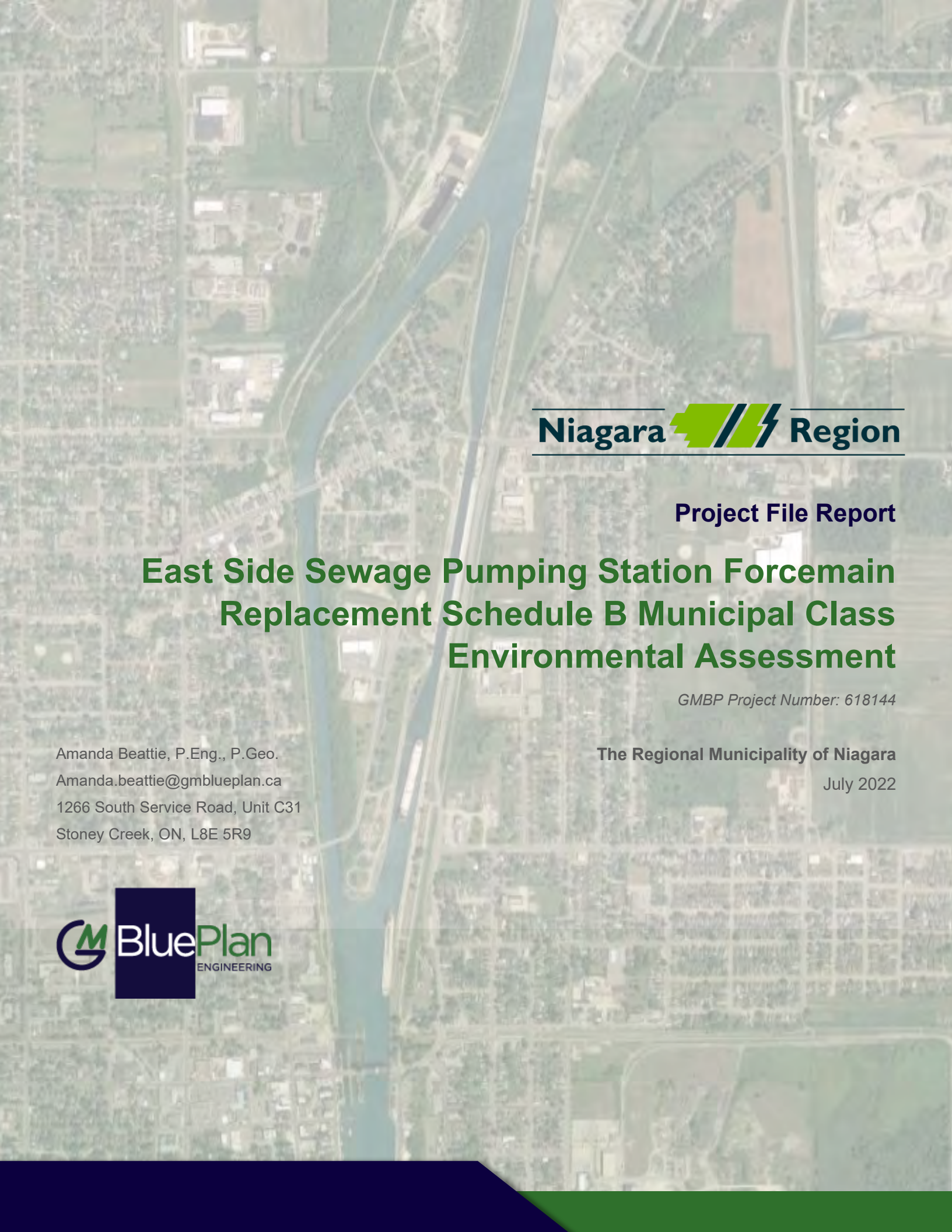


Niagara Region

Project File Report

East Side Sewage Pumping Station Forcemain Replacement Schedule B Municipal Class Environmental Assessment

GMBP Project Number: 618144

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The Regional Municipality of Niagara

July 2022

BluePlan ENGINEERING

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June 2022

Our File: 618144

Niagara Region
1815 Sir Isaac Brock Way
Thorold, ON L2V 4T7

Attention: Michelle Miller
Project Manager, Water & Wastewater Engineering

RE: Project File Report: East Side Sewage Pumping Station Forcemain Replacement Schedule B Municipal Class Environmental Assessment

GM BluePlan Engineering Limited (GMBP) is pleased to submit this Project File Report for the East Side Sewage Pumping Station (SPS) Forcemain Replacement Schedule B Municipal Class Environmental Assesmment to the Regional Municipality of Niagara (Region).

This Project File Report provides a comprehensive review of the various solutions, the evaluation criteria, summary of the various field investigations and the final recommendation for the preferred solution for the East Side SPS Forcemain Replacement. The GMBP team has conducted an in-depth examination of the area's history, servicing needs, and the stakeholder/public requirements. This report intends to:

- Provide an overview of how the various options were developed;
- Summarize the comparison of all options based on the evaluation criteria; and
- Provide a recommended solution that best suits the needs of the problem and opportunity statement.

