ ] Extension of a Temporary Use By-law
- [ ] Part Lot Control
- [ ] Cash-in-Lieu of Parking
- [ ] Renewable Energy Project or Radio Communication Tower

Please explain the desired end result of this application (for example: a special zoning provision on the subject lands, changing the zone and/or official plan designation of the subject lands, creating a certain number of lots, or similar)

The proposal is to modify the current draft plan of subdivision on this site, to allow for a 41 unit street townhouse development on the property. The zoning amendment application is to permit that use.

Property Assessment Roll Number: _____

A. Applicant Information

Name of Owner Mayberry Homes - Mike Quattrociocchi

It is the responsibility of the owner or applicant to notify the planner of any changes in ownership within 30 days of such a change.

Address 32 Dunsdon St,

Town and Postal Code Brantford, ON N3R 3J3

Phone Number 519 755 0909

Cell Number

Email Mike Quattrociocchi <mquattrociocchi@rogers.com>

Name of Applicant Same as Owner

Address

Town and Postal Code

Phone Number

Cell Number

Email

Name of Agent J H Cohoon Engineering Limited

Address 440 Hardy Road, Unit 1

Town and Postal Code Brantford, Ontario N3T 5L8

Phone Number 519 753 2656

Cell Number

Email rphillips@cohooneng.com

Please specify to whom all communications should be sent. Unless otherwise directed, all correspondence and notices in respect of this application will be forwarded to the agent noted above.

○ Owner ◉ Agent ○ Applicant

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

N/A

B. Location, Legal Description and Property Information

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

   Part of Block 28, Part of Wesley Street, North of Nichol Street (Closed by Bylaw 51L Inst. NR219731), Registered Plan 19-B, Part of Lot 5, Concession 8

   Municipal Civic Address: Nichol Street

   Present Official Plan Designation(s): Urban Residential

   Present Zoning: Urban Residential Type 4 Zone (R4)

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

   (●) Yes ( ) No If yes, please specify:

   Reduction in the rear yard setback from 7.5m to 6.0m

3. Present use of the subject lands:

   Vacant

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

   N/A

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

   Refer to Proposed Concept Plan No. 7 attached

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

   Refer to Proposed Concept Plan No. 7 attached

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

   If yes, identify and provide details of the building:

8. If known, the length of time the existing uses have continued on the subject lands:
   Unknown
9. Existing use of abutting properties:
   Community Centre, Waterford Pond, Industrial
10. Are there any existing easements or restrictive covenants affecting the subject lands?
    ◯ Yes ◉ No If yes, describe the easement or restrictive covenant and its effect:

Note: Please complete all that apply.

1. Please explain what you propose to do on the subject lands/premises which makes this development application necessary:
   Conversion of existing proposed residential development (single family) to a multi-family street townhouse style of development.

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

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

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

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

6. Description of land intended to be severed in metric units:
   Frontage: 247.82
   Depth: Varies
   Width: 247.82
   Lot Area: 1.986 ha
   Present Use: Vacant
   Proposed Use: Residential
   Proposed final lot size (if boundary adjustment): N/A
   If a boundary adjustment, identify the assessment roll number and property owner of the lands to which the parcel will be added: _____

   Description of land intended to be retained in metric units:
   Frontage: N/A
   Depth: _____
   Width: _____
   Lot Area: _____
   Present Use: _____
   Proposed Use: _____
   Buildings on retained land: _____

7. Description of proposed right-of-way/easement:
   Frontage: N/A
   Depth: _____
   Width: _____
   Area: _____
   Proposed use: _____

8. Name of person(s), if known, to whom lands or interest in lands to be transferred, leased or charged (if known):
   Unknown

9. **Site Information**	**Existing**	**Proposed**
Please indicate unit of measurement, for example: m, m^2 or %		
Lot frontage	Refer to Draft Plan	
Lot depth		
Lot width		
Lot area		
Lot coverage		
Front yard		
Rear yard		
Left Interior side yard		
Right Interior side yard		
Exterior side yard (corner lot)		
Landscaped open space		
Entrance access width		
Exit access width		
Size of fencing or screening		
Type of fencing		
10. Building Size		
Number of storeys	TBD	
Building height		
Total ground floor area		
Total gross floor area		
Total useable floor area		
11. Off Street Parking and Loading Facilities		
Number of off street parking spaces		
Number of visitor parking spaces		
Number of accessible parking spaces		
Number of off street loading facilities		

12. Residential (if applicable)

Number of buildings existing: 0

Number of buildings proposed: 41 Units

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

If yes, describe: _____

Type	Number of Units	Floor Area per Unit in m^2
Single Detached		
Semi-Detached		
Duplex		
Triplex		
Four-plex		
Street Townhouse	41	124.8 sq.m. min (Varies)
Stacked Townhouse		
Apartment - Bachelor		
Apartment - One bedroom		
Apartment - Two bedroom		
Apartment - Three bedroom		

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

13. Commercial/Industrial Uses (if applicable)

Number of buildings existing: _____

Number of buildings proposed: _____

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

If yes, describe:

_____

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

Seating Capacity (for assembly halls or similar): _____

Total number of fixed seats: _____

Describe the type of business(es) proposed: _____

Total number of staff proposed initially: _____

Total number of staff proposed in five years: _____

Maximum number of staff on the largest shift: _____

Is open storage required: ◯Yes ◯No

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

◯Yes ◯No If yes please describe:

14. Institutional (if applicable)

Describe the type of use proposed: _____

Seating capacity (if applicable): _____

Number of beds (if applicable): _____

Total number of staff proposed initially: _____

Total number of staff proposed in five years: _____

Maximum number of staff on the largest shift: _____

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

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

D. Previous Use of the Property

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

2. Is there reason to believe the subject lands may have been contaminated by former uses on the site or adjacent sites? ◯ Yes ◉ No ◯ Unknown

3. Provide the information you used to determine the answers to the above questions:

   Personal Knowledge

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

E. Provincial Policy

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

   If no, please explain:

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

   If no, please explain:

   N/A

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

   If no, please explain:

   Residential Development

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

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

   Livestock facility or stockyard (submit MDS Calculation with application)

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

   Wooded area

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

   Municipal Landfill

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

   Sewage treatment plant or waste stabilization plant

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

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

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

   Floodplain

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

   Rehabilitated mine site

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

   Non-operating mine site within one kilometre

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

   Active mine site within one kilometre

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

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

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

   Active railway line

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

   Seasonal wetness of lands

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

   Erosion

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

   Abandoned gas wells

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

F. Servicing and Access

1. Indicate what services are available or proposed:

Water Supply

- (●) Municipal piped water
- ( ) Individual wells
- ( ) Communal wells
- ( ) Other (describe below)

Sewage Treatment

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

Storm Drainage

- (●) Storm sewers
- ( ) Other (describe below)
- ( ) Open ditches

2. Existing or proposed access to subject lands:

- (●) Municipal road
- ( ) Unopened road
- ( ) Provincial highway
- ( ) Other (describe below)

Name of road/street: Nichol Street

G. Other Information

1. Does the application involve a local business? ( ) Yes (●) No
   If yes, how many people are employed on the subject lands?

2. Is there any other information that you think may be useful in the review of this application? If so, explain below or attach on a separate page.

H. Supporting Material to be submitted by Applicant

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

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

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

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

☐ Zoning Deficiency Form

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

☐ Architectural Plan

☐ Buildings Elevation Plan

☐ Cut and Fill Plan

☐ Erosion and Sediment Control Plan

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

☐ Landscape Plan

☐ Photometric (Lighting) Plan

☐ Plan and Profile Drawings

☐ Site Servicing Plan

☐ Storm water Management Plan

☐ Street Sign and Traffic Plan

☐ Street Tree Planting Plan

☐ Tree Preservation Plan

☐ Archaeological Assessment

☐ Environmental Impact Study

☐ Geotechnical Study / Hydrogeological Review

☐ Minimum Distance Separation Schedule

☐ Noise or Vibration Study

☐ Record of Site Condition

☐ Storm water Management Report

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

Site Plan applications will require the following supporting materials:

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

Standard condominium exemptions will require the following supporting materials:

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

☐ Draft condominium declaration

☐ Property Identification Number (PIN) printout

Your development approval might also be dependent on Ministry of Environment and Climate Change, Ministry of Transportation or other relevant federal or provincial legislation, municipal by-laws or other agency approvals.

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

I. Development Agreements

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

J. Transfers, Easements and Postponement of Interest

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

K. Permission to Enter Subject Lands

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

L. Freedom of Information

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

Owner/Applicant Signature	February 25, 2021 Date

M. Owner's Authorization

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

I/We Mike Quattrociocchi am/are the registered owner(s) of the lands that is the subject of this application.

I/We authorize J H Cohoon Engineering Limited to make this application on my/our behalf and to provide any of my/our personal information necessary for the processing of this application. Moreover, this shall be your good and sufficient authorization for so doing.

Owner	February 25, 2021 Date
Owner	Date

N. Declaration

I, R W Phillips of Brantford

solemnly declare that:

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

Declared before me at:

_____

Owner/Applicant Signature

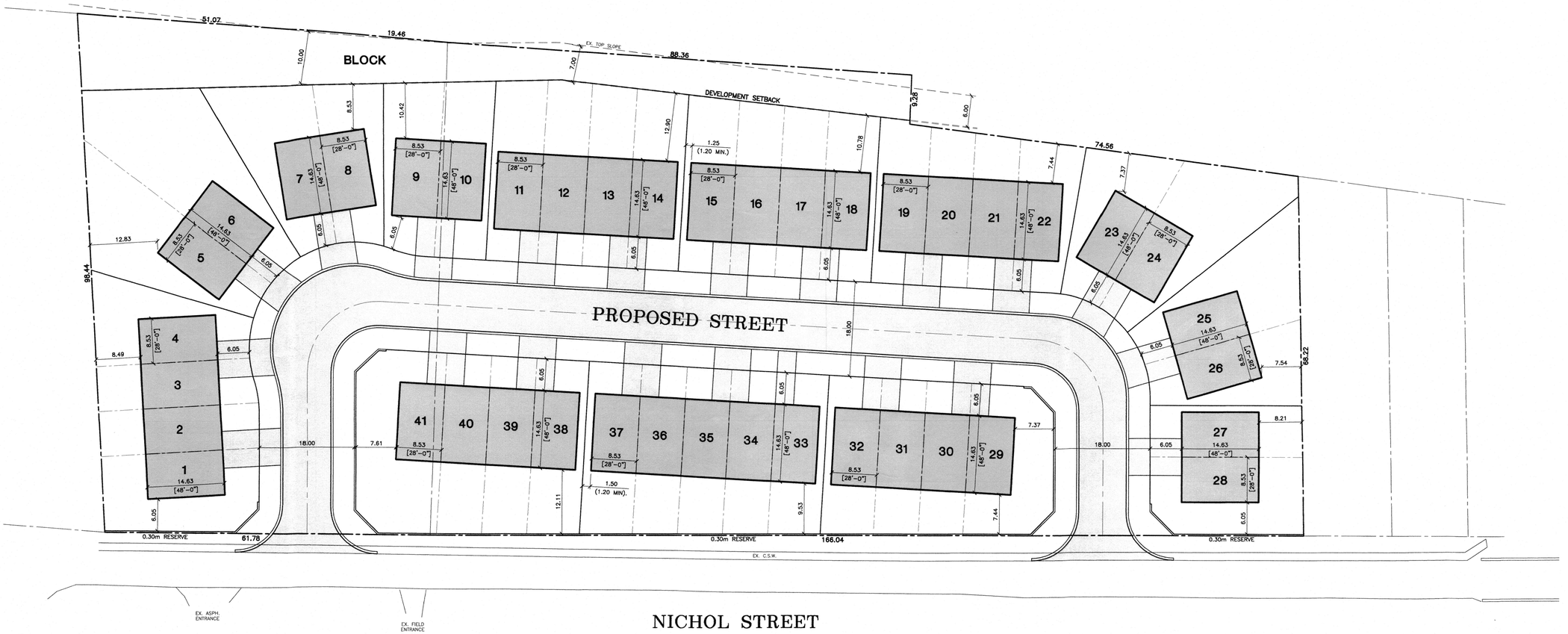
In BRANTFORD / COUNTY OF BRANT

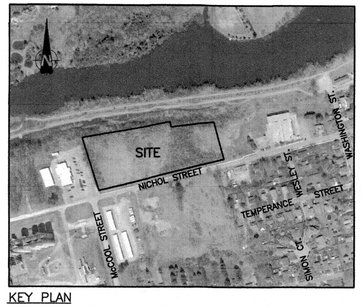
This 26TH day of FEB

A.D., 20 21

LINDA ELAINE CLARKSON,
a Commissioner, etc., Province of Ontario
for J.H. Cohoon Engineering Limited.
Expires June 5, 2021

A Commissioner, etc.





KEY PLAN

NO.	REVISION	DATE (MM/DD/YY)	BY

J.H. COHOON ENGINEERING LIMITED
CONSULTING ENGINEERS
440 HARDY ROAD , UNIT #1 , BRANTFORD – ONTARIO , N3T 5L8
TEL. (519) 753-2656 FAX. (519) 753-4263 www.cohooneng.com

PROJECT:

PROPOSED RESIDENTIAL DEVELOPMENT

NICHOL STREET
WATERFORD ONTARIO
NORFOLK COUNTY

CLIENT: MAYBERRY HOMES

CONCEPT PLAN No. 7

DESIGN:	R.W.P.	SCALE:	1:400
DRAWN:	K.P.B.	JOB No:	12502
CHECKED:	R.W.P.		
SHEET:	1 of 1	DWG. No:	12502–C7
DATE:	FEB. 23/21		

Englobe
Soils Materials Environment

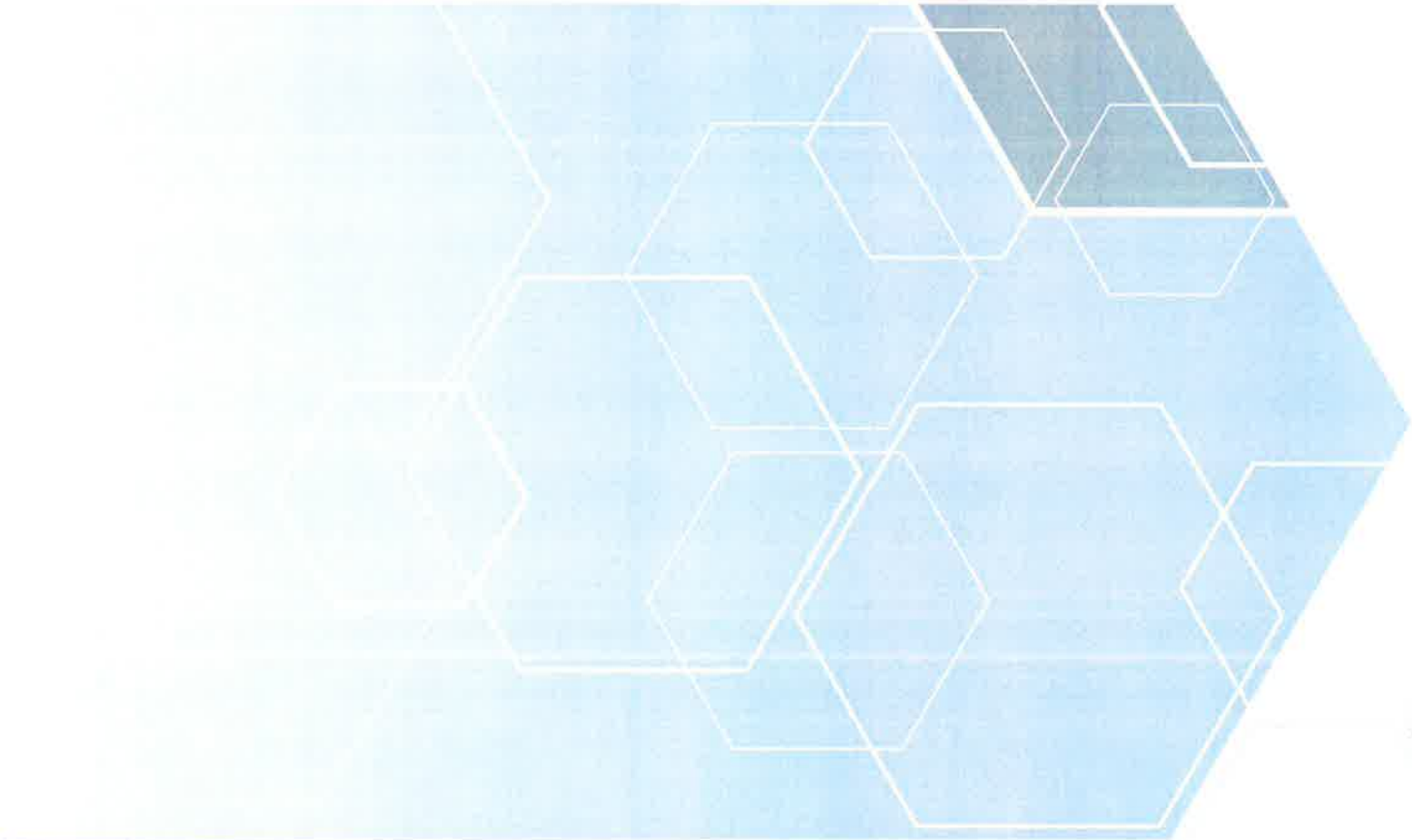
Mayberry Homes

GEOTECHNICAL INVESTIGATION AND SLOPE STABILITY

JANUARY 2021

NICHOL STREET,
WATERFORD, ONTARIO

OC04-02005877.000-01-100-GE-R-0001-01



REVISED REPORT

Englobe

CERTIFIED ENGINEERING TECHNOLOGIST
2021/01/29
OACETT
CANADA

Prepared by :

Thom Staples, C.E.T.
Team Leader, Brantford Area Manager
Geotechnical Engineering

LICENSED PROFESSIONAL ENGINEER
R. KHAMIS
100123563
PROVINCE OF ONTARIO

Approved by:

Raid Khamis, M.Sc., P.Eng.
Senior Geotechnical Engineer
Team Leader-Geotechnical and Materials
Engineering-SWO

Production Team

Client

Mayberry Homes	Mr. Mike Quattrociocchi

Englobe Corp.

Project Manager / Geotechnical Engineering Technologist	Thom Staples, C.E.T.
Team Leader – Geotechnical and Materials Engineering-SWO	Raid Khamis, M.Sc., P.Eng.

Revision and Publication Register		
Revision N°	**Date**	**Modification and/or Publication Details**
00	2021-01-29	Report Issued
01	2021-01-29	Revised Report Issued

Property and Confidentiality

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Tables

Appendices

1 Introduction

Englobe Corp. (Englobe) was retained by Mayberry Homes to carry out a geotechnical and slope stability investigation for the proposed construction of a residential development at the north side of Nichol Street at McCool Street in Waterford, ON at the location shown on Drawing 1 in Appendix A.

2 General Information

The project involves the design and construction of a new crescent and twelve residential lots. The site is located on the north side of Nichol Street, adjacent to McCool Street. A valley slope is located at the north side of the property. The new development is to comply with Ministry of Natural Resources (MNR) Policy with respect to natural hazards development set back.

The site is generally stripped of topsoil and minor earth grading was carried out prior to completion of the geotechnical report.

The purpose of this investigation was to explore the subsurface soil and groundwater conditions at the subject site and prepare a geotechnical report. The geotechnical report includes recommendations on building design and construction, site servicing, pavements, slope stability, and construction and inspection testing.

Concurrently with this investigation, Phase 1 and Phase 2 Environmental Site Assessments were completed at the site by Englobe. The results are provided under separate cover.