If you have any questions, or require additional information, please contact the undersigned.

Yours truly,
GM BLUEPLAN ENGINEERING LIMITED

Per:

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EXECUTIVE SUMMARY

ES.1 Introduction and Background

The East Side Sewage Pumping Station (SPS) is owned and operated by the Regional Municipality of Niagara (the Region) and is located at 53 Killaly Street East in the City of Port Colborne (the City), Ontario. The station and associated forcemain have been in service since 1980, and the station has an existing firm capacity of 252 L/s at 17.7m Total Dynamic Head (TDH) and receives sewage flows from four other sanitary pumping stations which service the lands of the east side of the Welland Canal in the City's urban area. A project is in progress with anticipated tender in 2022 with RV Anderson (RVA) to complete civil, electrical, mechanical, instrumentation and control improvements to meet the Region's industry standards and to extend the facility's useful life. The station's capacity (252 L/s at 17.7 TDH) remained the same after this upgrade.

The current forcemain consists primarily of 500mm diameter (nominal) high density polyethylene (HDPE) pipe with a 175m section of 450mm diameter (nominal) concrete pressure pipe (CPP) crossing the Welland Canal. The current forcemain extends west of the East Side SPS and crosses the canal north of Clarence Street. On the west side of the canal, the forcemain extends north to the discharge point of the Seaway Wastewater Treatment Plant (WWTP) headworks building. The Seaway WWTP is located at 30 Prosperity Ave, in the City, and has a 19.6 mega-litre per day (ML/d) capacity.

In 2018, RVA conducted a hydraulic analysis and performance assessment of the East Side SPS forcemain; the project design did not include upgrades or modifications to the forcemain but entailed review of the current condition and operation of the existing forcemain. Due to concerns regarding the condition and hydraulic operation of the existing forcemain in conjunction with historic forcemain breaks it was decided a new 500 mm diameter PVC DR25 forcemain of a similar length to the existing forcemain would be required to improve conveyance of sanitary flows from the east side of Port Colborne.

A Schedule B Municipal Class Environment Assessment Study (MCEA) was initiated to identify and assess viable alternatives to the replacement of the East Side SPS forcemain, and to select a preferred alternative route. Further, this MCEA included consideration of a joint Welland Shipping Canal (the canal) crossing for future services including a new Regional watermain and a City constructed forcemain to service the East Side Employment Lands (ESEL) (located north of Second Concession Road), along with other utilities.

ES.2 Scope of Current Environmental Assessment Study

This MCEA was carried out in accordance with Schedule 'B' of the Municipal Class Environmental Assessment document (2000, as amended in 2007, 2011, and 2015; and considering the 2020 addendum currently under review). Schedule B projects are defined as having the potential for some adverse environmental effects and the proponent is required to undertake a screening process involving mandatory contact with directly affected public and relevant review agencies to ensure all are aware of the project and have opportunity to provide input and feedback.

The purpose of this MCEA is to determine the preferred alternative for the forcemain replacement including the location of the forcemain crossing of the Welland Canal.

ES.3 Problem and Opportunity Statement

The focus of Phase One (1) of the MCEA process is the development of a problem and opportunity statement that identifies the opportunities and challenges that are being addressed. Based on the Region's knowledge of the study area and servicing needs, the problem/opportunity statement for the East Side SPS Forcemain Replacement MCEA is as follows:

> *"To provide sufficient capacity to accommodate the future flows generated by growth within the City of Port Colborne, as identified in the Region's 2016 Water and Wastewater Master Servicing Plan, and update aging infrastructure to provide long-term sanitary servicing for the community. In addition, provide the opportunity for a joint crossing of the canal with future planned infrastructure which includes the Regional watermain and East Side Employment Lands forcemain."*

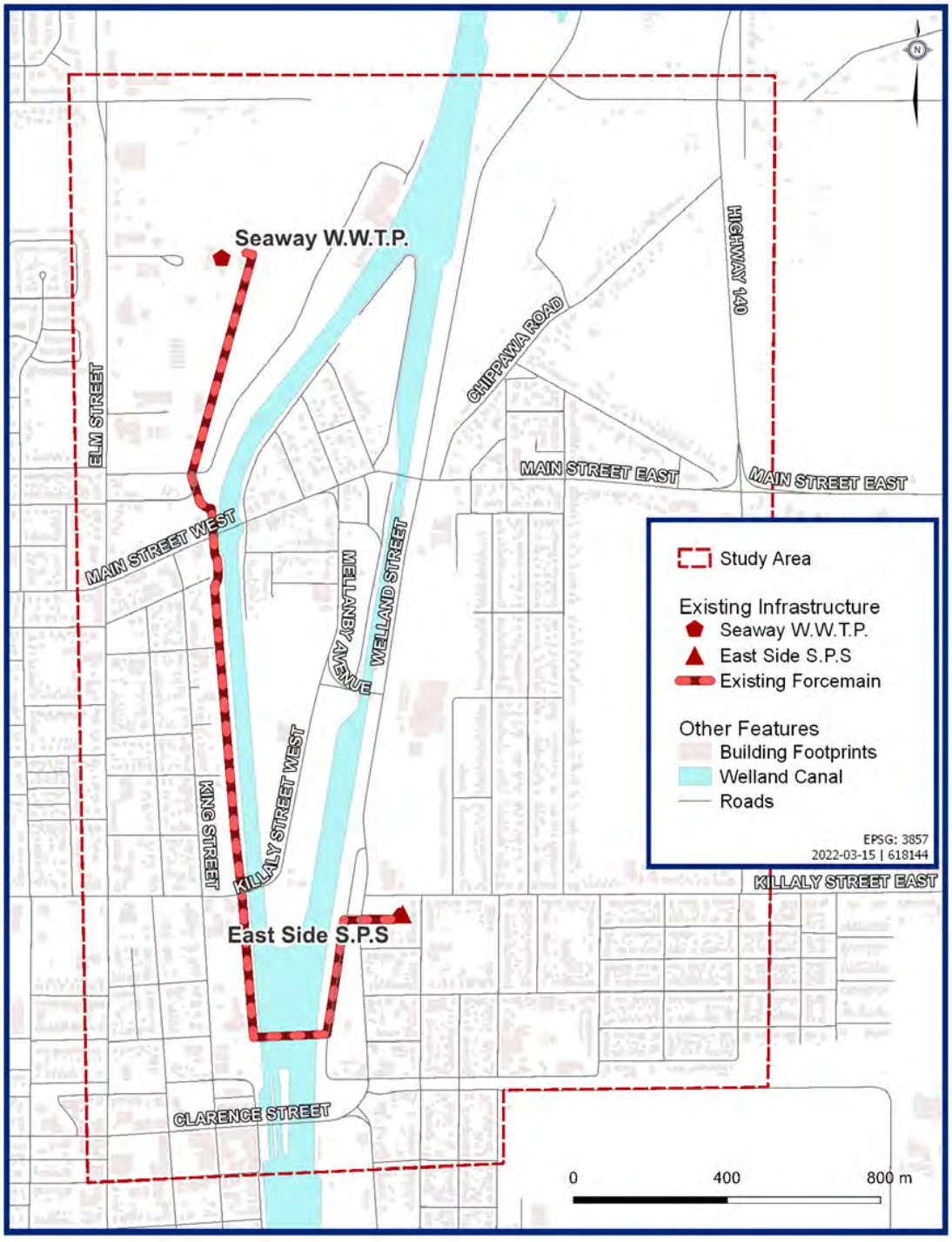
ES.4 Study Area

The study area is located in the City of Port Colborne (City) and is generally bounded by Second Concession Road to the north, Fraser Street/Clarence Street to the south, Highway 140/ Elizabeth Street to the east and Elm Street to the west (as shown in Figure ES-1).

Detailed reviews of the study area were carried out to provide information with respect to the natural environment, archaeological, cultural heritage and social characteristics that could be used to support the evaluation of alternative servicing strategies. The documents and information that were prepared under this MCEA include the following:

1. Natural Environmental Assessment prepared by Terrastory Environmental Consulting Inc. (Appendix B);
2. Stage 1 Archaeological Assessment prepared by Golder (Appendix C); and
3. Cultural Heritage Landscapes & Built Heritage Resources assessment prepared by Golder (Appendix D).

The information from these reports was used to populate the detailed evaluation matrix (Section 6.5,Table 7 and Table 6) and determine a preferred alternative solution.