3 Field and Laboratory Investigation

3.1 Field Program

The fieldwork for this investigation was completed on December 15 and 16th, 2021 and involved the drilling of nine boreholes (Boreholes BH-01-20 to BH-09-20) to depths of approximately 4.5 to 15.9 m below ground surface. The borehole locations are shown on Drawing 2 in Appendix A. The field investigation was carried out in general conformance with the professional standards set out in the Canadian Foundation Engineering Manual (CFEM 2006, 4th Edition), applicable Ontario Regulations and the ASTM International. The following is a summary of field investigation tasks:

- Public and private utility companies were contacted prior to the start of drilling activities in order to demarcate underground utilities on the site.
- The boreholes were advanced using a track mounted D-50 drill rig equipped with continuous flight hollow stem augers supplied and operated by Direct Environmental Drilling Inc. under the supervision of an Englobe drilling supervisor. The boreholes were logged by our geotechnical supervisor.
- The borehole locations, ground surface elevations, and slope profiles were surveyed by J. H. Cohoon Engineering Limited, and the data was supplied to us in CAD format. It is understood that the elevations are related to a geodetic datum.

- Soil samples were recovered from the boreholes at regular depth intervals using a 50 mm outside diameter split spoon sampler in accordance with ASTM D1586 Standard Penetration Test (SPT). The recorded SPT N-values are provided on the borehole logs (Appendix B).
- Samples of the cohesive soils were tested with a pocket penetrometer to determine approximate shear strength.
- Groundwater observations and measurements were carried out in the open boreholes during and upon completion of drilling and they are noted on the borehole logs.
- Monitoring wells were installed in Boreholes BH-01-20 BH-02-20 and BH-09-20 to allow measurement of groundwater levels. The monitoring wells were constructed using flush-threaded 50 mm diameter Trilock pipe with 3.05 m long 10-slot well screens, delivered to the site pre-cleaned in individually sealed plastic bags. The screen and riser pipes were not allowed to come into contact with the ground or any drilling equipment prior to installation.
- The monitoring wells were tagged and a completed well records submitted to the Ministry of Environment, Conservation and Parks (MOECP). A licensed well technician must properly decommission the monitoring wells before construction.
- Groundwater levels measured in the wells on December 18, 2020 are noted on the borehole logs and shown in Table 4.
- The boreholes without monitoring wells were backfilled with soil cuttings and bentonite in accordance with Ontario Regulation 903 as amended, under the Ontario Water Resources Act.

3.2 Geotechnical Laboratory Testing

The soil samples secured during this investigation were returned to our laboratory for visual examination, as well as moisture content testing. A total of 91 moisture content tests were performed and these results are plotted on the borehole logs (Appendix B), and one Atterberg Limits test with the results provided on the borehole logs and summarized in Section 4.1

Four particle size analyses were conducted on selected samples, and the results are summarized in Section 4.1 (Subsurface Conditions) and plotted on Figure 1 in Appendix C.

It is important to note that as per the standard policy of Englobe, the soil samples will be stored for a period of three months from the date of sampling. These soil samples will be discarded after the three-month period unless prior arrangements have been made for longer storage.

4 Subsurface Conditions

This section presents a brief summary of the subsurface soil and groundwater conditions encountered during the geotechnical investigation. The full details of the subsoil and groundwater conditions are presented on the borehole logs in Appendix B.

4.1 Subsoil Conditions

Fill was encountered surficially in most of the boreholes and ranges in thickness from 0.5 to 3.0 m. The fill ranges in composition from brown sandy silt with some clay, and trace gravel to gravelly sand with some silt. The fill is described as moist to wet at the time of the investigation. The fill in Boreholes BH-04-20 to BH-07-20 was place and compacted under engineering supervision by Englobe.

A sand deposit was encountered surficially in Borehole BH-08-20 and underlying the fill in Boreholes BH-02-20 to BH-6-20 and BH-09-20. A lower sand deposit was encountered underlying silt or glacial till in Boreholes BH-01-20 to BH-03-20 and BH-7-20 to BH-09-20. The sand generally ranges in composition from brown silty sand to grey silty sand with trace to some clay and gravel to sand with trace to some silt and gravel. The sand was moist to saturated at the time of the investigation.

The SPT N-values within the sand range from 4 to 70 blows per 300 mm indicating a very loose to very dense relative density(generally in compact to dense condition). The results of two particle size analysis carried out on samples of the sand are provided on Figure in appendix C and summarized in Table 1.

Table 1 Particle Size Analyses of Sand

Borehole No.	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH-01-20	12.19 to 12.80	0	92	8	-
BH-03-20	1.52 to 2.13	2	80	14	4

Silt or glacial till was encountered surficially in Borehole BH-01-20 or below the sand in Boreholes BH-02-20, BH-03-20 and BH-05-20 to BH-09-20. The silt or glacial till extended beyond the exploration depth in Boreholes BH-05-20 and BH-06-20 and was 2.4 to 4.3 m thick in the remainder of the boreholes in which it was encountered. The silt and glacial till was described as moist to wet and ranged in composition from brown to grey sandy clayey silt with trace sand and gravel to sandy silt with trace to some clay.

SPT N-values within silt and glacial till range from 4 to 59 blows per 300 mm indicating a very loose to very dense relative density.

The results of two particle size analyses carried out on samples of the silt to glacial till are provided in Appendix C and summarized in Table 2.

Table 2 Particle Size Analyses of Silt and Glacial Till

Borehole No.	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH-01-20	1.52 to 2.13	3	12	65	20
BH-02-20	14.57 to 4.80	6	24	50	20

One Atterberg limits test was carried out on a sample of the sandy clayey silt soil. The cohesive soil is classified as CL-ML to CL as per Plasticity Chart Index and the results are provided summarized in Table 3. Based on the moisture content of the recovered sample the till deposit is drier than the plastic limit.

Table 3 Atterberg Limits Analysis

Borehole No.	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Classification
BH-01-20	1.52 – 2.13	20	15	5	CL-ML

4.2 Groundwater

Groundwater observations and measurements carried out in the open boreholes and in monitoring wells installed in Boreholes BH-01-20, BH-03-20 and BH-09-20 are summarized on the appended borehole logs. Groundwater measurements taken in the monitoring wells on December 18, 2020 are summarized in Table 4:

Table 4 Water Level Measurements

Borehole No.\MW	Ground Surface Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)
BH-01-20	239.95	9.67	230.28
BH-03-20	237.68	7.50	230.18
BH-09-20	241.12	10.63	230.49

Perched groundwater may occur above this level particularly after heavy rainfall or snow melt.

It is important to note that the groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These elevations and conditions may vary locally due to seasonal fluctuations, groundwater regimes encountered at the site or as a consequence of construction activities on the site or adjacent sites.

5 Geotechnical Design Recommendations

This project involves the proposed construction of a residential development that will include a new crescent at the north side of Nichol Street and twelve residential lots as shown on Drawing 2 in Appendix A. The house lots will be serviced with municipal sewer and water.

5.1 Foundations

Conventional spread footings founded on the approved native compact sand or engineered fill materials constructed at the east side of the site (Boreholes BH-04-20, BH-05-20 and BH-08-20), may be designed for soil bearing resistance at Serviceability Limit States of 75 kPa (as per the OBC), and a factored geotechnical resistance at Ultimate Limit States of 125 kPa, where the resistance factor is equal to 0.5. The depth and elevation of the soil suitable to support the maximum bearing capacity of 75 kPa at SLS is provided in the following Table 5.

Table 5 Highest Founding Levels

Borehole No.	Ground Surface Elevation (m)	Highest EL./Depth for SLS Design of 75 KPa (m)
BH-04-20	238.34	1.50 / 236.84
BH-05-20	2239.84	1.50 / 238.34
BH-06-20	2241.16	1.50 / 239.66
BH-07-20	242..62	3.00 / 239.62
BH-08-20	239.82	1.50/238.32
BH-09-20	241.12	1.50/240.62

Settlement potential at the SLS loading is less than 25 mm (1.0 in), and differential settlement is less than 10 mm (0.5 in).

Where required, the approved native subgrade can be raised to a higher founding level by constructing engineered fill consisting of approved onsite sand or imported sand and gravel such as OPSS 1010 MUNI Type 1 Granular B. The above recommended soil bearing pressure may be used for the design of footings founded on engineered fill.

A Site Classification 'D' should be used for earthquake load and effects in accordance with Table 4.1.8.4.A of the Ontario Building Code (2012).

5.2 Basements

Basements are planned below the residential units and based on the groundwater measured in the monitoring wells installed in Boreholes BH-01-20, BH-03-20 and BH-09-20 between Elevation 230.18 and 230.49 groundwater will not be encountered during basement construction. However, if groundwater will be encountered during the excavation than Minor seepage and accumulated precipitation may be removed from excavations using sumps and filtered pumps.

5.2.1 Footing Weeping Tiles

House basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code (Section 9.14). The drain tile or pipe should be laid on undisturbed or well-compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the basement floor slab. The top and sides of the drain tile or pipe shall be surrounded with not less than 150 mm of crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone should be wrapped with filter cloth. The weeping tile must drain to a suitable frost-free outlet or sump. The sump shall be equipped with an automatic pump that will discharge the water into a sewer, drainage ditch or dry well.

5.2.2 Basement Walls

The portion of the exterior basement wall below finished ground level must be damp-proofed as per Subsection 9.13.2 of the Ontario Building Code (OBC). The basement wall backfill should be graded to prevent drainage towards the foundation after settling as per OBC Subsection 9.12.3.

The basement walls should be designed to resist the lateral earth pressure. For calculating the lateral earth pressure, the coefficient of earth pressure (K) may be assumed as 0.50 for cohesionless sandy soils and 1.0 for silt and clay (Section 24.12.3.3 CFEM). The bulk unit weight of the retained backfill may be taken as 21 kN/m^3 for well-compacted soil. An appropriate factor of safety should be employed.

5.2.3 Basement Floor Slabs

The subgrade for the basement floor slabs should comprise undisturbed native soil or well-compacted fill. A minimum 100 mm thick layer of coarse clean granular material containing not more than 10% material that will pass a 4 mm sieve shall be placed beneath slabs in houses as per Subsection 9.16.2 of the OBC. If the subgrade soil is wet, it is recommended that subfloor weeping tiles be placed and connected to the sump pit.

To prevent the migration of moisture vapour into the buildings from beneath ground floor slabs, particularly where moisture sensitive floor coverings are placed, a vapour retarder shall be placed directly beneath the floor slab that meets the requirements of the designer and flooring manufacturer. Prior to installing moisture sensitive floor coverings, the moisture content of the concrete slab must be determined at operational conditions by internal relative humidity testing to ensure an acceptable slab moisture level. It should be noted that it typically takes more than 90 days at operational conditions to lower the slabs internal relative humidity to 85%. Different flooring systems have different responses to slab moisture (i.e., some systems can tolerate more moisture than others), and the flooring contractor must assess the floor moisture levels with respect to their flooring components.

The water to cement ratio and slump of the concrete utilized in the floor slab should be strictly controlled to minimize shrinkage of the slab. Control joints should be sawed into the slab at maximum 4 m spacing's within 12 hours of initial concrete placement in order to pre-locate shrinkage cracks. The saw-cut depths should be ¼ of the slab thickness.

5.3 Pavement Structure Recommendations

Asphalt pavements will be constructed for the new crescent. A light duty (car parking) pavement structure is proposed for this site.

Any loose fill or native soil, and topsoil shall be removed and the subgrade shall be thoroughly proof rolled and inspected below the pavement areas and any soft or unsuitable soil removed; and if required, grades should be raised with approved inorganic soils. The subgrade fill should be placed in 200 mm thick lifts and compacted to 100% standard Proctor maximum dry density (SPMDD).

The pavement component thicknesses in Table 6 are recommended based on the anticipated pavement usage, the frost-susceptibility, and strength of the subgrade soils.

Table 6 Pavement Component Thicknesses

Pavement Component	Thickness (mm)
Hot-Mix Asphalt	90
Granular A Base Course	150
Granular B Type I Subbase Course	400

Samples of both the Granular A and Granular B Type 1 aggregates should be checked for conformance to OPSS.MUNI 1010 prior to utilization on site and during construction. The Granular B Type 1 subbase and Granular A base courses must be compacted to 100% SPMDD, as verified by insitu density testing. The hot-mix asphalt should comprise 50 mm of HL4 or HL8 binder and 40 mm of HL3 surface. The hot-mix asphalt paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. Performance graded asphalt cement (PGAC) 58-28 should be utilized in the hot mix asphalt in accordance with the recommendations of OPSS 1101.

The pavement subgrade and granular courses will lose their strength to support traffic loads if allowed to become wet due to surface water or groundwater infiltration; therefore, drainage of the pavement and the granular courses is essential. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped to provide effective drainage. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas.

The need for continuous paving supervision by a qualified pavement technician, and quality control testing during pavement construction cannot be over emphasized. All materials and construction services required for the work should be in accordance with the applicable sections of the Ontario Provincial Standard Specifications.

5.4 Slope Stability Analysis

The general soil profile at the top of the slope comprises fill overlying sand, silt and glacial till deposits. The slope is approximately 6 to 9 m high with an overall inclination of approximately 2.0 to 3.0 horizontal to 1.0 vertical as shown on Drawing 3 – Appendix A.

The stability of the overall slope was analyzed using a computer model prepared using the Geo Slope computer program (GeoStudio 2018, version 7.16, Geo-Slope International Ltd.). The soil strength parameters used in the analyses are provided in Table 7.

Table 7 Summary of Soil Strength Parameters Used for Slope Stability Analysis

Soil	Unit Weight (kN/m3)	Effective Cohesion (kPa)	Angle of Internal Friction (deg.)
Fill	17.5	2.5	28
Silt	17.5	5	26
Silt Till	19	2.5	30
Sand (loose)	18	0	29
Sand (dense)	20	0	35

The soil strength parameters are based on the results of the boreholes (SPT tests), and laboratory test results.

5.1.1 Erosion Hazard limit

The proposed houses must be constructed in general compliance with MNR Policies for addressing natural hazards. The erosion hazards include four components including toe erosion allowance, stable slope, meander belt allowance and erosion access allowance. However, meander belt allowance is not applicable at this site as the creek is 45 m from the toe of the slope.

5.1.2 Toe Erosion Allowance

The toe erosion allowance provides a setback for slope regression due to erosion of the slope wall by stream action. The creek is 45 m from the toe of the slope and toe erosion will not impact the residential development or stability of the slope.

5.1.3 Stable Slope Allowance

The slope stability analysis was carried out for the groundwater levels as noted on Table 4 and deep rotational failures through the entire height of the slope were analyzed.

The results of the analyses for the existing slope indicate a Factor of Safety (FoS) against slope failure of 1.3 to 1.8 at Cross Section A-A' to C-C'. The slope W analyses are provided in Appendix D. The recommended FoS 1.5 for active habitable structures as outlined on Table 4.3 from Section 4.3.3.1., Design Minimum Factors of Safety in the MNR Technical Guide. Based on the results of this investigation a stable slope allowance setback of 4 m is required at Section A-A' and 1 m at Section B-B' is required. No stable slope setback is required at Section C-C' since the FoS is greater than 1.5.

5.1.4 Erosion Access Allowance

The purpose of this setback is to provide continued access to the slope beyond the 100 year erosion and stable slope limits. The required access setback allowance is 6.0 to 15.0 m based on MNR Guidelines (Natural Hazards Training Manual). It is recommended that the 6.0 m setback be applied from the top of the bank since a high FoS was achieved (=1.5) during the slope stability analysis.

5.1.5 Total Setback

The existing slope on the property is comprised of geologically stable soil deposits but in order to comply with the MNR Guidelines , and to ensure a long term safe development, the following is recommended:

Construction of permanent structures at the site should only occur beyond the Erosion Hazard Limit shown on Drawing 2 in Appendix A (6.0 to 12.0 m from top of bank) The setbacks are summarized in Table 8:

Table 8 Setbacks

Cross-Section	Stable Slope (m)	Toe Erosion (m)	Erosion Access (m)	Development Setback (m)
A-A'	6	0	6	12
B-B'	1	0	6	7
C-C'	0	0	6	6

- Direction of surface water run-off away from the top of bank if possible;
- No fill placement over the slope or at the top of bank; and,
- It is recommended that geotechnical monitoring be carried out during construction to ensure that there are no negative impacts on the slope stability.

6 Construction Recommendations

6.1 Excavations and Dewatering

All trench excavations and excavations for foundations must comply with Ontario Regulation 213/91 (Construction Projects) under the Occupational Health and Safety Act. The predominant sand and silt soils contacted in the boreholes would be classified as Type 3 soils (O.Reg. 213/91, s. 226(4)). Temporary cut slopes within Type 3 soil should be at a slope of 1:1 (H:V) or flatter from the bottom of the excavation as per O.Reg. 213/91, s. 234(2). If wet deposits are exposed, the cut slopes are expected to slough to flatter slopes, potentially as flat as 3:1 (H:V) or flatter.

If an excavation may affect the stability of an adjacent structure, the constructors shall take precautions to prevent damage to the adjacent structure (O.Reg. 213/91 s. 229). Precautions need to be taken if excavations intersect with a line projected downwards at 45° from the edge of the adjacent structure foundations. Where special limitations do not allow sloping temporary excavations back to a safe angle, temporary support would be required.

Every pre-fabricated hydraulic support system shall be designed by a professional engineer and shall be constructed, installed, used, and maintained in accordance with its design drawings and specifications (O.Reg. 213/91, s. 236).

The excavation side slopes should be regularly inspected for evidence of instability following periods of heavy rainfall, thawing or when an excavation has been left open for an extended period of time. Appropriate remedial actions should be taken to ensure the continual stability of the slopes.

No major groundwater problems are expected for excavations to conventional depth for foundations and services; however, perched groundwater within the more permeable layers in the silt should be expected. Any minor groundwater infiltration should be handled using conventional sump pumping techniques. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O.Reg. 213/91, s. 230).

6.2 Pipe Bedding

The subgrade soils beneath the service pipes should comprise compacted fill or native soils.

Prior to installation of the services, the subgrade should be inspected by an experienced geotechnical engineer/technician. If any, very loose or soft areas are encountered during inspection they should be excavated and replaced with compacted granular material such as OPSS.MUNI 1010 Granular A.

The pipe bedding for the services should be conventional Class B pipe bedding comprising a minimum 150 mm thick layer of OPSS.MUNI 1010 Granular A aggregate below the pipe invert. The bedding course may be thickened if portions of the subgrade become wet during excavation. OPSS.MUNI 1010 Granular A type aggregate should be provided around the pipe to at least 300 mm above the top, and the bedding should be compacted to 100% SPMDD. Service lines installed outside of heated areas should be provided with a minimum 1.2 m of soil cover or equivalent insulation for frost protection.

6.3 Trench Backfill

The trenches above the specified pipe bedding should be backfilled with inorganic soils that are not excessively wet placed in 200 mm thick lifts and compacted to at least 98% SPMDD. Where the service trenches enter the buildings, the trench backfill must be compacted as structural fill to a minimum of 100% SPMDD. Any trench backfill below a pavement structure should be compacted to 100% SPMDD within 1 m from the top of subgrade level. Based on the results of insitu moisture content tests carried out on the native overburden deposits, the materials may be suitable for reuse as trench backfill. Organic material (topsoil) is not considered suitable for reuse as trench backfill and if encountered, shall be separated.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to direct surface runoff away from the excavations. Should construction extend into the winter season then backfilling operations should be planned to ensure that backfill material is kept to a minimum and ensured that frozen material is not used as backfill.

6.4 Foundations

The following recommendations are given based on results of the geotechnical investigation:

- Prior to construction of the foundations any unsuitable material including pre-existing fill, organics, and loose soils shall be excavated from within the building footprint. The subgrade should be inspected and approved by an experienced geotechnical engineer/technician upon excavation.
- Fill material within the buildings must be placed on approved subgrades as structural fill under full time geotechnical supervision. The structural fill should comprise granular material such as OPSS.MUNI 1010 Type 1 Granular B or equivalent, placed in 200 mm thick lifts and compacted to 100% SPMDD.
- Full-time compaction testing by experienced geotechnical personnel should be carried out in order to examine and approve structural fill materials, and to verify that the specified degree of compaction has been achieved.
- Structural fill shall extend at least 1 m beyond the edge of the buildings and outwards and downwards to the subgrade level at a slope of 1 horizontal to 1 vertical, if embedded. For the exposed structural fill, a slope of 3 horizontal to 1 vertical is recommended.
- The footing areas must be inspected by a qualified geotechnical engineer/technician at the time of construction to confirm soil conditions encountered and recommended bearing capacity.
- All exterior footings and those exposed to freezing should be provided with a minimum of 1.2 m of soil cover to provide protection from freezing. If construction extends into the winter months, all founding soil must be protected from freezing during construction.
- The materials excavated from the foundation trench areas may be suitable for reuse as exterior foundation wall backfill. The backfill should be placed in 200 mm thick lifts and compacted to 95% SPMDD on the exterior of the buildings and 100% SPMDD on the interior of the buildings. The backfill should be placed evenly on both sides of walls that are not designed to resist lateral earth pressure. Over-compaction must be avoided since this could cause excessive lateral earth pressure.

6.5 Construction Inspection and Testing

During construction of the new buildings, testing should be carried out for quality assurance. Soils testing for the project would include engineering site visits to confirm bearing capacity for footings for the new buildings. Compaction testing shall be carried out on structural fill beneath the buildings, foundation wall backfill, sub-slab granular fill, and service pipe bedding and trench backfill.

During the placement of concrete at the construction site, testing should be performed to determine the slump and air content of the concrete, and concrete cylinders should be cast for compressive strength testing in accordance with the requirements of CSA A23.1 and A23.2. Field sampling and testing of concrete shall be according to OPSS 904. Preparation of the test cylinders, curing, and testing should be carried out by Englobe.

Englobe maintains CCIL certified concrete laboratories in Kitchener and London, and can provide concrete sampling and testing services for the project as required. Englobe staff also provide quality testing services for building envelope, structural steel, reinforcing steel, and roofing.

7 Statement of Limitations

The geotechnical recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, Englobe should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood.

The geotechnical recommendations provided in this report are intended for the use of the owner and its retained designer. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. Englobe accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It is important to note that the geotechnical investigation involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered. The subsurface geotechnical, hydrogeological, environmental and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also, such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions.

Appendix A Drawings

Drawing 1: Location Plan
Drawing 2: Site Plan
Drawing 3: Cross Sections A-A' to C-C'

NOTES:

1-REFERENCE: © OpenStreetMap contributors (2021).

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 100 200 300 400 500 m

SCALE 1:15000

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Project

Geotechnical Investigation - Slope Stability

Nicol Street, Waterford, Ontario

Title

LOCATION PLAN

Englobe

440, Hardy Road, Unit 3
Brantford (Ontario) N3T 5L8
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Drawn E.Ciochon	Scale 1 : 16000	Sequence no. 01 of 03	
Checked T.Staples	Date 2021-01-14		

M. dept.	Project	Disc.	Dwg no.	Rev.
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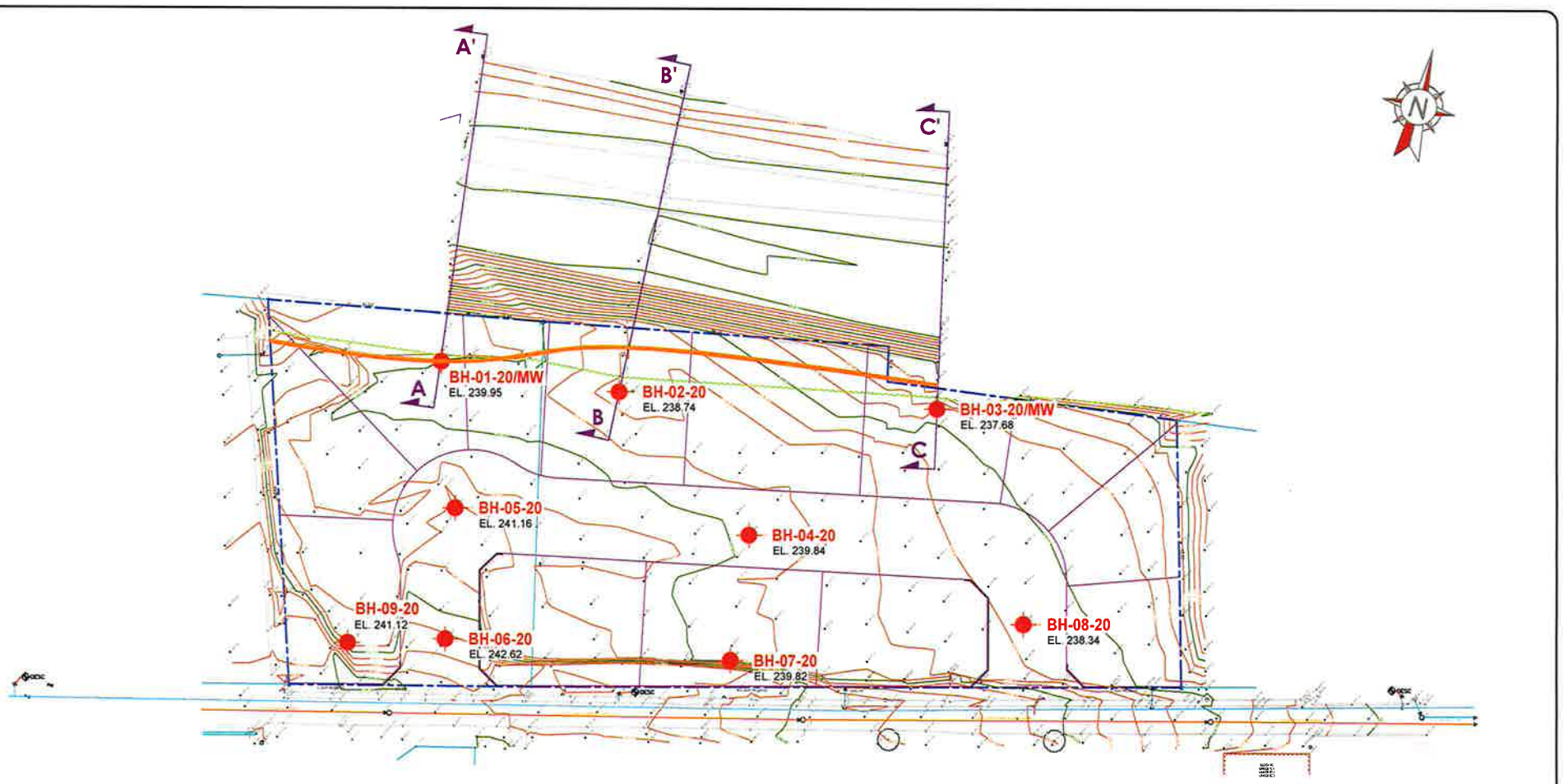

LEGEND :

DEVELOPMENT SETBACK LINE

BOREHOLE LOCATION

EL. 237.68 GROUND SURFACE ELEVATION (m)

A A' CROSS SECTION

0 10 20 30 40 50 m

SCALE 1:1000

NOTES :

1-REFERENCES: J.H. COHOON ENGINEERING LIMITED, Job No.12502, Drawing No.12502-1, November 26, 2020.

2-Borehole locations and elevations based on client drawing.

3-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

4-MW refers to monitoring well installed at borehole location.

Project

Geotechnical Investigation - Slope Stability

Nisbet Street, Waterford, Ontario

Title

SITE PLAN

Englobe

Englobe Corp.
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London (Ontario) N6E 3T6
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M. dept.	Project	Disc	Dwg no	Rev
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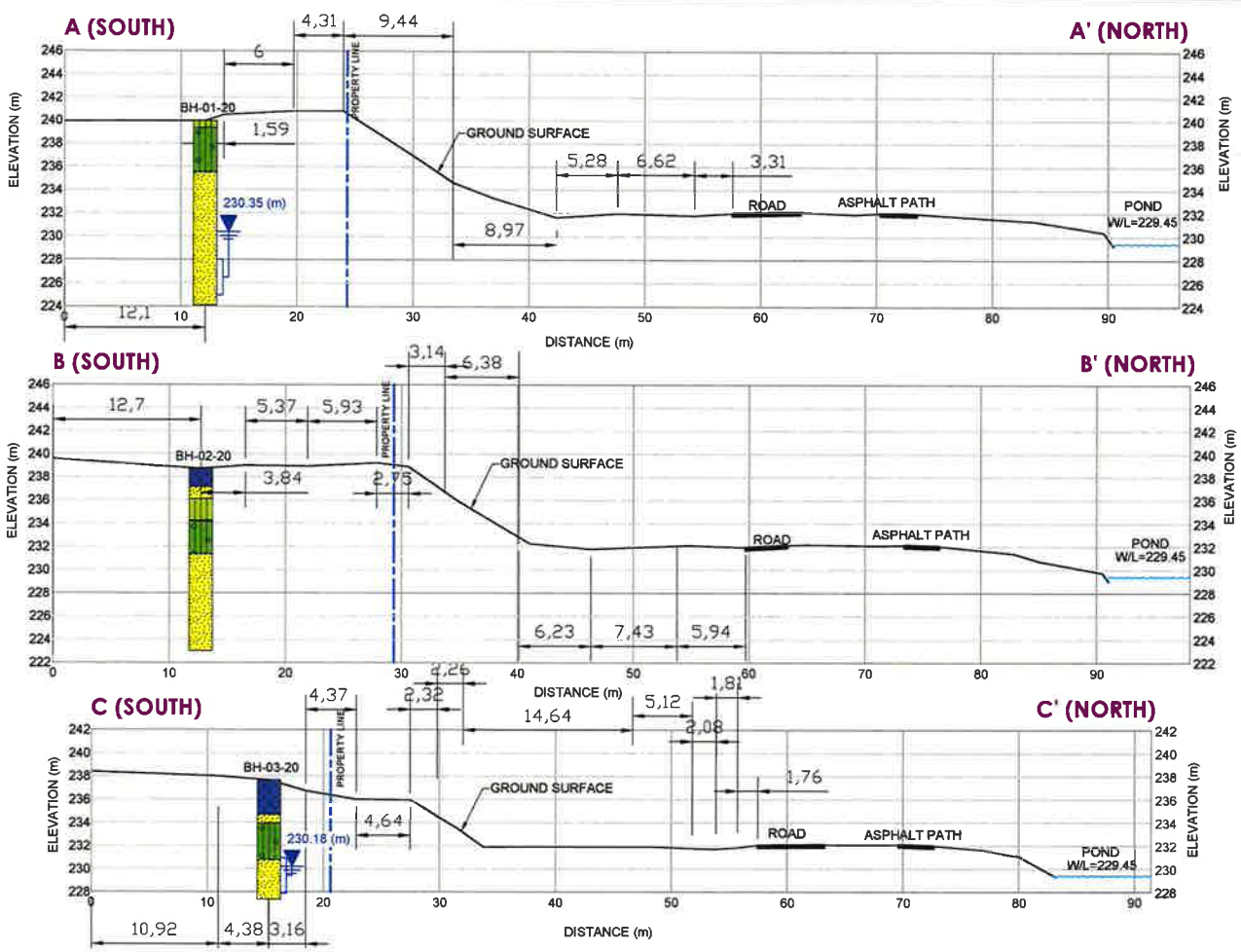

LEGEND :

- FILL
- SILT
- SAND
- SILT TILL
- SCREENED INTERVAL

WATER ELEVATION (m)
(December 18, 2020)

0 5 10 15 m
SCALE 1:400

Project
Geotechnical Investigation - Slope Stability
Nicol Street, Waterford, Ontario

Title
CROSS SECTIONS A - A', B - B' AND C - C'

Englobe

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Drawn Ciochon	Scale 1 : 400	Sequence no. 03 of 03
Checked T.Staples	Date 2021-01-14	

M. dept.	Project	Disc.	Dwg no.	Rev.
160	02005877.000	GE	003	00

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Appendix B Borehole Logs

List of Abbreviations
Boreholes BH-01-20 to BH-09-20

LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Tests and Properties	
AS	Auger Sample	SPT	Standard Penetration Test
CS	Core Sample	UC	Unconfined Compression
RC	Rock Core	FV	Field Vane Test
SS	Split Spoon	ø	Angle of internal friction
TW	Thinwall, Open	γ	Unit weight
WS	Wash Sample	w_p	Plastic limit
BS	Bulk Sample	w	Water content
GS	Grab Sample	w_L	Liquid limit
WC	Water Content Sample	I_L	Liquidity index
TP	Thinwall, Piston	I_p	Plasticity index
		PP	Pocket penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60° cone a distance 300 mm (12 in.). The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 mm (12 in.)
WH	sampler advanced by static weight of hammer
PH	sampler advanced by hydraulic pressure
PM	sampler advanced by manual pressure

Soil Description		
Cohesionless Soils	**SPT N-Value**	**Relative Density (D_r)**
Compactness Condition	(blows per 0.3 m)	(%)
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	over 50	80 to 100

Cohesive Soils	**Undrained Shear Strength (C_u)**	
Consistency	**kPa**	**psf**
Very Soft	less than 12	less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000

DTPL	Drier than plastic limit	Low Plasticity, W_L <30
APL	About plastic limit	Medium Plasticity, 30 < W_L < 50
WTPL	Wetter than plastic limit	High Plasticity, W_L > 50

Englobe

Ground Elevation: *239.95 m*

Borehole Number: **BH-01-20**

Job N°: *2005877.000*

Drill Date: *2020-12-15*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		239.95			
	SILT: brown silt, some clay, sand and gravel, moist		0.00 / 239.34	AS-1		
1	***SILT TILL:*** dense brown gravelly sandy silt, trace clay, moist		0.61 / 238.55	SS-2	7-13 30-31	43
2	sandy clayey silt, trace gravel		1.40 / 237.76	SS-3	11-19 18-25	37
	very dense gravelly sandy silt, silty sand layers		2.19 / 237.03	SS-4	7-28 31-27	59
3	compact brown sandy silt layers		2.92 / 236.14	SS-5	5-7 20-24	27
4	dense		3.81 / 235.53	SS-6	9-16 19-28	35
	SAND: compact to dense brown silty sand, trace gravel, moist		4.42	SS-7	3-17 13-16	30
5						
6	dense		6.10 / 233.85	SS-8	11-21 26-22	47
7						
8	trace silt and gravel, wet		8.23 / 231.72	SS-9	12-16 22-29	38
9						
				SS-10	4-2 6-22	8
10						
11	very dense, trace to some silt, wet to saturated		10.67 / 229.28	SS-11	13-27 18-47	45
12						
	dense, grey, trace silt		12.19 / 227.76	SS-12	5-13 23-29	36
13						
14				SS-13	6-11 20-20	31
15						
	compact		15.24 / 224.71	SS-14	3-5 19-16	24
16	Borehole terminated at 15.85 m		15.85 / 224.10			

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa: 50 100 150 200

WP WL — Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

- protective cover and concrete
- bentonite seal
- native backfill
- el. 230.35 m 2020-12-18
- bentonite seal
- sand pack
- 50 mm pipe
- 3.05 m slotted screen
- native cave

Reviewed by: *T.Staples*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 95.0

EQ-09-Ge-72 R.1 18.02.2011

Englobe

Ground Elevation: *238.74 m*

Borehole Number: **BH-02-20**

Job N°: *2005877.000*

Drill Date: *2020-12-15*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		238.74			
	FILL: brown sandy silt, wet		0.00	AS-1		
1	very loose		237.98 0.76	SS-2	1-1 1-1	2
	some clay and gravel		237.22 1.52	SS-3		
2						
			236.12	SS-4A	0-2	3
	SAND: loose brown sand, some gravel and silt, very moist		2.62 235.69	SS-4B	1-4	
3			3.05 235.21	SS-5A	7-10	23
	compact brown gravelly sand, some silt with sandy silt layers, moist		3.53 234.93	SS-5B	13-13	
4			3.81 234.30	SS-6	12-19 43-45	62
	SILT: compact brown silt, some sand and gravel, trace clay, moist		4.45 234.17	SS-7	12-50 /50 mm	35
5	very dense		4.57	SS-7A	4-13 22-24	
	SAND: very dense brown gravelly silty sand, some cobbles, moist		232.95 5.79			
6	***SILT TILL:*** dense brown sandy silt, some clay and gravel			SS-8	12-20 20-23	40
	SAND: dense brown sand, trace silt		231.73 7.01			
7	some silt		231.12 7.62	SS-9	16-10 22-27	32
8	compact, wet					
			229.60 9.14			
9	dense			SS-10	2-3 11-24	14
10						
11				SS-11	5-17 25-27	42
12				SS-12	12-17 25-28	42
13			225.02			
14	very dense		13.72	SS-13	8-27 43-50 /125 mm	70
15				SS-14	7-26 48-50 /75 mm	74
			223.02			
16	Borehole terminated at 15.72 m		15.72			

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 (Initial, Remold)

WP WL — Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

native backfill

bentonite seal

native cave

At drilling completion, water level at 7.01 m.

Reviewed by: *T.Staples*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 95.0

EQ-09-Ge-72 R.1 18.02.2011

Englobe

Ground Elevation: *237.68 m*

Borehole Number: **BH-03-20**

Job N°: *2005877.000*

Drill Date: *2020-12-15*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		237.68			
	FILL: brown sand, some silt and topsoil, moist		0.00	AS-1		
			236.92			
1	very loose, very moist		0.76	SS-2	2-1 2-2	3
			236.16			
	loose, trace gravel and clay, moist		1.52	SS-3	2-4 3-4	7
2			235.39			
	some silt, trace topsoil		2.29	SS-4	2-3 4-5	7
			234.73			
3	***SAND:*** very loose brown silty sand, trace rootlets, moist		2.95	SS-5	2-2 2-3	4
			233.97			
	SILT TILL: compact brown sandy silt, some gravel		3.71	SS-6	4-8 6-5	14
4			233.11			
	silt and sand layers		4.57	SS-7	3-8 11-11	19
5						
6			231.58			
	grey, trace clay, wet		6.10	SS-8	9-10 19-24	29
			230.82			
7	***SAND:*** compact brown silty sand, some gravel, some cobbles at 7.01 m, saturated		6.86			
8				SS-9	7-11 12-21	23
9			228.54			
	trace silt		9.14	SS-10	9-13 11-18	24
10				SS-11	15-30 50 /100 mm	80
	Borehole terminated at 10.31 m		227.37 10.31			

Dynamic Cone: 20 40 60 80

Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200

Initial / Remold

Shear Strength (FV) kPa: 50 100 150 200

WP WL

Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

- protective cover and concrete
- bentonite seal
- native backfill
- el. 230.18 m 2020-12-18
- sand pack
- 50 mm pipe
- 3.05 m slotted screen
- native cave

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Sheet: *1 of 2*

Notes:

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Vertical Scale = 1 : 60.0

EQ-09-Ge-72 R.1 18.02.2011

Englobe

Ground Elevation: *238.34 m*

Borehole Number: **BH-04-20**

Job N°: *2005877.000*

Drill Date: *2020-12-15*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		238.34			
	FILL: brown silty sand, moist		0.00	AS-1		
	loose, trace topsoil		237.58 0.76	SS-2	2-2 5-4	7
1	***SAND:*** compact brown sand, trace silt, moist		236.94 1.40	SS-3	5-6 7-8	13
2	loose		236.05 2.29	SS-4	4-5 4-6	9
3	compact		235.29 3.05	SS-5	3-6 5-6	11
4	some silt		234.53 3.81	SS-6	4-9 14-20	23
5	loose, trace clay, wet		233.77 4.57	SS-7	5-3 4-5	7
	Borehole terminated at 5.18 m		233.16 5.18			
6						
7						
8						
9						
10						

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 — Initial, Remold

Water Content (%): WP, WL; 10 20 30

Groundwater Observations and Standpipe Details

native backfill

At drilling completion, borehole open and dry.