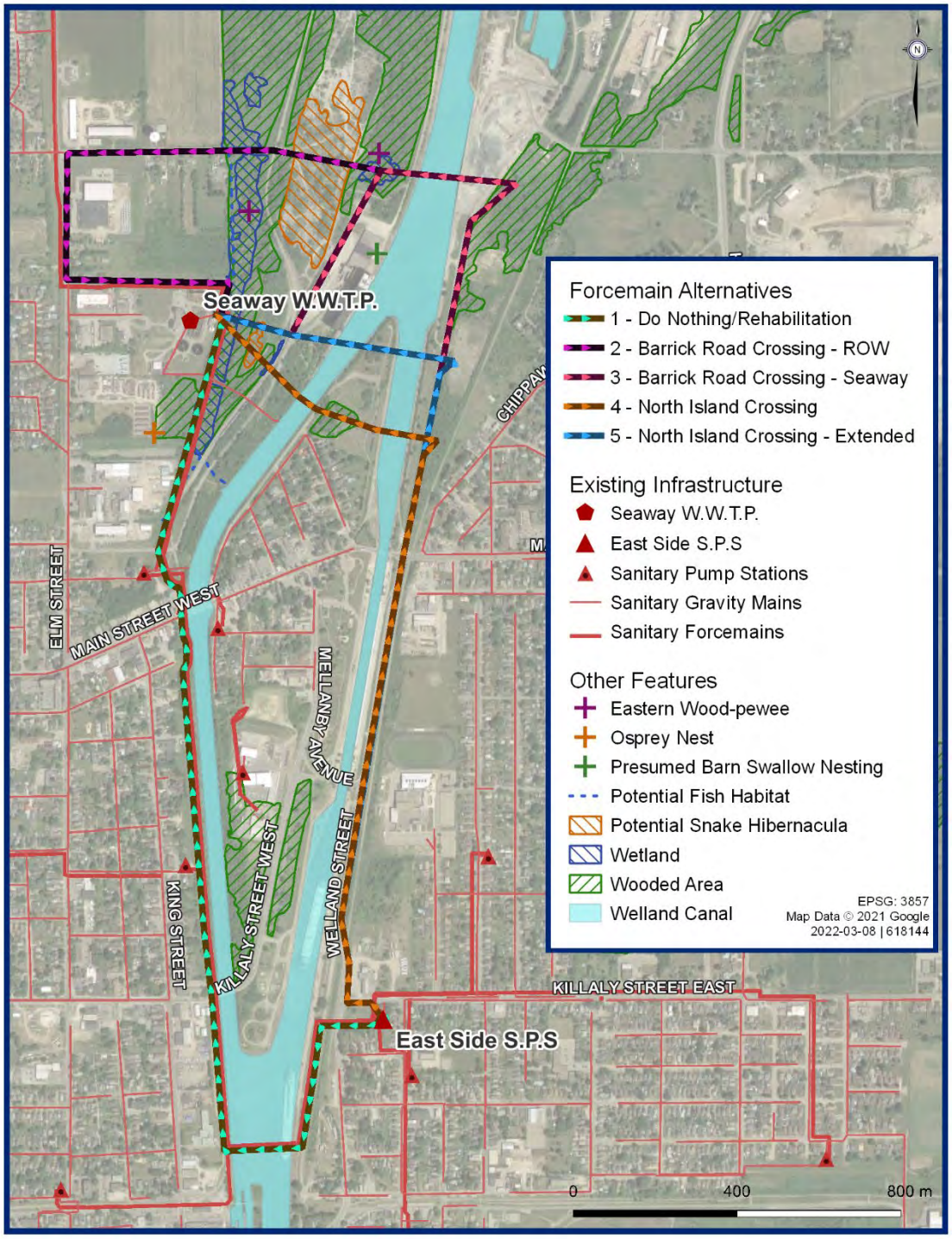


ES-1. Study Area

ES.5 Forcemain Alternatives

Five potential alternative solutions, including the “Do Nothing” alternative, were identified as possible routes for the forcemain replacement, as described in Section 7. The long list of alternatives as visually represented in Figure ES-2 includes:

- Alternative 1 - Do Nothing
- Alternative 2 – Barrick Road Crossing – Elm Street
- Alternative 3 – Barrick Road Crossing – Seaway
- Alternative 4 – North Island Crossing
- Alternative 5 – North Island Crossing - Extended Northern Crossing



ES-2. Forcemain Alternatives

ES.6 Analysis and Evaluation of Alternatives

To identify the short list of forcemain alternatives to be carried forward for the detailed evaluation, each of the five alternatives on the long list was subjected to the following preliminary screening criteria which were developed by the project team to reflect major goals and objectives of the MCEA (Section 7.3, Table 4):

- **Screening Criteria #1 - Effectiveness and Reliability**
  - Can it effectively and reliably meet 2041 capacity requirements?
- **Screening Criteria #2 - Compatibility with Existing System**
  - Is it compatible with the existing wastewater system, such that it will not require major changes if implemented?
- **Screening Criteria #3 - Implementation Challenges**
  - Can it be implemented without facing major constraints or time delays, including regulatory, technical, land availability, environmental or social constraints?

Based on the results of the screening, the following three alternatives were carried forward for detailed evaluation:

- Alternative 2 – Barrick Road Crossing – Elm Street
- Alternative 3 – Barrick Road Crossing – Seaway
- Alternative 4 – North Island Crossing

The three short-listed forcemain alternatives were then subjected to a detailed comparative evaluation using an evaluation matrix that enabled a systematic and rational comparison of the alternatives focusing on six main impact categories; financial, social and cultural, legal and jurisdictional, technical constructability, technical flexibility and environmental impacts associated with each alternative (Section 7.5, Table 5).