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Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 60.0

EQ-09-Ge-72 R.1 18.02.2011

Englobe

Ground Elevation: *239.84 m*

Borehole Number: **BH-05-20**

Job N°: *2005877.000*

Drill Date: *2020-12-16*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Solid Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		239.84			
	FILL: brown silty sand, trace gravel, moist		0.00 / 239.38	SS-1		
	SAND: dense brown gravelly silty sand with sandy silt layers, moist		0.46	SS-2	20-24 19-20	43
	very dense		238.32 / 1.52	SS-3	15-25 26-23	51
	some boulders		237.35 / 2.49	SS-4	11-50 /75 mm	
	compact, some silt and gravel		236.89 / 2.95	SS-5	13-14 15-15	29
	SILT TILL: very dense brown sandy silt, some gravel, moist		236.03 / 3.81	SS-6A	9-15	33
				SS-6B	18-50 /125 mm	
	Borehole terminated at 4.47 m		235.37 / 4.47	SS-7	50 /75 mm	

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 — Initial, Remold

WP WL — Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

native backfill

At drilling completion, borehole open and dry.

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Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 60.0

EQ-09-Ge-72 R.1 18.02.2011

Englobe

Ground Elevation: *241.16 m*

Borehole Number: BH-06-20

Job N°: *2005877.000*

Drill Date: *2020-12-15*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Solid Stem Auger*

SOIL PROFILE			SAMPLE								
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) WP WL (10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation 241.16									
	FILL: brown silty sand		0.00 / 240.40	AS-1						
1	compact, silty sand layers		0.76 / 239.79	SS-2	4-6 7-12	13				
	gravelly sand, some silt, trace topsoil		1.37 / 239.64							
	SAND: compact brown silty sand		1.52 / 238.97	SS-3A / SS-3B	3-10 12-9	22				
2	loose brown sand, some silt		2.19 / 238.72	SS-4A	2-2	4				
	SILT: loose brown silt, trace clay and sand, wet		2.44 / 238.26	SS-4B	2-4					native backfill
3	compact, dilatant		2.90 / 237.35	SS-5	4-7 6-10	15				
	silty clay and sandy silt seams		3.81 / 236.69	SS-6	4-7 9-29	16				
	SILT TILL: dense brown gravelly sandy silt, moist		4.47 / 235.98	SS-7	18-18 29-14	47				
5	Borehole terminated at 5.18 m		5.18							At drilling completion, borehole open and dry.
6										
7										
8										
9										
10										

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Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 60.0

EQ-09-Ge-72 R.1 18.02.2011

Englobe

Ground Elevation: *242.62 m*

Borehole Number: BH-07-20

Job N°: *2005877.000*

Drill Date: *2020-12-16*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Solid Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		242.62			
	FILL: brown sand, some silt and gravel, trace topsoil, moist		0.00 / 241.86	AS-1		
1	sandy silt layers		0.76 / 241.10	SS-2	6-7 4-2	11
2	***SILT:*** loose to very loose brown sandy silt, moist		1.52 / 240.33	SS-3	2-2 2-2	4
	some sand and clay, trace gravel, very moist		2.29 / 239.57	SS-4	4-2 2-2	4
3	***SILT TILL:*** dense brown silt, some sand and gravel, trace clay		3.05 / 238.89	SS-5	4-22 22-24	44
4	***SAND*** dense brown silty sand, trace gravel, moist		3.73 / 237.44	SS-6	11-17 20-20	37
5				SS-7	11-16 20-18	36
	Borehole terminated at 5.18 m		5.18			

Dynamic Cone: 20 40 60 80

Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200

Initial / Remold

Shear Strength (FV) kPa: 50 100 150 200

WP WL

Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

bentonite seal

native backfill

At drilling completion, borehole open and dry.

Reviewed by: *T.Staples*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 60.0

EQ-09-Ge-72 R.1 18.02.2011

Englobe

Ground Elevation: *239.82 m*

Borehole Number: **BH-08-20**

Job N°: *2005877.000*

Drill Date: *2020-12-16*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Solid Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		239.82			
	SAND: brown sand, trace silt and gravel, moist		0.00 / 239.06	AS-1		
1	compact		0.76 / 238.30	SS-2	5-7 8-9	15
	dense, trace silt and gravel		1.52 / 237.69	SS-3	4-7 24-20	31
2	***SILT TILL:*** compact brown sandy silt, some clay and gravel, sand and gravel layers, moist		2.13 / 236.77	SS-4	6-6 13-24	19
3	some gravel with sand layers		3.05 / 236.01	SS-5	3-10 17-18	27
4	dense		3.81 / 235.38	SS-6	2-20 23-28	43
	SAND: very dense brown sand, some gravel and silt, moist		4.45 / 234.64	SS-7	11-25 31-28	56
5	Borehole terminated at 5.18 m		5.18			
6						
7						
8						
9						
10						

Dynamic Cone: 20 40 60 80
Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200
Initial
Remold
Shear Strength (FV) kPa: 50 100 150 200

WP WL
Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

native backfill

At drilling completion, borehole open and dry.

Reviewed by: *T.Staples*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 60.0

EQ-09-Ge-72 R.1 18.02.2011

Englobe

Ground Elevation: *241.12 m*

Borehole Number: **BH-09-20**

Job N°: *2005877.000*

Drill Date: *2020-12-16*

Project: *Geotechnical Investigation - Slope Stability*

Field Tech: *M.Arthur*

Location: *Nichol Street, Waterford, Ontario*

Drill Method: *Solid Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		241.12			
	FILL: brown silty sand, very moist		0.00 / 240.66	AS-1		
1	***SAND:*** compact brown gravelly sand, some silt, moist		0.46 / 239.72	SS-2	6-7 12-12	19
2	***SILT TILL:*** compact brown sandy silt, some gravel		1.40 / 238.61	SS-3	6-10 19-50 /125 mm	29
				SS-4A	5-12 13-21	25
3	***SAND:*** dense brown gravelly sand, some silt, moist		2.52 / 238.07	SS-4B		
	compact		3.05 / 236.70	SS-5	3-13 13-22	26
4						
5	dense brown sand, some gravel, trace silt		4.42 / 235.18	SS-6	5-25 20-15	45
6	fine sand and gravel, some silt		5.94 / 233.50	SS-7	5-13 19-22	32
7						
8	fine to medium sand, trace silt and gravel		7.62 / 231.98	SS-8	11-22 24-22	46
9	compact, wet		9.14 / 230.45	SS-9	3-8 15-21	23
10						
11	saturated		10.67 / 228.93	SS-10	1-2 10-15	12
12	trace gravel and silt		12.19 / 228.32	SS-11	3-7 21-18	28
13	Borehole terminated at 12.80 m		12.80			
14						
15						
16						

Dynamic Cone — Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 — Initial / Remold

Water Content (%): WP — WL; 10 20 30

Groundwater Observations and Standpipe Details

- protective cover and concrete
- bentonite seal
- el. 230.49 m 2020-12-16
- sand pack
- 50 mm pipe
- 4.57 m slotted screen

Reviewed by: *T.Staples*

Drafted by: *E.Ciochon*

Sheet: *1 of 1*

Notes:

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Vertical Scale = 1 : 95.0

EQ-09-Ge-72 R.1 18.02.2011

Appendix C Laboratory Test Results

Particle Size Distribution

Englobe

PARTICLE SIZE ANALYSIS

Project: **Geotechnical Investigation - Slope Stability**

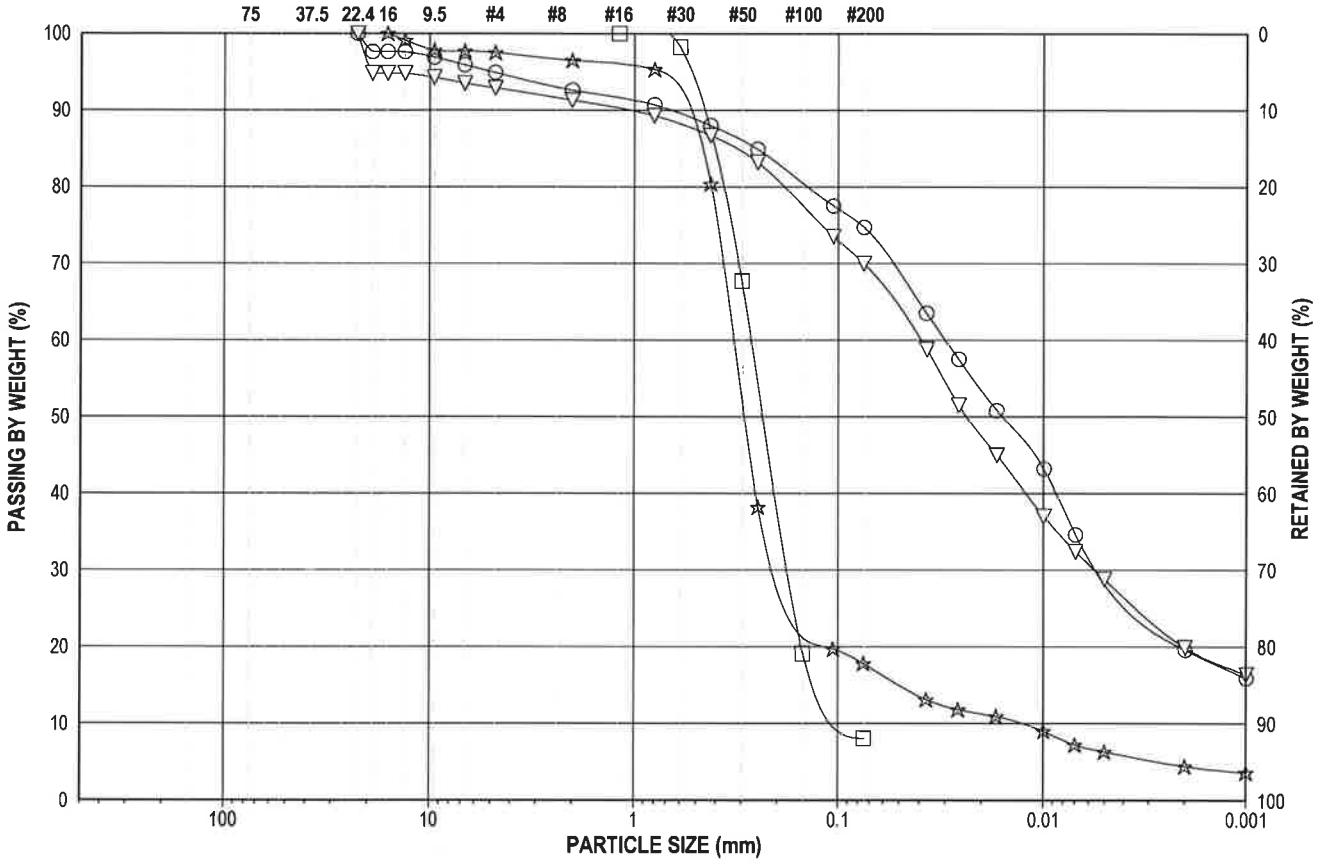
Figure No : **1**

Location: **Nichol Street, Waterford, Ontario**

File No : **2005877.000**

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER

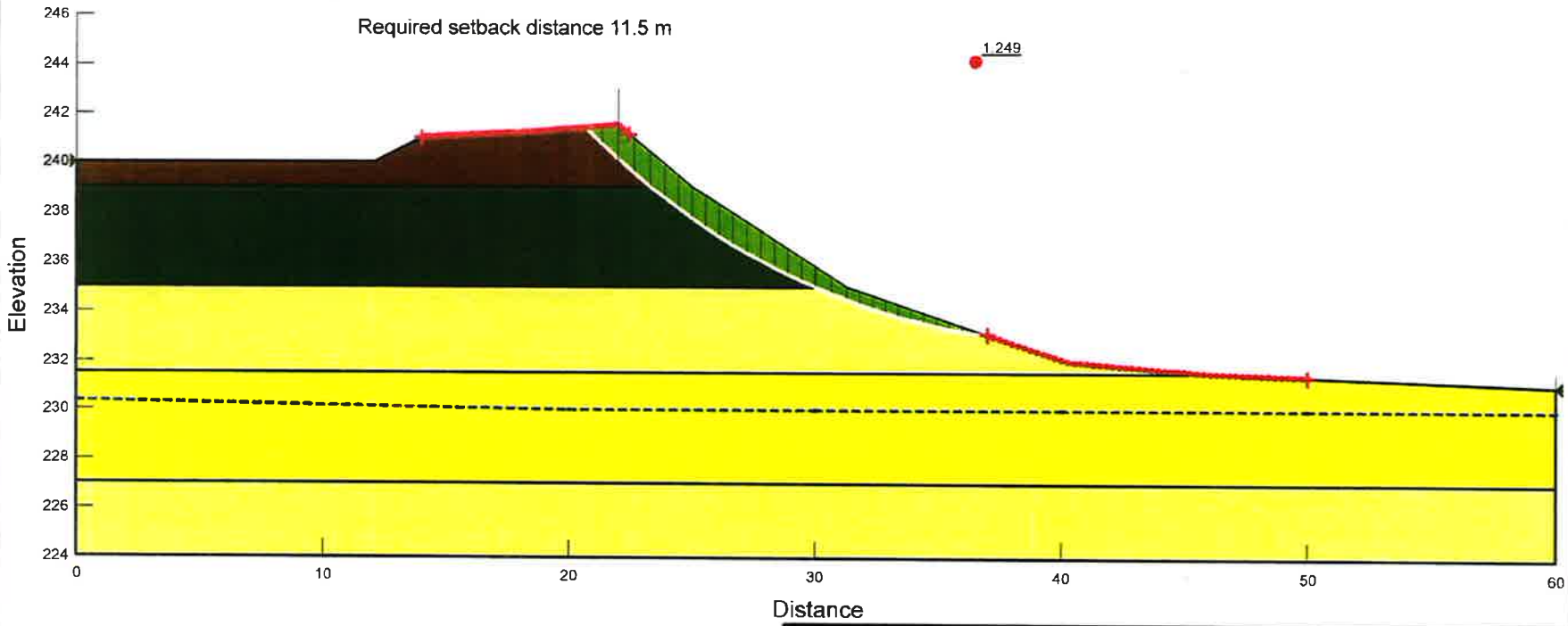


Symbol	Borehole n°	Sample n°	Depth (m)	Description
○	BH-01-20	SS-3	1.52 - 2.13	Sandy Caley SILT, trace Gravel
□	BH-01-20	SS-12	12.19 - 12.80	SAND, trace Silt
▽	BH-02-20	SS-7	4.57 - 4.80	Clayey SILT, some Sand, trace Gravel
☆	BH-03-20	SS-3	1.52 - 2.13	SAND, some Silt, trace Gravel and Clay

Appendix D Slope W Analysis

BH-01-20
BH-02-20
BH-03-20

Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line
	Dense to very dense sand	Mohr-Coulomb	20	0	35	0	1
	Dense to very dense silt till	Mohr-Coulomb	19	0	32	0	
	Loose sand	Mohr-Coulomb	18	0	29	0	1
	Silt layer at the ground surface	Mohr-Coulomb	17.5	5	26	0	

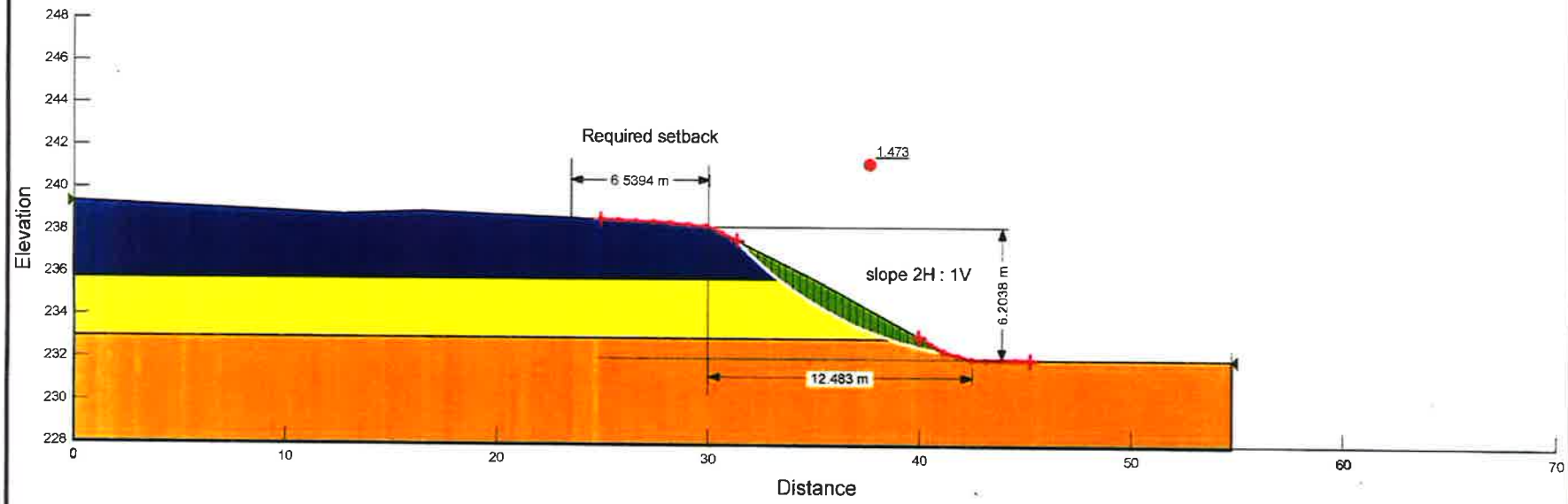


Slope/W Analysis BH-01-20

BH 01-20-Setback distances of 11 m.gsz

2021-01-26 1:252

Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)
	Fill upto 3 m - Very loose sandy silt some clay	Mohr-Coulomb	17.5	5	29	0
	Sand - below 5.79 m - dense to very dense	Mohr-Coulomb	20	0	35	0
	Sand and silt - 3 m to 5.79- compact to very dense	Mohr-Coulomb	19	0	32	0

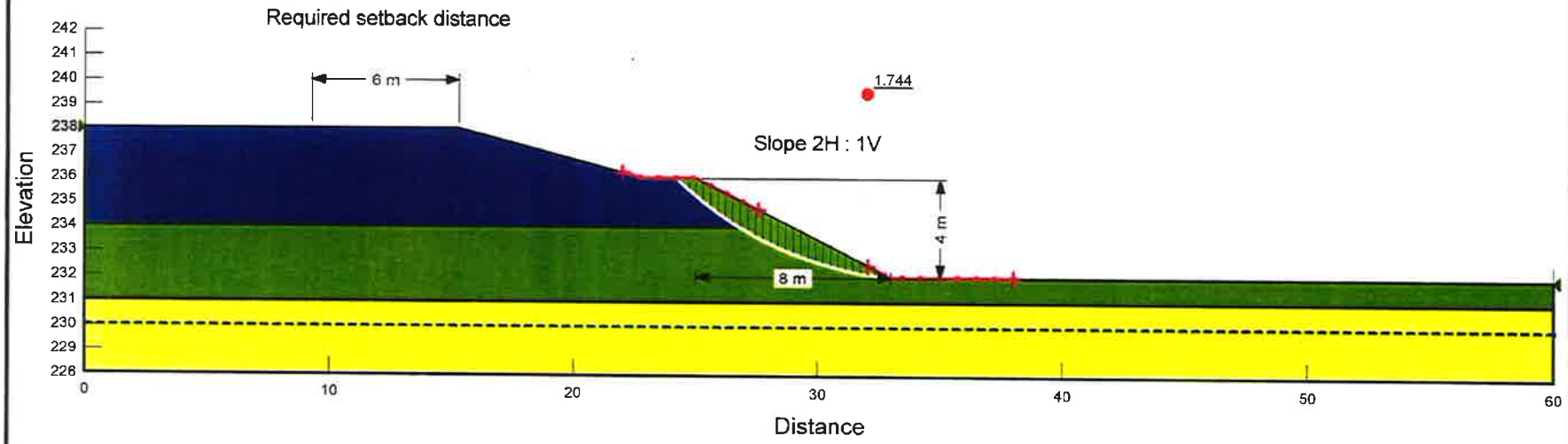


Slope/W BH-02-20

BH-02-20- 2005877- 2H to 1V-FOS 1.47- req setback 6.5 m.gsz

2021-01-26 1:291

Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Phi-B (°)	Piezometric Line
	Fill - Very loose to loose	Mohr-Coulomb	17.5	2.5	28	0	1
	Sand - Compact to very dense	Mohr-Coulomb	19	0	32	0	1
	Silt till - Compact	Mohr-Coulomb	19	2.5	30	0	1



Slope Stability- BH-03-20-02005877	
BH-03-20-2005877_PV Setback distance 6 m.gsz	
2021-01-26	1:252

J.H. COHOON ENGINEERING LIMITED

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#12502

April 30, 2021 (UPDATED)

Norfolk County
Planning Department
185 Robinson Street, Suite 200
Simcoe, Ontario
N3Y 5L6

Attention: Mr. S. Gradish
Development Technologist

Dear Sir:

Re: **Proposed Residential Development**
Nichol Street
Waterford, Ontario
Traffic Considerations

In response to a request of Ms. Nicole Goodbrand of Norfolk County Planning Department, we would like to take this opportunity of updating you on the traffic considerations of the impact of the change in the proposed development from 32 single family homes to 41 street townhouse units on the subject property.

In this case, an original traffic brief was prepared by Mr. F. Berry of F.R. Berry and Associates (Transportation Planning Consultants) in his correspondence dated May 14, 2018 (copy attached).

The original traffic brief outlined the current conditions of the streets in the vicinity of the site which indicated that the traffic volumes in the area were low as the development is low density residential in nature with the industrial commercial uses also being low.

The original traffic being generated by the site was outlined to approximately 7 entering trip vehicles and 21 existing trips during the morning peak hour with the afternoon peak being 21 entering trips and 13 exiting trips during the afternoon peak time period. These were indicated to be established utilizing the Institute of Transportation Engineer (ITE) Trip Generation Manual, Tenth Edition. With the change in the style of residential units within this development, a change in the peak hour trips would be realized. However, the total trips likely would be reduced on a per unit basis which would result in the following:

Peak Morning Period 9 vehicle trips entering
32 vehicle trips exiting

Peak Afternoon Period 26 vehicle trips entering
15 vehicle trips exiting

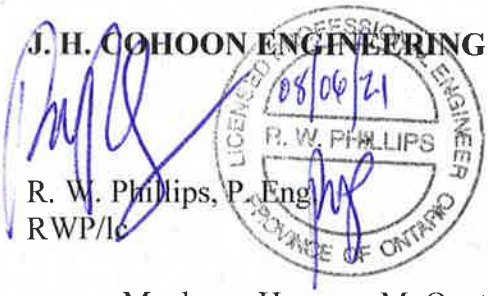
The resulting peak hour demand on Nichol Street would remain below the 100 vehicle trips per hour which is well within the capacity of the street which was estimated at 1000 to 1500 vehicles per hour. Similarly, the impact on the abutting streets (i.e., Alice Street) would have incremental increase of about 25 vehicles per hour. This magnitude of traffic volumes would not be considered significant.

In consideration of an increase in traffic over a 20-year time horizon at a 1.5% annual growth rate, then the resulting peak flows on Nichol Street would be 135 vehicles trips per year in the year 2041. The capacity of the street being estimated at 1000, to 1500 vehicles per hour. This magnitude of traffic volumes would not be considered significant.

I trust that this information will be of some assistance in evaluating the impacts of the proposed development on the above noted traffic infrastructure. If you have any further questions, please do not hesitate to contact this office.

Yours truly,

J. H. COHOON ENGINEERING LIMITED



R. W. Phillips, P. Eng.
RWP/lc

c.c Mayberry Homes – M. Quattrociocchi

F.R. Berry & Associates
TRANSPORTATION PLANNING CONSULTANTS

660 Inverness Avenue
London, Ontario N6H 5R4
Tel: (519) 474 2527 Toll Free: 1 888 665 9192 Email: fyberry@rogers.com

May 14, 2018

Our Ref. **1835**

Mr. M. Quattrociocchi
32 Dunsdon Street
Brantford ON
N3R 3J3

Dear Mr. Quattrociocchi:

RE: PROPOSED RESIDENTIAL DEVELOPMENT
223 NICHOL STREET, WATERFORD

At your request, I have assessed the potential traffic impact of your proposed residential development at 223 Nichol Street in Waterford. The location of the site is shown in **Figure 1**.

Nichol Street in the vicinity of the site is a two lane local street which terminates approximately 200 metres west of the west limit of the site. Between Main Street and St. James Street, traffic operation on Nichol Street is limited to one-way westbound. West of St. James Street, Nichol Street has recently been rebuilt with a wider pavement. Eastbound traffic on Nichol Street has the option of turning left to access Alice Street and the downtown business district, or turning right to reach Main Street via Temperance Street or Church Street.

West of St. James Street, traffic volumes on Nichol Street are relatively low. The area is characterized by low density single family residences. There are only two significant traffic generators on Nichol Street in this area, the Legion Hall immediately west of the site and the Waterford Heritage and Agricultural Museum west of Washington Street. Neither of these facilities is expected to generate traffic during weekday peak hours.

There is an industrial area to the west of the site including a self-storage facility at the intersection with McCool Street and some abandoned silos at the west end of Nichol Street. Typically, self-storage facilities generate little or no traffic during weekday peak periods. There are adjacent industrial facilities with access off Church Street West. None of these facilities would have any significant impact on traffic operation on Nichol Street.

The site plan for the proposed development is shown in **Figure 2**. Based on fitted curve equations contained in the Institute of Transportation Engineers (ITE) Trip Generation Manual, Tenth Edition, 32 single family homes will generate 28 vehicle trips in the morning peak hour, 7 entering and 21 exiting, and 34 vehicle trips in the afternoon peak hour, 21 entering and 13 exiting. All of these trips would access and leave the site to and from the east. **Figure 3** shows the estimated assignment of these trips to the local street system. A single point of access has been shown at the site for simplicity.

The capacity of a two lane local street is generally considered to be in the range of 1000 to 1500 vehicles per day, or up to 150 vehicles in the peak hour. West of St. James Street, the current demand in the weekday peak hour is estimated to be no more than 50 vehicles. The addition of up to 34 vehicles in the peak hour would bring the future demand on this section of Nichol Street to less than 100 vehicles per hour, well within the capacity of the local street.

East of St. James Street, site generated traffic would be distributed to several streets as shown in **Figure 3**. The majority of site generated trips are likely to use Alice Street, with anticipated peak hour incremental volumes of about 20 vehicles. These increases would have no significant impact on Alice Street. Other streets would have incremental volumes of less than 10 vehicles per hour.

All intersections in the study area are two-way stop controlled. Sight distance is not an issue at any of the intersections.

In summary, the proposed residential development is expected to generate about 28 vehicle trips in the morning peak hour and about 34 vehicle trips in the afternoon peak hour. The addition of site generated trips to the local street system will have no significant impact on traffic operation and safety on these streets.

Very truly yours
F. R. Berry & Associates

Frank R. Berry, P.Eng.
Principal

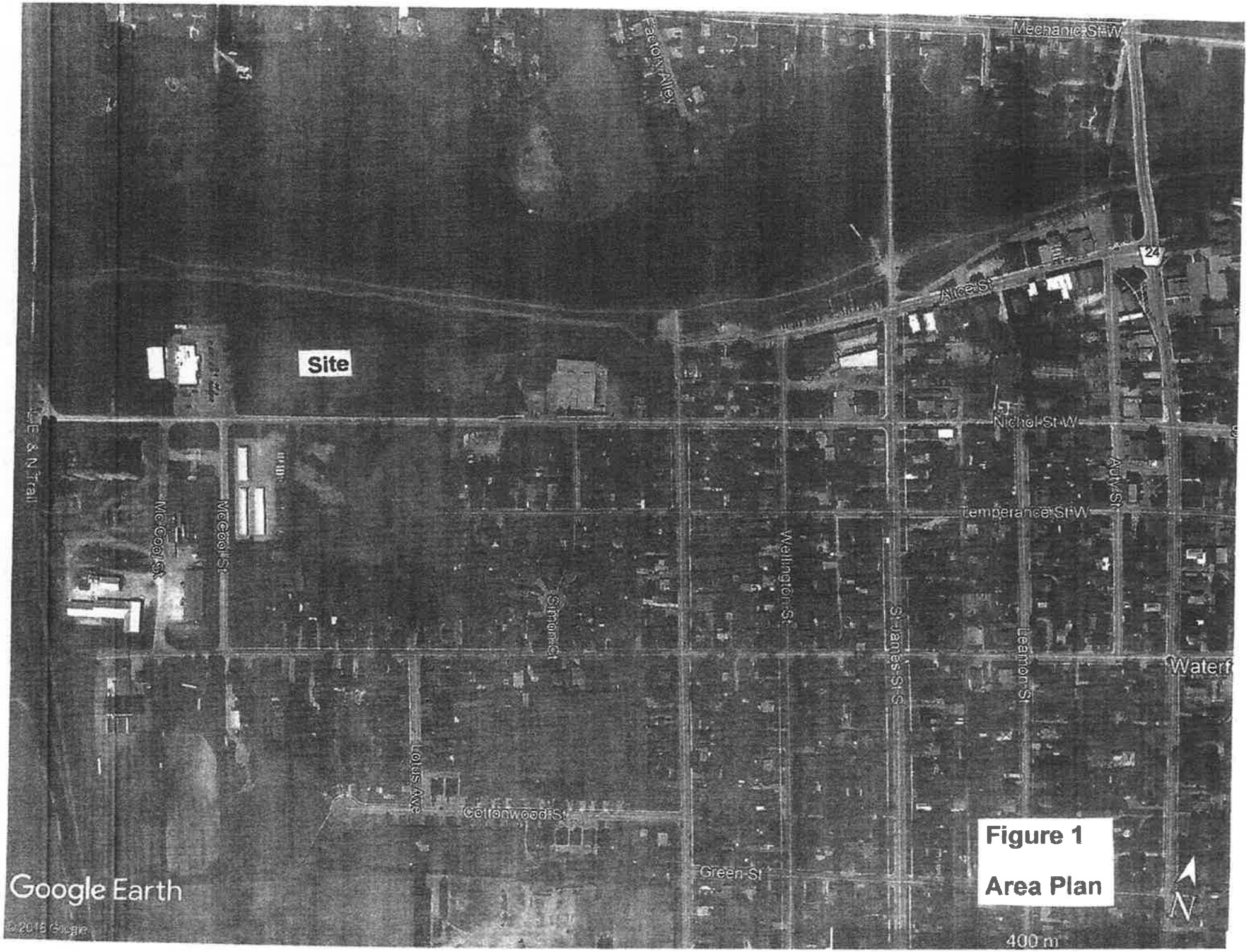
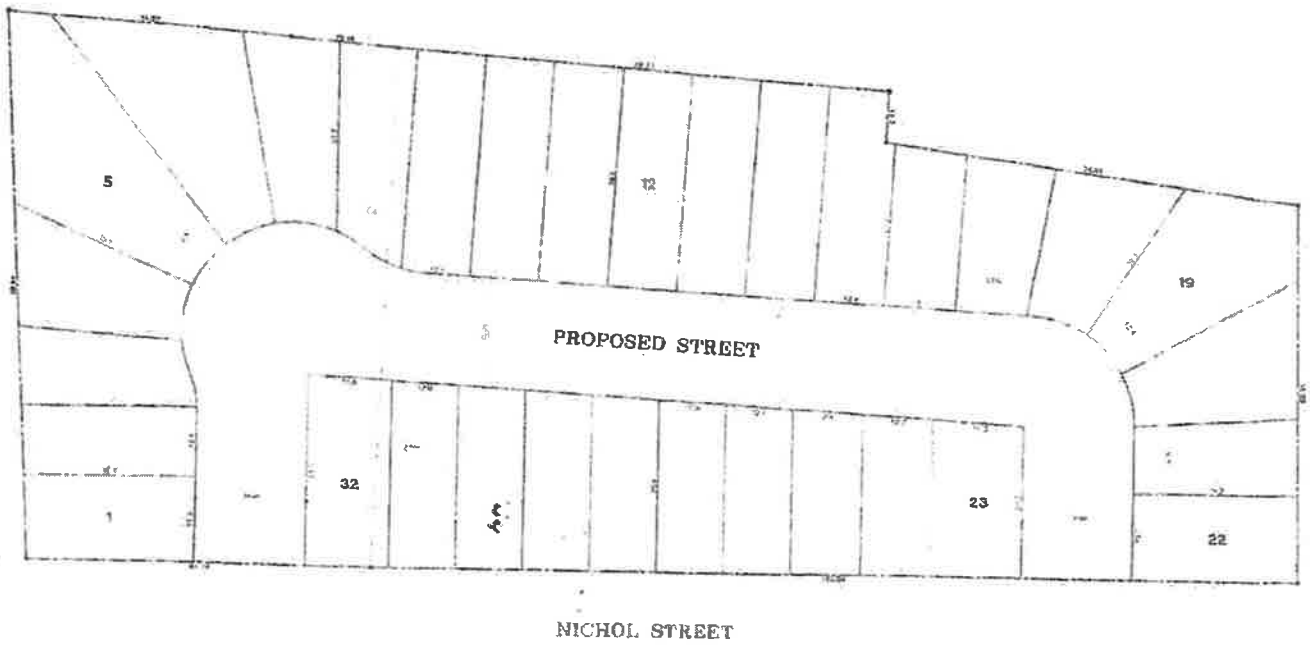


Figure 1

Area Plan



J.H. COHOON ENGINEERING LIMITED

PROPOSED RESIDENTIAL DEVELOPMENT
NICHOL STREET
NORFOLK COUNTY

MAYBERRY HOMES

CONCEPT PLAN No. 1

12502

12502-C1

Figure 2

Site Plan

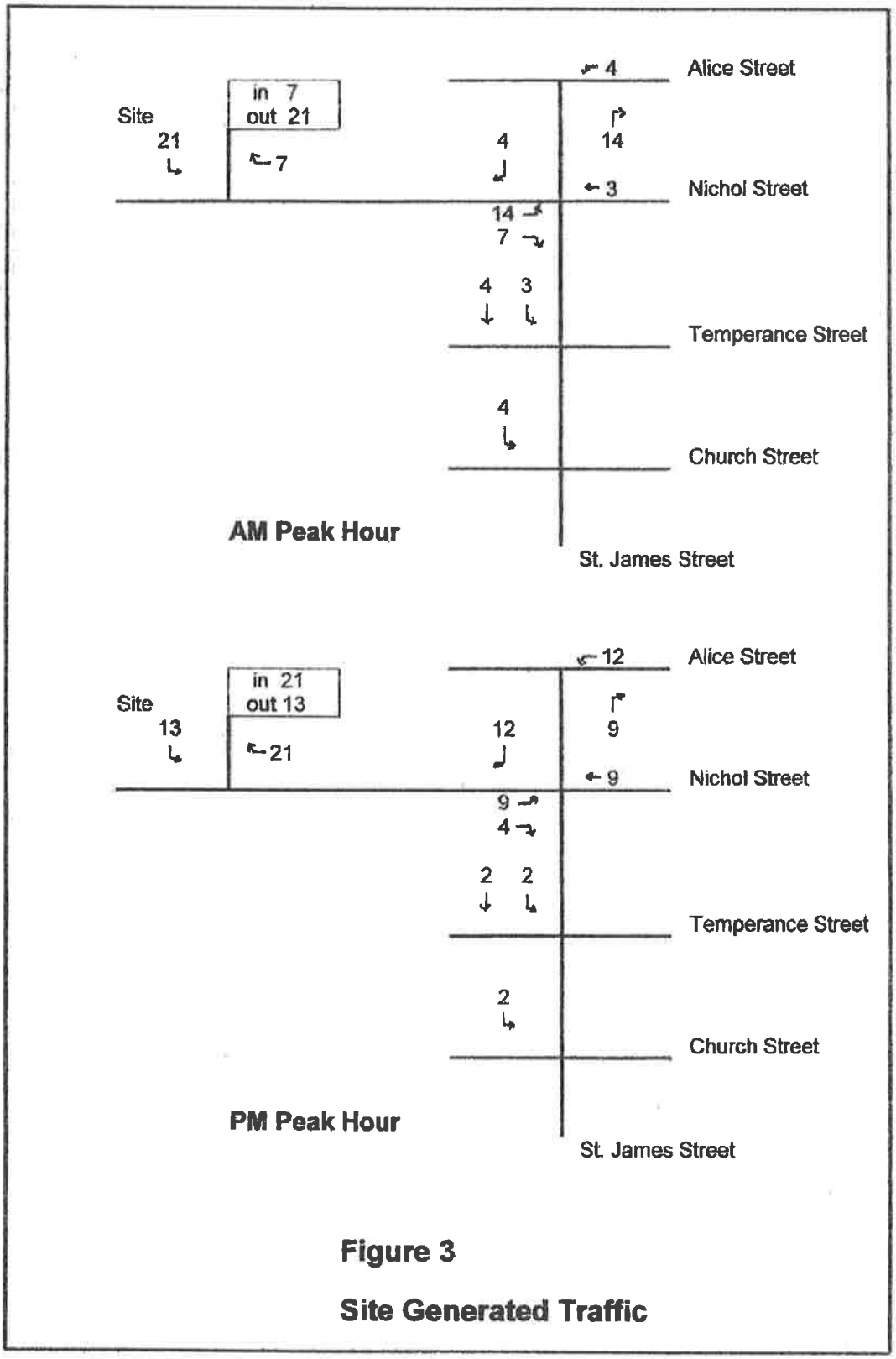


Figure 3

Site Generated Traffic

Stage 1 and 2 Archaeological Assessment of the Waterford Housing Development Registered Plan 19-B Part Lot 5, Concession 8, Township of Townsend Now in the Town of Waterford County of Norfolk

P387-0032-2020, P387-0034-2020

Prepared by:
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Date: November 23, 2020
Type of Report: Draft

Executive Summary

This report describes the methodology and results of the Stage 1 and 2 Archaeological Assessment of the Waterford Housing Development, Registered Plan 19-B, part of Lot 5, Concession 8, Township of Townsend, County of Norfolk. This study was triggered by a Municipal Class EA, and conducted under the Professional Archaeological Consulting License P-387 issued by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) for the Province of Ontario.

Horizon Archaeology Inc was engaged by the proponent to undertake a Stage 1 Archaeological Assessment of the study area and was granted permission to carry out archaeological fieldwork by the proponent. The study area was subject to a Stage 1 site inspection on October 28th , 2020. As per Section 1.1.2 of the Standards and Guidelines for Consultant Archaeologist the mapping provided by the proponent represents the best available (MHSTCI 2011).

The proponent is proposing to build a new housing subdivision in the Town of Waterford. The site inspection found that 90% of the project area had been previously disturbed by earth moving activities. A small section on the northern border of the project area, approximately 8m wide but running the entirety of the project area, is not disturbed.

On November 29, 2020 Horizon Archaeology Inc was granted permission by the proponent to conduct the Stage 2 test pit survey. Test piting was completed on a 5m grid, with test pits being at least 30cm in diameter, excavated 5cm into subsoil, with all soil being screened through 6mm mesh. Screens were checked for artifacts and test pits were examined for stratigraphy and cultural features. No archaeological materials were recovered during the Stage 2 test pit survey.