ES.7 Preferred Alternative

The preferred alternative, Option 3 – Barrick Road Crossing, Seaway, as illustrated in Figure ES-3, is to replace the East Side SPS 500 mm forcemain connecting to the Seaway WWTP via a 500 mm wastewater forcemain from the East Side SPS to the Seaway WWTP by traveling north along Welland Street/Barber Road and crossing the Welland Canal at Barrick Road, connecting south back to the WWTP.

This alternative accommodates the projected future growth and servicing needs while also accommodating the forthcoming upgrades completed at the East Side SPS while facilitating the future extension of the Regional Watermain off Highway 140 and the future East Side Employment Land forcemain. Lastly, this alternative reduces impact to the existing infrastructure by utilizing undeveloped lands that are owned by the St. Lawrence Seaway Management Corporation (SLSMC).

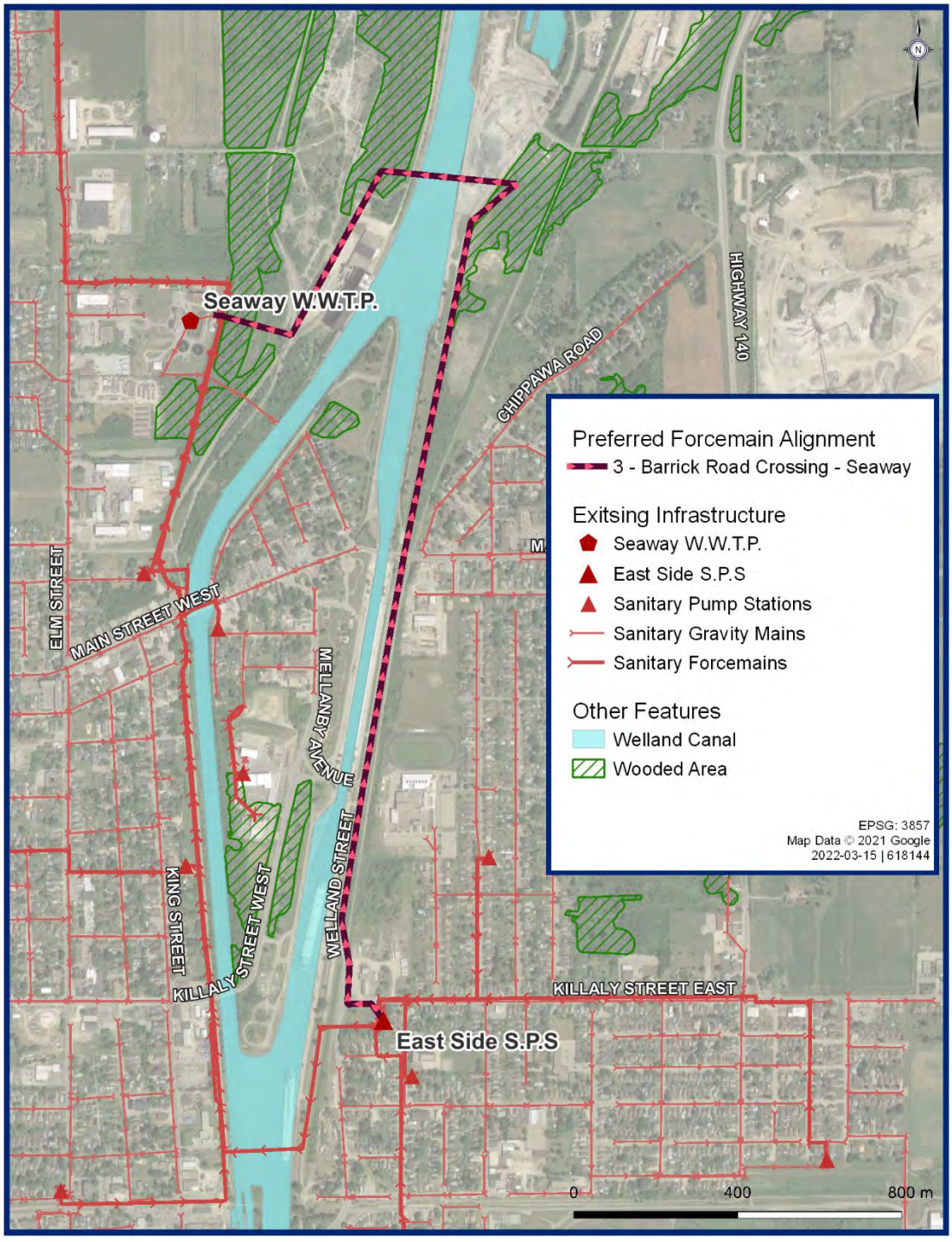


Figure ES-3 Preferred Forcemain Alternative

ES.8 Public Consultation Process

Consultation with review agencies, stakeholders and the public is a necessary and important component of the MCEA process. Further documentation related to the consultation activities undertaken during this MCEA is included in Appendix A. The Region has met the MCEA consultation requirements within the following components for this project:

- Notice of Commencement and Public Information Centre (PIC)
- Direct Mailing to Stakeholders
- Project Website
- Hosting a PIC
- Agency Consultation
- Indigenous Communities' Consultation
- Notice of Completion

ES.9 Implementation

The Region has outlined the commitments and/or mitigation measures that will be undertaken during the implementation of the preferred alternative as well as approvals that will be required to implement the preferred alternative. Commitments and mitigation measures have been identified and documented for the design, construction and post-construction and operation phases of the project.