Based upon the background research, the results of the property inspection and the Stage 2 test pit survey it is recommended that the project area should be cleared of further archaeological concerns

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Project Personnel

Project Director:	Victoria Brooks-Elder, MA (P387)
Field Director:	Victoria Brooks-Elder
Field Crew:	Samantha Price, M.A.
Photographs:	Victoria Brooks-Elder
Report Preparation:	Victoria Brooks-Elder
Maps:	Proponent
	Victoria Brooks-Elder

1.0 Project Context

1.1 Objectives

The objectives of a Stage 1 archaeological assessment, as outlined by the Standards and Guidelines for Consultant Archaeologists (2011), are as follows:

1) To provide information about the property's geography, history, previous archaeological fieldwork and current land conditions
2) To evaluate in detail the property's archaeological potential, which will support recommendations for Stage 2 survey for all or parts of the property
3) To recommend appropriate strategies for Stage 2 survey

1.2 Development Context

This report describes the methodology and results of the Stage 1 Archaeological Assessment of the Waterford Housing Development, Registered Plan 19-B, part of Lot 5, Concession 8, Township of Townsend, now in the Town of Waterford, County of Norfolk (**Map 1-2**). This study was triggered by a Municipal Class EA, and conducted under the Professional Archaeological Consulting License P-387 issued to Victoria Brooks-Elder by the Ministry of Heritage, Sport, Tourism, Culture Industries (MHSTCI) for the Province of Ontario.

Horizon Archaeology Inc was engaged by the proponent to undertake a Stage 1 Archaeological Assessment of the study area in advance of a housing development (**Map 3**) and was granted permission to carry out archaeological fieldwork by the proponent. The study area was subject to a Stage 1 site inspection on October 13th, 2020. As per Section 1.1.2 of the Standards and Guidelines for Consultant Archaeologist the mapping provided by the proponent represents the best available (MHSTCI 2011).

The archaeological assessment reported here was undertaken on the Treaty Lands and Territory of the Mississaugas of the Credit.

All records, documentation, field notes and photographs related to the conduct and findings of the these investigations are held at the office of the licensee with copies at the Horizon Archaeology Inc office in North Bay until such time that they can be transferred to an agency or institution approved by the Ontario Ministry of Heritage, Sport, Tourism, Culture Industries on behalf of the government and citizens of Ontario. The documentary record generated in the field comprises of one page of field notes, GPS points, and 15 digital photographs.

1.3 Historical Context

1.3.1 Pre-Contact Period

Palaeo-Indian sites date 10,000 to 5,000 B.C. , and inhabited a tundra like environment as the glaciers retreated northward. In such an environment, fruits, nuts and other sources of food harvested from trees or other plants are rare, and it is thought that the Palaeo-Inidans subsisted largely by hunting, trapping and fishing (Ellis 2013: 36). Palaeo-Indian sites are most often located on relic beach ridges associated with glacial lakeshores (Stork 1984). They have also been located at ancient river crossings, places where modern caribou hunters often assemble as the animals may slow and file through a narrow area making them easier to hunt (Ellis 2013: 36). The predominance of sites being located on ancient strandlines may be more indicative of the survey methodology employed to find them rather than an actual preference for site situation on the part of the Palaeo-Indian peoples of Ontario, as a number of sites have been recovered away from ancient shorelines (Ellis & Deller 1990: 50)

Most Palaeo-Indian sites are small, indicating campsites that were inhabited briefly as its occupants followed the seasonal routes and cycles of their prey. Larger sites seem to be associated with animal migration routes, primarily at river crossing as mentioned above (Ellis 2013: 35-6).

Large, fluted spear points define an Early Palaeo-Indian site. While one of the earliest artefacts in North America, they are also one of the most technologically advanced stone tools on the continent (Ellis 2013: 37-8). Other artefacts encountered include hammerstones, and large choppers, knives / cutting tools, lunate bifaces, and piece esquillée's, possibly employed as wedges for wood or bone working, unifacial triangular end scrapers, beaked scrapers, spokeshaves, burins or gravers (Ellis & Deller 1990: 43, 47-9).

Late Palaeo-Indian points do not exhibit the same fluting that is present on Earlier assemblages. Two point types are found on Late Palaeo-Indian sites, one group having a concave base with either rounded or pointed ears, and the other group comprising lanceoloate forms (Ellis 1990: 57-8). Most of the lithic tool kit continues from the Early Palaeo-Indian Period, however there a few new forms or tools that appeared, including: drills, and small thumbnail or fan shaped end scrapers replace the unifacial triangular end scraper (Ellis & Deller 1990: 59).

The toolstone recovered from Palaeo-Indian sites in Ontario has been sourced to have been quarried from sites up to 200 km away. The tool stone was likely at least roughed out at the quarry site and carried to the site on seasonal routes. Other sources originated further afield from sources in Ohio or Michigan, and were likely obtained through trade (Ellis & Deller 1990: 43).

The Archaic peoples were still nomadic hunter-gatherers, however the greater range of tools has caused some to hypothesise that this indicated a shift from exploiting large-game over a large

area to a more extensive, localised range (Ellis et al 1990: 67). This could also be a factor of preservation of perishable materials, which is also a factor from the earlier Palaeo-Indian period.. There is also evidence, through presence of imported / exotic cherts, that great distances were still covered during seasonal rounds (Ellis et al 1990: 78).

In southern Ontario, the Archaic is subdivided into Early, Middle, and Late periods, which in turn are further subdivided into horizons based upon point types (Ellis et al 1990). In northern Ontario, there is no such subdivision and the entire period is known as the Shield Archaic (Wright 1972, Hamilton 2013). Areas around the north shore of the Great Lakes, and along the southern border between northwestern Ontario and Minnesota could possibly have been part of the Middle Archaic "Laurentian Archaic" group found in southern Ontario (Hamilton 2013, Ellis et al 1990).

The Archaic period also witnessed the rise of the "Old Copper" culture centred around Lake Superior."Old Copper" culture is a name given to the people from this area who exploited the available copper veins or outcroppings, and not a distinct Archaic group separate from others based upon material culture, settlement patterns etc. Copper artefacts from this area have been recovered from sites in Southern Ontario, west to into Saskatchewan, and south of Lake Michigan into Illinios (Hamilton 2013: 89). Copper artifacts include spear points, knives, chisels, and celts (Dawson 1966). Most of these artifacts have been found by collectors or out of context and their role in society is open for debate.

A major change in the Archaic tool-kit from that of the Palaeo-Indian period is the appearance of smaller, notched points that replace the large lanceolate forms. This has been thought to indicate a technological advance; the adoption of the spear-thrower, or *atl atl* . Other artifacts typical of the Archaic period include those associated with wood-working such as axes, gouges and adzes (Ellis et al 1990: 65). These woodworking tools have been thought to indicate that the dug-out canoe was introduced during this period.

Archaic houses are rare, however the Davidson Site (AhHk-54) along the Ausable River inland from Lake Huron has revealed a number of features that have been identified as pit-houses, dating to the Late Archaic, predating 3000 BP based upon dates from carbonised remains found in flood deposits above the floor (Ellis et al 2010).

The house was circular, approximately 5 metres in diametre, had a sloping entrance, interior hearth, posts, and a bench surrounding the edges of the structure, and likely possessed a soil or sod roof. It was hypothesised that this structure was a cold weather domicile, owing to the greater insulating properties of pit-houses (Ellis et al 2010: 10). The labour involved in construction of such a house is also believed to indicate a more-or-less sedentary lifestyle, those occupying it relying on stored foodstuffs (Ellis et al 2010: 10).

Burials from southern Ontario date to the Late Archaic, and have been divided into two

complexes, the Haldimand and Glacial Kame. While it has been hypothesised that the Haldimand Complex groups interred their dead in what could be the first cemeteries in the province, it is fairly certain that the Glacial Kame culture had deliberate cemeteries to bury their deceased, possibly in an annual ritual or celebration (Ellis et al 1990: 116-8). Haldimand Complex burials included projectile points, chert bifaces, red ochre, copper artefacts including beads and awls, and beaver incisor grave goods (Ellis et al 1990: 116). Glacial Kame burials were composed both of inhumations as well as cremations. Grave goods were rather elaborate, and included bannerstones, bird stones, stone pipes, copper artefacts including adzes, awls and beads, bear maxilla masks, exotic sea shells, and gorgets (Ellis et al 1990: 116-8).

In southern Ontario the Woodland, like the Archaic period, has been subdivided into three phases, Early, Middle and Late, dating between ca. 1000-900 BC to and AD 1650-1700. This period is marked by the introduction of pottery. The Late Woodland period begins ca. AD 800 with the widespread adoption of agriculture.

The Early Woodland people still maintained seasonal routes similar to those from the preceding period. The adoption of pottery seem to indicate an increasing exploitation of plant resources (Williamson 2013: 48). These seasonal rounds were likely focussed around watersheds with families living separately in autumn and winter, coming together in the spring and summer to exploit seasonal resources such as fish spawning. While these larger groups had their own territories, they were not isolated and did not isolate themselves.

Across most of southern Ontario, Quebec and western New York State the people of the Early Woodland shared a similar culture known as “Meadowood”. Common artefacts from this time period include: Vinette 1 ceramics, distinctive side-notched “Meadowood” projectile points, and the “Meadowood Cache Blades”, trapezoidal gorgets, and bar and expanded bodied pop-eyed birdstones. Also common on Meadowood sites are drills and scrapers made from Meadowood preforms, other gorget types, pendants, copper beads and awls, and fire making kits of iron pyrite. These artefacts are believed to have developed from the preceding Glacial Kame culture of the Late Archaic (Spence et al 1990: 128-9). This could be indicative of the extension or continuance of the Archaic period type lifeways into the Early Woodland in the region like has been hypothesised for other regions of northern Ontario.

Most of what is known about the Meadowood culture stems from cemeteries, domestic sites often yield little in the way of house plans, often only hearths and pits are recovered. People were buried in individual graves, often coated with imported red ochre with varying quantities and types of grave goods. Long-distance trade items recovered from both cemetery and domestic sites are numerous, but also less so compared to the preceding period (Spence et al 1990: 136).

The Early Woodland Middlesex Complex indicates increasing influence from Adena and Hopewell Complexes in the mid-west United States, what is now Ohio and Indiana. These include both finished artefacts and raw material that originate in this area. Burial mounds also

appear on the Ontario landscape, and are also believed to be a result of influence or increasing contact from this region (Spence et al 1990: 138-42).

The Middle Woodland period in southern Ontario has revealed three separate complexes or cultures: the Couture in the southwest, the Saugeen in the northwestern portion of southwestern Ontario, and Point Peninsula in the central and eastern parts of southern Ontario. Owing to the still nomadic nature of these groups, 'borders' are not clearly defined, and within these groups there is still variability. There is also the possibility that there exist other complexes that owing to the lack of research that have so far been classified as belonging to Point Peninsula and Saugeen especially (Spence et al 1990: 143-8).

Common Middle Woodland artifacts include psuedo-scallop shell followed by dentate stamp decorated ceramics, and Vinette 2 ware. Other artefacts recovered from Middle Woodland sites include bone and antler harpoons, antler combs with incised decorations, antler hafted beaver incisors, bone fish hooks, and a wide variety of projectile point forms (Spence et al 1990: 158). The construction of burial mounds continued into the Middle Woodland period.

Settlement patterns indicate a gathering of family groups between the spring and autumn at or near river mouths to fish, then to harvest wild rice, hunt deer and gather nuts. In the winter, the groups would disperse and travel inland to each families' winter camping territory (Spence et al 1990: 164).

In northern Ontario, the Woodland period has been divided into 2 periods, known as Initial and Terminal Woodland. The Initial Woodland period coincides with the Middle Woodland of southern Ontario. Laurel Tradition artifacts define the Initial Woodland period in northern Ontario. Early and Late manifestations of this tradition have been identified, the early phase dating between 200 BC and 500 AD, and the late 500 to 1000 AD. The Laurel Tradition occupies nearly all of the northern parts of the province, save for the very far north, and as far south in Ontario as Lake Nipissing and the French River. The Laurel Tradition spans north and eastern Manitoba, and a small part of Saskatchewan in the west, and extends into northern Quebec to the east, and into northern Minnesota and Wisconsin. Initial Woodland sites are often located along river banks or on the shores of lakes.

Burial mounds were constructed in the Middle/Initial Woodland period throughout. The best known and most researched group is the Manitou Mounds near Rainy River. The mounds were constructed of relatively clean fill or sod over top of wooden cribbing or scaffold that contained the initial burials (Dawson 1981: 34, Wright 1986: 63-4). Remains of birch bark baskets have been recovered from the mound fill (Dawson 1981: 34, Wright 1986: 34). Subsequent burials, either primary inhumations or secondary burials, interred alone or in a mass burial have been recovered from the mound, and at its base (Wright 1986: 63). Some of the burials were coated with powdered red ochre, and grave goods included such items as lithic bifaces, ceramics, and exotic imports such as a monitor pipe, and an Ohio pipestone sucking tube (Dawson 1981:34,

Wright 1986:64). Closer to the project area, a burial ground containing artefacts from the Meadowood Complex was excavated near Kilarney on the north shore of Lake Huron (ASI 1994: 8).

Laurel ceramics were produced from either a single lump of clay or by coil manufacture, grit tempered, a smoothed exterior, rims relatively straight with the lip either flattened or rounded (Wright 1967, Wilford Laboratory of Archaeology 2012). There are a variety of decorative techniques utilised on these vessels including a variety of incised, stamped, punctated, embossed, and cord-wrapped stick decorations (Wright 1967, Wilford Laboratory of Archaeology 2012).

Early in the Laurel sequence, projectile points continue to resemble the notched points of the Archaic period (Dawson 1981:3). These are later superceded by stemmed points (Dawson 1980: 55). Side scrapers dominate scraper types in the early phases, and end scrapers assume prominence in the later phases (Dawson 1980: 33). Other typical tools include stone biface blades, abraders, pottery decorating tools, and net sinkers, copper beads, awls, barbs, fragments, nuggets, pendants, projectile points, chisels, and bone awls, needles, knives which are usually manufactured from beaver incisors, pottery decorating tools, and beads (Wright 1967: 152, Dawson 1980:33, 1981: 34).

The Late Woodland period in southern Ontario saw the widespread adoption of agriculture and increasing sendentarisation. This period has numerous cultural and temporal subdivisions within it: commencing ca. AD 600 with the Princess Point complex, and culminating with the Huron, Neutral, Petun, Odawa and other groups encountered by explorers, missionaries and traders.

Settlement size increases in southern Ontario, especially in the later Late Woodland period, with people living in large palisaded villages in locations that may have been chosen with defence at least partly in mind. Ossuary burials become common, where the dead were communally interred in pits along with grave goods.

The Late (Terminal) Woodland in Northern Ontario is composed of numerous ceramic assemblages; Blackduck, Selkirtk Composite, and the Sandy Lake/Psinomani Complex. The last two assemblages are restricted to areas of northwestern Ontario, and unlikely to be recovered in the study region. Blackduck, out of all the northern Ontario Terminal Woodland groups is the most likely to be found in Muskoka.

Blackduck ceramics are globular, and are more rounded than the other Late Woodland ceramics from northern Ontario, with a more constricted neck, and often have out-flaring rims. They are produced by the paddle and anvil technique, and tempered with grit. Decoration is usually limited to the interior and exterior of the rim, and the exterior neck. Decorative techniques include cord-wrapped stick stamping, “comb” stamping, punctuations of various kinds, and vertical brushing on the exterior rim surface. Distinctive of early Blackduck vessels is bossed decoration, a motif that appeared late in the Laurel sequence (Wilford Laboratory of Archaeology 2010, Wright

1967). Pottery of typical Blackduck manufacture but with Laurel design motifs have been recovered, and these have been dated to very early in the sequence, as early as 700 AD (Dawson 1982:32).

Non-ceramic artefacts considered typical of the Blackduck people include: clay pipes, stone oval and lunate chipped knives; side scrapers; trapezoidal, oval, and thumbnail end scrapers; tubular-shaped drills; steatite pipes; bone awls and needles; unilaterally barbed harpoon; spatulas antler flakers; beaver incisor knives; bear canine ornaments; and native copper fishhooks, gorges, and beads (Gibbon & Anfinson 2008).

1.3.2 Post-Contact

The first Europeans to come to what would become Norfolk County were two French missionary priests, Casson and Galinee, who were based out of Montreal. In October of 1669 they constructed two log cabins where they spent the winter where Port Dover would one day stand (Norfolk Genealogy 2019).

In 1792 August Jones completed his survey and created the County of Norfolk. Norfolk County was named after Norfolk in England. Between 1815 and 1825 the capital of the London District was located in Vittoria, within Norfolk County. In the late 19th and early 20th Centuries Norfolk County was noted for its fruit production. Around World War 1 tobacco was introduced to the area, which greatly increased the value of crops. Norfolk County was also home to small factories in towns such as Waterford and Simcoe. It was also home to the first provincial forest nursery, established in 1908. In 1974 Norfolk and Haldimand Counties were joined to become the County of Haldimand-Norfolk but were split again in 2001. As present Norfolk County is known for growing tobacco, small grains, peanuts and ginseng (Mcdonald 2012).

On February 7th, 1792 Lieutenant Governor Simcoe issued a proclamation inviting prospective settlers with a promise of free land grants in Upper Canada. American entrepreneurs formed settlement companies and applied to the government for entire townships in which to establish their clients. Pierce and associates prepared a petition in 1793 requesting six townships in Upper Canada but were granted three - Darlington, Townsend and Windham.

Townsend Township was originally named Exeter but was renamed by Simcoe. It was named after Thomas Townsend, Lord Sydney, the British Secretary of State. He had distinguished himself as a general in the taking of Quebec in the Seven Years War. The earliest official document of settlement was given to Strong Sturgess in 1793 (Mutrie).

In 1796 Jab Slaght and family left New Jersey for the Niagara District where he purchsed 1400 acres of land. A year later, in 1797, he came along the shore of Lake Erie and turned north at what would become Port Dover. Here, he and his family followed a First Nations trail until it reached the Nanticoke Creek. Here they settled on Lot 8 and 9, Concession 8 in Townsend

Township. Others who same with the Slaght family included Ezra Parney who helped clear the land and Paul Averill who built the first mill in the area.

Originally Waterford was called Averill's Mill after the grist mill first constructed by Paul Averill. It was then called Sayle's Mills and then Sovereign's Mills. The town grew, centred on the grist mill and the Nanticoke Creek (Norfolk Tourism).

After the War of 1812 the mill site, which has been burned by invading American forces, was rebuilt by Job Loder who also added a saw mill to the grist operations. It was at this time that the town was known as Lodorsville. The mill was then bought by Aaron Slaght. It burned down again and was replaced with a stone structure. This mill was taken down in the 1930s to make way for the highway bridge (Pearce 1941: 3-4).

In 1826 the post office was opened and renamed the town again to Waterford, after the county in Ireland. The Canadian Southern Railway, connecting Buffalo and Detroit passed through the town until the decline of the railway in the mid 20th Century (Norfolk Tourism).

1.3.3 Summary of Historical Context

The project area is located within the Town of Waterford, which was first established by Jab Slaught in 1796. The town grew steadily with a grist and saw mill on the Nanticoke Creek.

1.4 Archaeological Context

1.4.1 Current Conditions

The project area is located on part of Lot 5, Concession 8, Registered Plan 19-B, Township of Townsend, now in the Town of Waterford, County of Norfolk. The developer plans creating a housing development. The project area is bounded to Nichol Street to the south, the local Canadian Legion to the west, railway to the north and a field to the west. The project area was disturbed by earth moving activities prior archaeological assessment. The remaining undisturbed area consists of a forested area.

1.4.2 Physiography

The project area is located within the Norfolk Sand Plain. This is a region of low relief with slopes being reported being a long as 0.1 or 0.2m per km. The region is composed of sands and silts which were deposited by glacial Lakes Whittlesay and Warren. These deposits can be up to 23m thick but are usually less than 9m (Barnett 1978: 3).

1.4.3 Previous Archaeological Assessments

No archaeological assessments have taken place within 50m of the project area.

1.4.4 Registered Archaeological Sites

A request of the MHSTCI data base showed that there were 35 archaeological sites registered within 2km of the project area.