Additionally, agency permits and approvals required for implementation have been identified from the following agencies:

- Ministry of the Environment, Conservation and Parks
- Ministry of Indigenous Affairs
- Ministry of Economic Development, Job Creation and Trade
- Niagara Peninsula Conservation Authority
- Ministry of Transportation
- Ministry of Natural Resources and Forestry
- Fisheries and Oceans Canada
- Various Utilities – Bell Canada, Hydro One Inc., Union Gas Limited, Canadian Niagara Power, Trillium Railway
- Niagara District School Board and Niagara Catholic District School Board
- Niagara Peninsula Conservation Authority
- City of Port Colborne
- Great Lakes St. Lawrence Seaway Management Corporation

Upon completion of the 30-day review period for this Schedule B MCEA, the Region will proceed with detailed design and construction as detailed within this Project File Report.

MOVING WATER FORWARD

Notice of Completion

Eastside Sewage Pumping Station

Forcemain Replacement

Municipal Class Environmental Assessment

City of Port Colborne

The Study

Niagara Region has completed a Municipal Class Environmental Assessment Study to assess alternative alignments for the East Side Sewage Pumping Station forcemain. The project evaluated options for crossing the canal together with other planned infrastructure, specifically a Regional watermain to Barrick Road and the City of Port Colborne's sanitary forcemain for the future East Side Employment Lands Sewage Pumping Station. The East Side Sewage Pumping Station forcemain is the only sewer crossing servicing the east side of the City, and the location of the existing forcemain crossing at the canal near the Port Colborne Water Treatment Plant is not ideal.



Study Recommendations

In accordance with Ontario's Environmental Assessment Act, Niagara Region has planned this project under Schedule "B" of the Municipal Class Environmental Assessment. A Public Information Centre was held on Sept. 8, 2021, to present and obtain comments on the problem statement, identified solutions, and preliminary design concepts. Interested members of the public, local business communities, and agencies were encouraged to attend. Information pertaining to the Study was presented and interested members were encouraged to submit questions or concerns. Through an extensive evaluation process that included public engagement with local residents and businesses, the City of Port Colborne and Niagara Region, a preferred solution has been identified. The study recommends a new forcemain alignment along Welland Street, which will cross the canal near Barrick Road and be directed to the Seaway Wastewater Treatment Plant.

For More Information

A Project File Report, documenting the planning process undertaken, key elements of the preferred design is available for public review online at niagararegion.ca/projects/eastside-sewage and on display for review at the following location for 30 calendar days beginning on July 23, 2022 and ending on August 22, 2022.

The Project File Report will be made available for public review at the following locations during normal business hours:

Clerks Department
Niagara Region
1815 Sir Isaac Brock Way, PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000, ext. 3222
Toll-free: 1-800-263-7215
Monday - Friday 8:30 a.m. – 4:30 p.m.

Clerks Department
City of Port Colborne
66 Charlotte St.,
Port Colborne, ON, L3K 3C8
905-835-2900
Monday - Friday 8:30 a.m. – 4:30 p.m.

Written comments on this Project File should be submitted to:

Michelle Miller, C.E.T
Project Manager
Water and Wastewater Services
Niagara Region
3501 Schmon Pkwy., PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000 ext. 3737
Toll-free: 1-800-263-7215
michelle.miller@niagararegion.ca

Amanda Beattie, P.Eng., P.Geo., CMRP, PMP©
Project Manager, Partner
GM BluePlan Engineering Limited
1266 South Service Rd., Unit C31
Stoney Creek, ON, L8E 5R9
905-643-6688
amanda.beattie@gmblueplan.ca

In addition, a request may be made to the Ministry of the Environment, Conservation and Parks for an order requiring a higher level of study (i.e. requiring an individual/comprehensive Environmental Assessment approval before being able to proceed), or that conditions be imposed (e.g. require further studies), only on the grounds that the requested order may prevent, mitigate or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Requests on other grounds will not be considered. Requests should include the requester contact information and full name for the Ministry.

Requests should specify what kind of order is being requested (request for additional conditions or a request for an individual/comprehensive environmental assessment), how an order may prevent, mitigate or remedy those potential adverse impacts, and any information in support of the statements in the request. This will ensure that the Ministry is able to efficiently begin reviewing the request.

Requests should be sent by email or in writing to:

Minister of the Environment, Conservation and Parks
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto, ON, M7A 2J3
minister.mecp@ontario.ca

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto, ON, M4V 1P5
EABDirector@ontario.ca

Personal information collected or submitted in writing at public meetings will be collected, used and disclosed by members of Regional Council and Regional staff in accordance with the Freedom of Information and Protection of Privacy Act. The written submissions including names, contact information and reports of the public meeting will be made available. Questions should be referred to the Privacy Office at 905-980-6000, ext. 3779 or **FOI@niagararegion.ca.**

If you require any accommodations for a disability in order to attend and participate in meetings or events, please let us know in advance so that arrangements can be made in a timely manner. Please contact the Accessibility Advisory Coordinator at 905-980-6000 ext. 3252 or **accessibility@niagararegion.ca.**

This notice was first issued on July 23, 2022.

TABLE OF ACRONYMS

Term of Acronym	Definition
ATRIS	Aboriginal and Treaty Rights Information System
CPP	Concrete Pressure Pipe
DFO	Fisheries and Oceans Canada
EAA	Ontario's Environmental Assessment Act
EA	Environmental Assessment
EASR	Environmental Sector Registry
ESEL	East Side Employment Lands
ESR	Environmental Study Report
FWCA	Fish and Wildlife Conservation Act
HADD	Harmful Alteration, Disruption or Destruction
HDPE	High Density Polyethylene
INAC	Indigenous and Northern Affairs Canada
MCEA	Municipal Class Environmental Assessment Study
MCFN	Mississauga of the Credit of First Nation
MEA	Municipal Engineers Association
MECP	Ministry of the Environment, Conservation and Parks
MHSTCI	Ministry of Heritage, Sport, Tourism and Culture Industries
MNRF	Ontario Ministry Natural Resources and Forestry
MSP	Master Servicing Plan
MTO	Ministry of Transportation
NPCA	Niagara Peninsula Conservation Authority
OP	Official Plan
PFR	Project File Report
PIC	Public Information Centre
PVC	Polyvinyl Chloride
PWWF	Peak Wet Weather Flow
PTTW	Permit to Take Water
SAR	Species at Risk

Term of Acronym	Definition
SLSMC	St. Lawrence Seaway Management Corporation
SPS	Sewage Pumping Station
SWH	Significant Wildlife Habitat
TAC	Technical Advisory Committee
TDH	Total Dynamic Head
TSP	Tree Saving Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1 INTRODUCTION AND BACKGROUND

The Regional Municipality of Niagara (the Region) has initiated a Schedule 'B' Municipal Class Environmental Assessment Study (MCEA) to evaluate alternatives for the East Side Sewage Pumping Station (SPS) replacement forcemain.

The City of Port Colborne (the City) is located in the south of the Region on the shore of Lake Erie and is bisected by the Welland Shipping Canal (Welland Canal). The City owns and operates the local wastewater collection system, while the Region owns and operates the transmission and treatment system consisting of various pumping stations, forcemains, trunk sewers and the Seaway Wastewater Treatment Plant (WWTP), which serves the City. The Seaway WWTP is located on the west side of the Welland Canal.

The East Side SPS is located at 53 Killaly Street, on the east side of the Welland Canal. The East Side SPS conveys sanitary flows from the urban area on the east side, across the Welland Canal to the Seaway WWTP headworks building. The forcemain extends west of the East Side SPS and crosses the canal north of Clarence Street near the intake of the Port Colborne Water Treatment Plant (WTP); the forcemain then extends north to the WWTP along an easement shared with the Elm Street SPS and Union Street SPS forcemains.

The East Side SPS and its forcemain have been in service since 1980. The East Side SPS has a firm capacity of 252 L/s at 17.7m Total Dynamic Head (TDH) and receives sewage flows from four other sanitary pumping stations which service the east side of the Welland Canal in the City's urban area. In 2019, an upgrade project was undertaken by RVA and is currently in progress to complete civil, electrical, mechanical, instrumental and control improvements to meet the Region's industry standards and to extend the facility's useful life. The station's capacity (252 L/s at 17.7 TDH) remained the same after this upgrade.

The current forcemain consists primarily of 500mm diameter (nominal) high density polyethylene (HDPE) pipe with a 175m section of 450mm diameter (nominal) concrete pressure pipe (CPP) crossing the Welland Canal. On the west side of the canal, the forcemain extends north to the discharge point of the Seaway WWTP headworks building. The Seaway WWTP is located at 30 Prosperity Ave, in Port Colborne, and has a 19.6 mega-litre per day (ML/d) capacity.

The 2019 RVA project entailed a review of the current forcemain condition and operation via a hydraulic analysis and performance assessment. RVA's report indicated the system curve C-factor to be considerably less than expected based on the age and material of the forcemain. Further, there have been breaks along the forcemain which have led to concerns about the security of sanitary flow conveyance across the canal, as well as the potential for contamination of the water supply due to the proximity of the existing forcemain to the WTP intake. Due to these concerns, it was decided a new forcemain would be required. The station's preferred pump (252 L/s at 17.7m TDH) was selected on the premise that the existing forcemain would be replaced with a new 500 mm diameter PVC DR25 forcemain, similar in length to the existing forcemain.