Table 1: Registered Archaeological Sites within 1km of the project area

Borden Number	*Site Name*	*Researcher*	*Time Period*	*Inferred Site Type*	*Comments*
AfHb-90		R. Williamson (1996)	Pre-Contact	Findsport	No further Cultural Heritage Value or Interest (CHVI)
AfHb-91		R. Williamson (1996)	Pre-Contct	Scatter	Further CHVI
AfHb-92		R. Williamson (1996)	Pre-Contact	Scatter	Further CHVI
AfHb-93		R. Williamson (1996)	Pre-Contact	Findspot	No further CHVI
AfHb-94		R. Williamson (1996)	Early Archaic	Findspot	One projectile point
AfHb-95		R. Williamson (1996)	Pre-Contact	Findspot	Further CHVI
AfHb-96		R. Williamson (1996)	Pre-Contact	Scatter	Further CHVI
AfHb-97		R. Williamson (1996)	Middle Archaic Post-Contact	Scatter Homestead	Further CHVI
AfHb-98		R. Williamson (1996)	Pre-Contact	Scatter	Further CHVI
AfHb-99		R. Williamson (1996)	Early Archaic	Findspot	No further CHVI
AfHb-100		R. Williamson (1996)	Pre-Contact	Scatter	No further CHVI
AfHb-101		R. Williamson (1996)	Middle Archaic	Findspot	No further CHVI
AfHb-102		R. Williamson (1996)	Pre-Contact	Scatter	Further CHVI
AfHb-103		R. Williamson (1996)	Pre-Contact	Scatter	Further CHVI

AfHb-104	Chanyi Pit #2 Property	R. Williamson (1996) S. Martin (2011)	Pre-Contact		
AfHb-105		R. Williamson (1996) S. Cherubin (2017)	Pre-Contact	Scatter	No further CHVI
AfHb-106		R. Williamson (1996) S. Cherubin (2017)	Pre-Contact	Scatter	Further CHVI
AfHb-107		R. Williamson (1996) S. Cherubin (2017)	Late Woodland	Hunting Loss	No further CHVI
AfHb-109		R. Williamson (1996) S. Cherubin (2017)	Middle Archaic Late Archaic	Brewerton Camp Lamoka Camp	No further CHVI
AfHb-110		R. Williamson (1996)	Pre-Contact	Scatter	No further CHVI
AfHb-111		R. Williamson (1996) S. Cherubin (2017)	Middle Archaic	Scatter	No further CHVI
AfHb-113		R. Williamson (1996)	Pre-Contact	Scatter	No further CHVI
AfHb-114		R. Williamson (1996) S. Cherubin (2017)	Early Archaic	Kick-Nettling scatter	
AfHb-115		R. Williamson (1996)			No further CHVI
AfHb-116		R. Williamson (1996)	Pre-Contact	Scatter	No further CHVI
AfHb-119		R. Williamson (1996)	Pre-Contact	Findspot	No further CHVI
AfHb-120		R. Williamson (1996)	Pre-Contact	Scatter	Further CHVI

AfHb-149		K. O'Neal (2012)	Late Archaic		
AfHb-150		R. Williamson (1996)	Other	Unknown	No further CHVI
AfHb-151		R. Williamson (1996)	Other	Unknown	No further CHVI
AfHf-30	Clendenning Farm 4	H. Martelle (2009)	Early Archaic	Scatter	Further CHVI

2.0 Field Methods

Stage 1 Site Inspection

An optional property inspection took place on October 28th, 2020. In keeping with Section 1.2.2 of the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011) the property inspection was completed when weather conditions permitted good visibility of land features. Inspection did not take place when weather conditions could reduce the chances of observing features of archaeological potential. The high for the day was 15 degrees Celsius.

The proponent is planning to construct a housing development on the project area. In keeping with Section 1.2 *Property Inspection* of the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011) the property was entirely systematically inspected. When Stage 1 site inspection took place the project area had already been disturbed by earth moving activities. Specifically, heavy machinery was present and the ground had been turned up and brought up to level with the roadway (**Figures 1-3**).

In keeping with section 1.3.2 *Features indicating that archaeological potential has been removed* in the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011) it was deemed that archaeological potential was deemed to not be present due to major landscaping involving grading below grade.

A small section of the project area, which runs east-west on the norther border was found to be undisturbed. This section was approximately 8m wide. At present this area is not to be developed. According to Section 1.3.1 *Features indicating archaeological potential* in the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011) this long area contains archaeological potential as it is located with 300m of a primary water source as well as being on elevated topography (**Figures 4-6**). Should this area be developed then it would require Stage 2 test pit survey in keeping with Section 2.1.2 *Test pit survey* in the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011).

Site inspection found that approximately 90% of the project area was disturbed while 10% contained archaeological potential (**Map 4**).

Stage 2 test pit survey

On November 29, 2020 Horizon Archaeology Inc completed the Stage 2 assessment of the Waterford housing development. The area under investigation was approximately 8m wide and 280m long and consisted of a forested area which contained a steep sloped leading down to a roadway to the north and the disturbed part of the project area to the south. To the east and west there was more forested area.

In keeping with Standard 3, Section 2.1 Property survey in the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011), stage 2 assessment took place in weather and lighitng conditions which permitted good visibility of land features. The high for November 29, 2020 was 9 degrees Celsius and the weather was sunny.

Test pit survey was completed on a 5m grid, with test pits being at least 30cm in diameter and being dug 5cm into subsoil. Test pits were examined for stratigraphy, cultural features and evidence of fill. All soil was screened through 6mm mesh and the screen checked for artifacts. All test pits were backfilled upon investigation. This was all done in compliance with Section 2.1.2 *Test Pit survey* of the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011). Test pits encountered at the Waterford housing development project area averaged a depth of 22cm and contained a dark brown loam soil and a bright orange subsoil. No artifacts were found during the Stage 2 assessment (**Figures 7-8**).

3.0 Analysis

3.1 Features Indicating Archaeological Potential

A number of factors are employed in determining archaeological potential. Criteria for pre-contact archaeological potential is focussed on physiographic variables that include distance from the nearest source of water; the nature of that source; distinguishing features in the landscape (e.g., ridges, knolls, eskers, wetlands); the types of soils found within the area of the assessment and resource availability. Also considered are known archaeological sites within or the vicinity of the study area.

Land registry records , assessment rolls, census, historic maps and aerial photographs as well as a property inspection all assist in determining historical archaeological potential. Additionally, the proximity of historic transportation corridors such as roads, rail and water courses also affect the historic archaeological potential.

3.2 Conclusions

The Stage 1 assessment of the Waterford Housing Development found that 90% of the project area was disturbed by major landscaping involving grading below topsoil. The remaining 10% contains archaeological potential and should be subject to Stage 2 test pit survey as per Section 2.1.2 *Test pit survey* in the Standards and Guidelines for Consultant Archaeologists (MHSTCI 2011).

4.0 Recommendations

Based upon the background research, the results of the property inspection and the test pit survey, it is recommended that the Waterford Housing Development should be cleared of further archaeological concerns.

5.0 Advice on Compliance with Legislation

This report is filed with the Ministry of Tourism, Culture, and Sport as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c. 0.18. The report is reviewed to ensure that is complies with the standards and guidelines that are issued by the Ministry, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matter relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism and Culture and Sport, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Section 48 and 69 of the Ontario Heritage Act for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such a time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the Ontario Heritage Act.

Should previously unknown or deeply buried archaeological resources by uncovered during development, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The Proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologists to carry out archaeological fieldwork, in compliance with Section 48 (1) of the Ontario Heritage Act.

The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the Ontario Heritage Act and may not be altered, or have artifacts removed from them, except by a person holding an archaeological license.

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7.0 Images

Figure 1: Disturbed project area, facing east

Figure 2: Disturbed project area, facing northeast

Figure 3: Disturbed project area, facing northwest

Figure 4: Area requiring Stage 2 test pit survey, facing east.

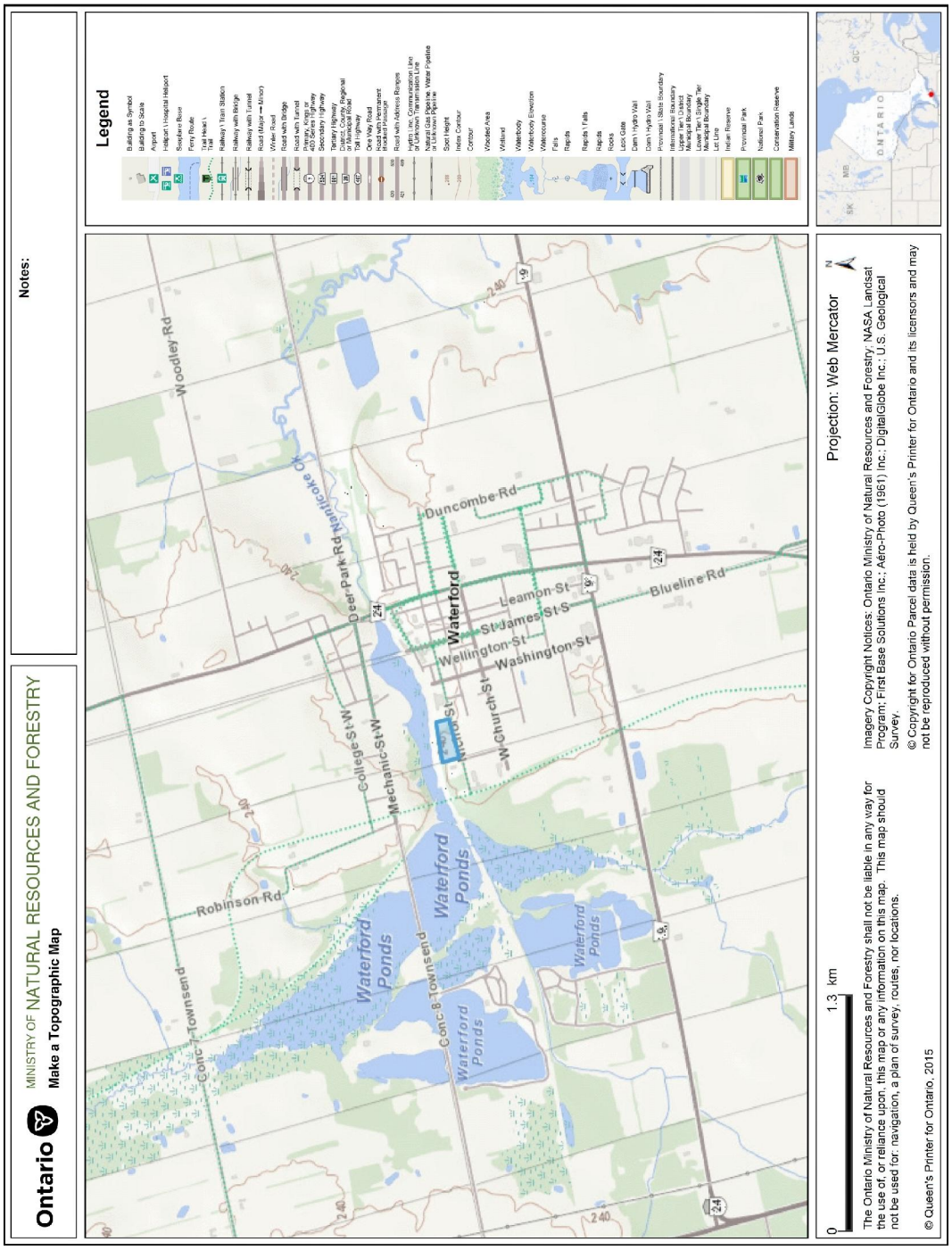
Figure 5: Looking up to undisturbed part of project area, facing southeast

Figure 6: Looking up to undisturbed part of the project area, facing south

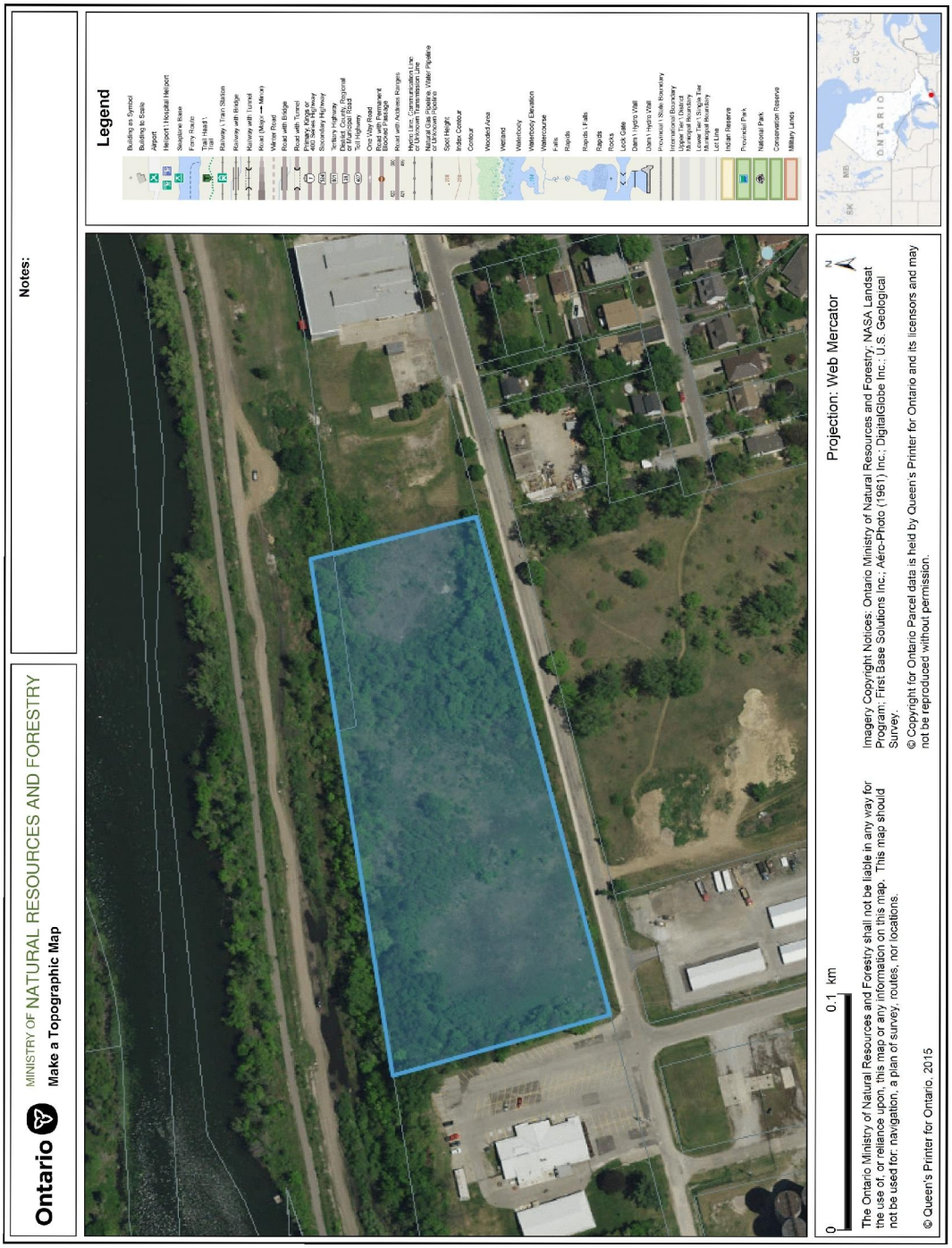
Figure 7: Crew at work, facing southeast

Figure 8: Area subject to Stage 2 test pit survey, facing west.

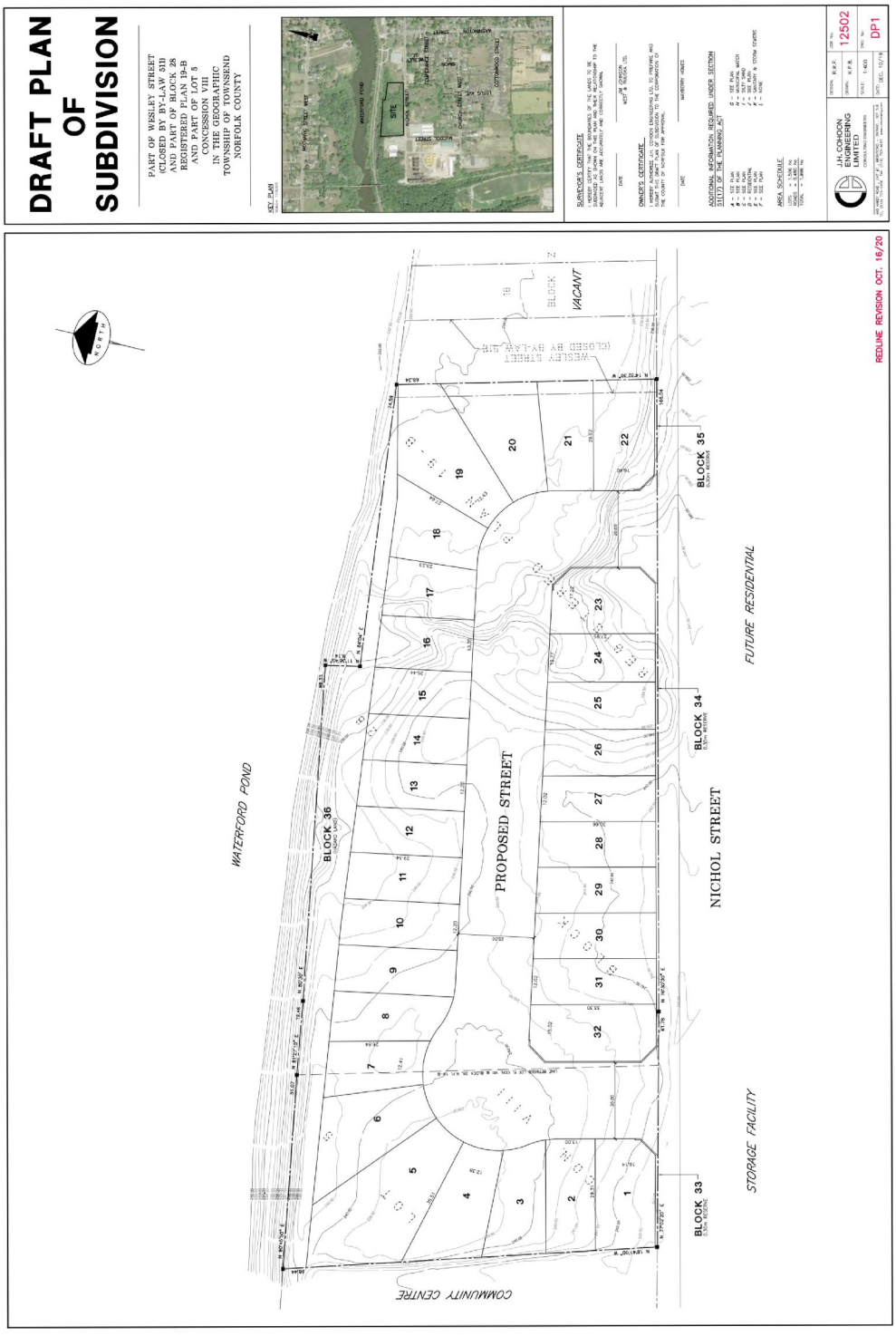
8.0 Maps



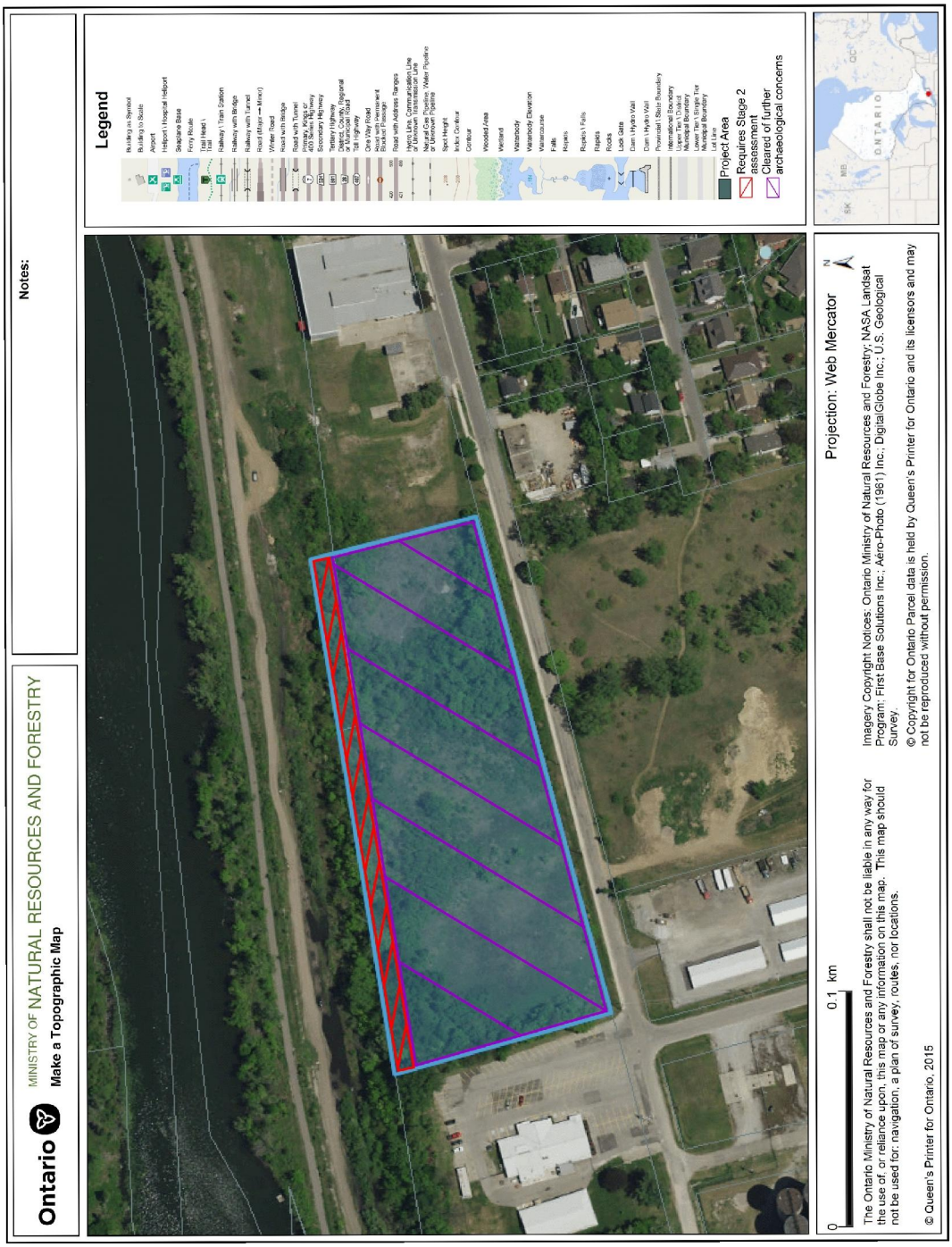
Map 1: Project area location



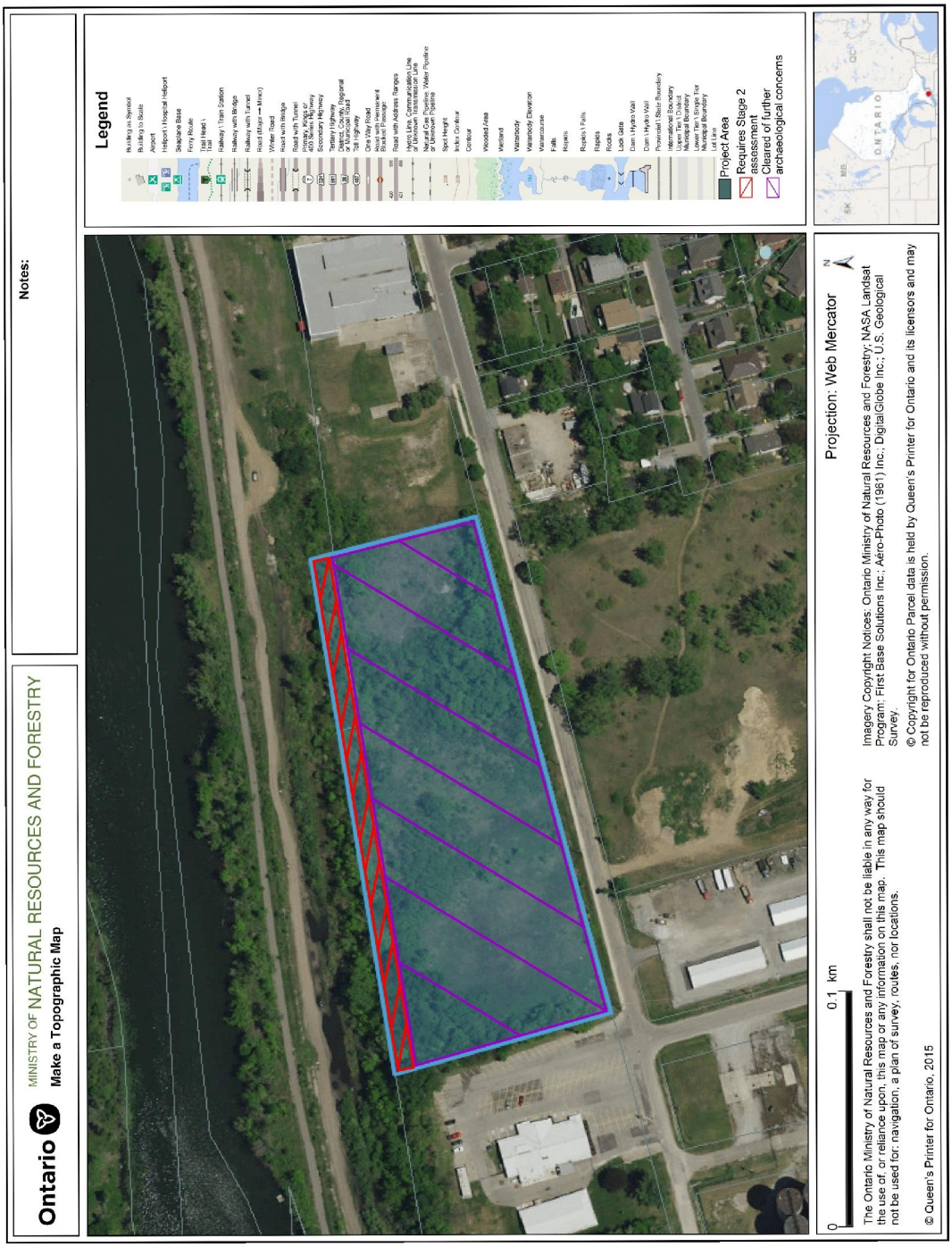
Map 2: Detail of project area



Map 3: Development map



Map 4: Results of the Stage 1 and 2 archaeological assessment



Map 5: Location and direction of figures mentioned in text

MAP A

CONTEXT MAP

Urban Area of WATERFORD

28TPL2021166
ZNPL2021167

Legend

Subject Lands

2015 Air Photo

2021-06-16

N

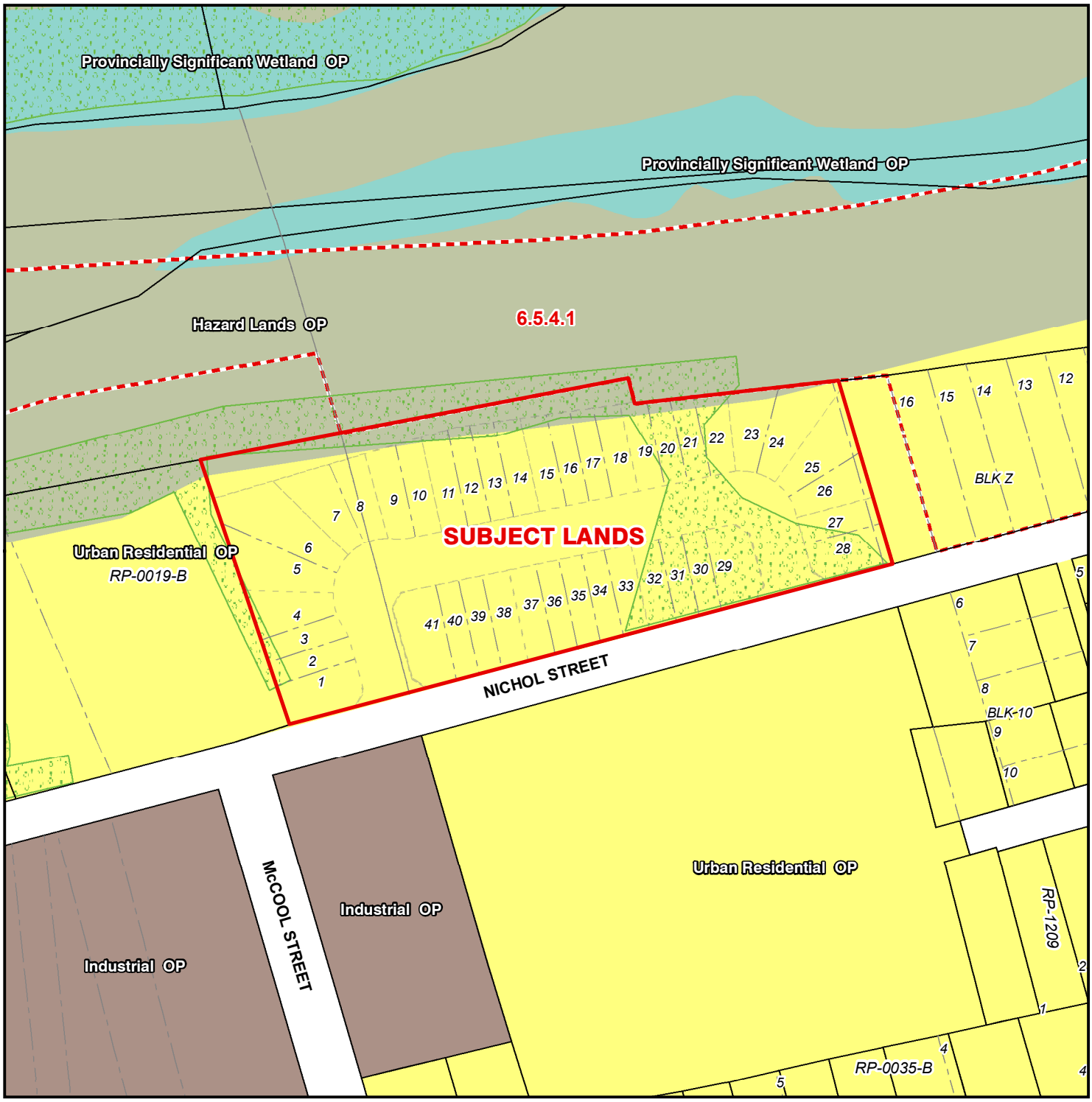
10 5 0 10 20 30 40 Meters

MAP B

OFFICIAL PLAN MAP

Urban Area of WATERFORD

28TPL2021166
ZNPL2021167



2021-06-16

Legend

Subject Lands

Official Plan Designations

- Hazard Lands
- Provincially Significant Wetland
- Urban Residential
- Industrial
- Special Policy Area
- Urban Area Boundary
- Significant Woodland

N

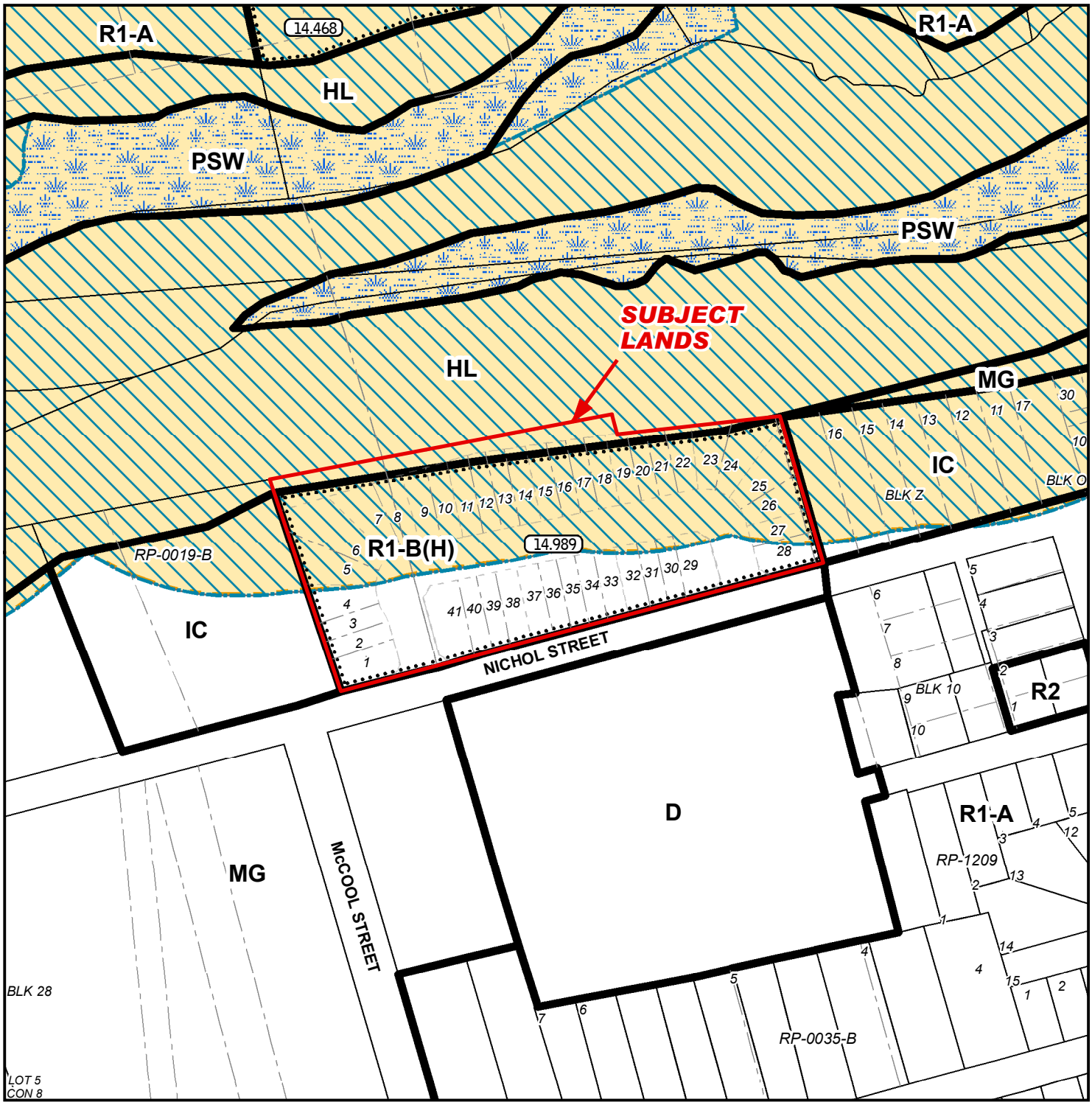
10 5 0 10 20 30 40 Meters

MAP C

PROPOSED ZONING BY-LAW AMENDMENT MAP

Urban Area of WATERFORD

28TPL2021166
ZNPL2021167



LEGEND

- Subject Lands
- Adjacent Lands
- Wetland
- LPRCA Generic RegLines

ZONING BY-LAW 1-Z-2014

- (H) - Holding
- IC - Community Institutional Zone
- D - Development Zone
- MG - General Industrial Zone
- HL - Hazard Land Zone
- PSW - Provincially Significant Wetland Zone
- R1-A - Residential R1-A Zone
- R1-B - Residential R1-B Zone
- R2 - Residential R2 Zone
- R4 - Residential R4 Zone

2021-06-16

From:
R1-B with Special Provision 14.989
To:
R4 with Amended Special Provision

N

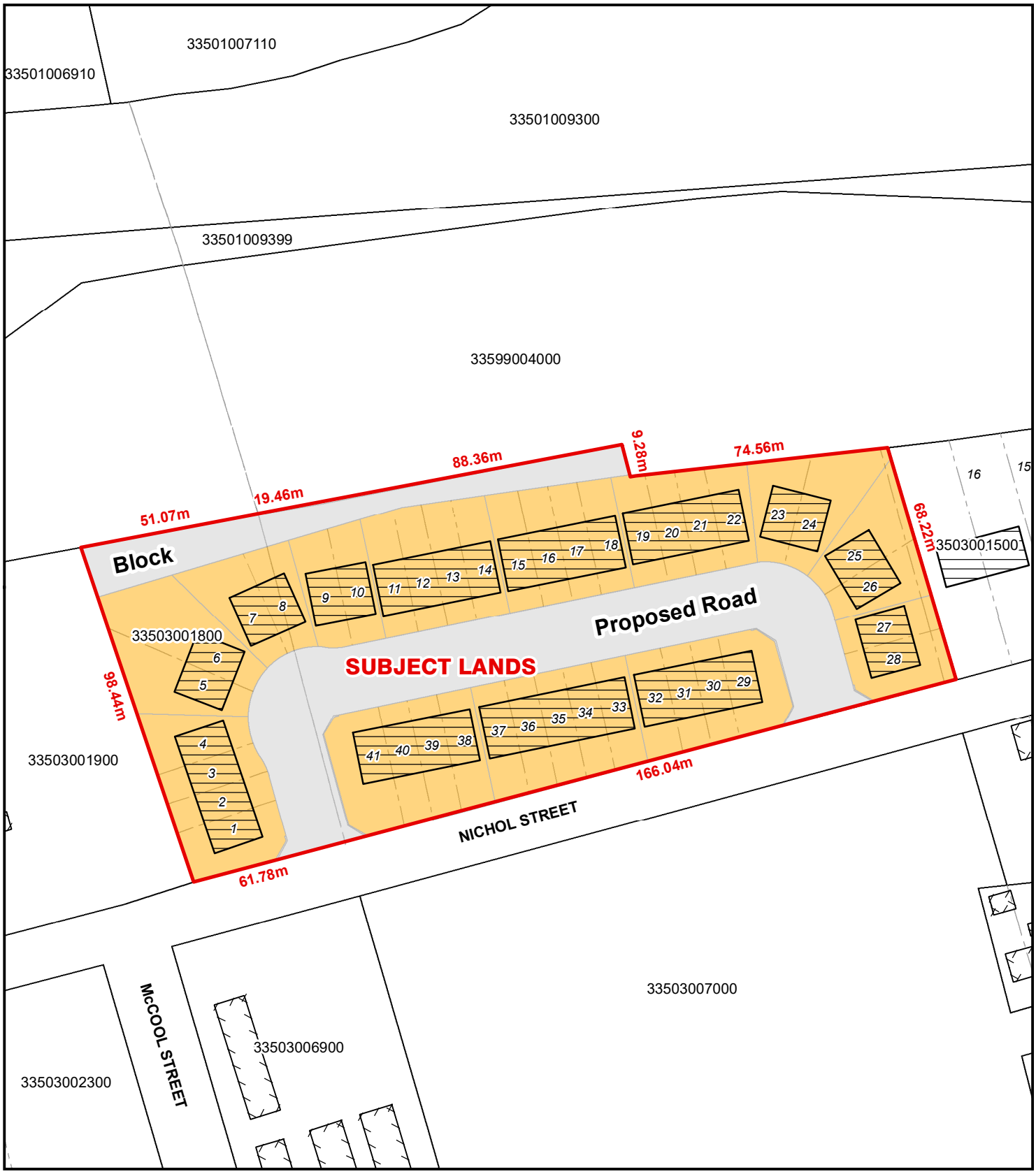
20 10 0 20 40 60 80 Meters

MAP D

CONCEPTUAL PLAN

Urban Area of WATERFORD

28TPL2021166
ZNPL2021167



Legend

- Subject Lands
- Multi Family Dwellings
- Other

2021-06-16

N

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