Further to the above, there is the need to consider and coordinate with other infrastructure projects planned in the study area that may also require crossing the Welland Canal including:

- The Region plans to twin the existing 450 mm diameter regional watermain servicing the east side of the City to provide reliability and security of the water supply system. Currently there is only one watermain.
- The City plans to construct a future forcemain to provide sanitary service to an area known as the East Side Employment Lands (ESEL), located north of Second Concession Road.
- Potential opportunity to incorporate other utility crossings at this location.

A joint crossing of the Welland Canal to accommodate these projects will reduce construction costs, social and environmental impacts. This MCEA will explore alternatives for a shared canal crossing of the East Side SPS forcemain, a new Regional watermain, and a new forcemain to service the ESEL.

The objective of this MCEA is therefore to identify and assess viable alternatives to the replacement of the East Side SPS forcemain, and to select a preferred alternative route.

2 CLASS ENVIRONMENTAL PROCESS

This MCEA was completed as a Schedule 'B' undertaking in accordance with the requirements of the Municipal Class Environmental Assessment process (2000, as amended in 2007, 2011, and 2015; and considering the 2020 addendum currently under review). Schedule B projects are defined as having the potential for some adverse environmental effects and the proponent is required to undertake a screening process involving mandatory contact with directly affected public and relevant review agencies to ensure all are aware of the project and have opportunity to provide input and feedback. The MCEA process includes public and review agency consultation, evaluation of alternatives, an impact assessment of the recommended alternative, and identification of measures to mitigate potential adverse effects.

2.1 Class Environmental Assessment Act

Ontario's *Environmental Assessment Act* (EAA) was passed in 1975 and proclaimed in 1976, with municipal projects subject to the EAA in 1981. The EAA requires proponents to examine and document the environmental effects that could result from projects or activities and their alternatives.

The EAA's comprehensive definition of the environment is:

- Air, land or water;
- Plant and animal life, including human life;
- The social, economic and cultural conditions that influence the life of humans or a community;
- Any building, structure, machine or other device or thing made by humans;
- Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities; and,
- Any part of combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario.

The purpose of the EAA is the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management of the environment in Ontario (RSO1990, c.18, s.2). An

EAA must also ensure that decisions result from a rational, objective, transparent, replicable, and impartial planning process.

In 1987, the Minister of the Environment approved Class Environmental Assessments as a means for municipal projects of similar nature and with predictable and mitigable impacts to meet the requirements of Ontario's EAA. MCEAs are streamlined step-by-step approaches which when followed meet the five key principles of the EAA:

- Consultation with affected parties. Consultation with the public and government review agencies is an integral part of the planning process. Consultation allows the proponent to identify and address any concerns cooperatively before final decisions are made. Consultation should begin as early as possible in the planning process.
- Consideration of a reasonable range of alternatives. Alternatives may include alternative solutions and alternative design concepts (alternative methods)" of implementing the preferred solution. The "do nothing" alternative must also be considered.
- Identification and consideration of the effects of each alternative on all aspects of the environment. These aspects include the natural, social and cultural, technical and economic environments.
- Systematic evaluation of alternatives in terms of their advantages and disadvantages to determine their net environmental effects. The evaluation considers the potential effects of each alternative relative to the other to support sound decision making and identification of a recommended solution.
- Provision of clean and complete documentation of the planning process followed to allow "traceability" of decision-making with respect to the project. The planning process must be documented in such a way that it may be repeated with similar results.

This project is subject to the Municipal Engineers Associations (MEA) Municipal Class Environmental Assessment (MCEA). A process, approved 1987, and revised and updated in 1993, 2000, 2007, 2011, 2015 and recent 2020 addendums are currently under review

2.2 Class Environmental Assessment

The MCEA, prepared by the MEA, outlines the procedures to be followed to satisfy MCEA requirements for water, wastewater, stormwater, road, and transit projects.

The process includes five phases, described below and illustrated in Figure 1, integrating consultation with the public, review agencies, Indigenous Communities, and other interested stakeholders throughout the process:

- **Phase 1:** Problem or Opportunity Definition;
- **Phase 2:** Identification and Evaluation of Alternative Solutions to determine a preferred solution while taking input from the public and other stakeholders into consideration;
- **Phase 3:** Examination of Alternative Design Concepts (i.e., Alternative Methods) of implementation of the preferred solution while taking input from the public and other stakeholders into consideration;
- **Phase 4:** Documentation of the MCEA process in the form of an Environmental Study Report (ESR) for public review; and
- **Phase 5:** Implementation and Monitoring.

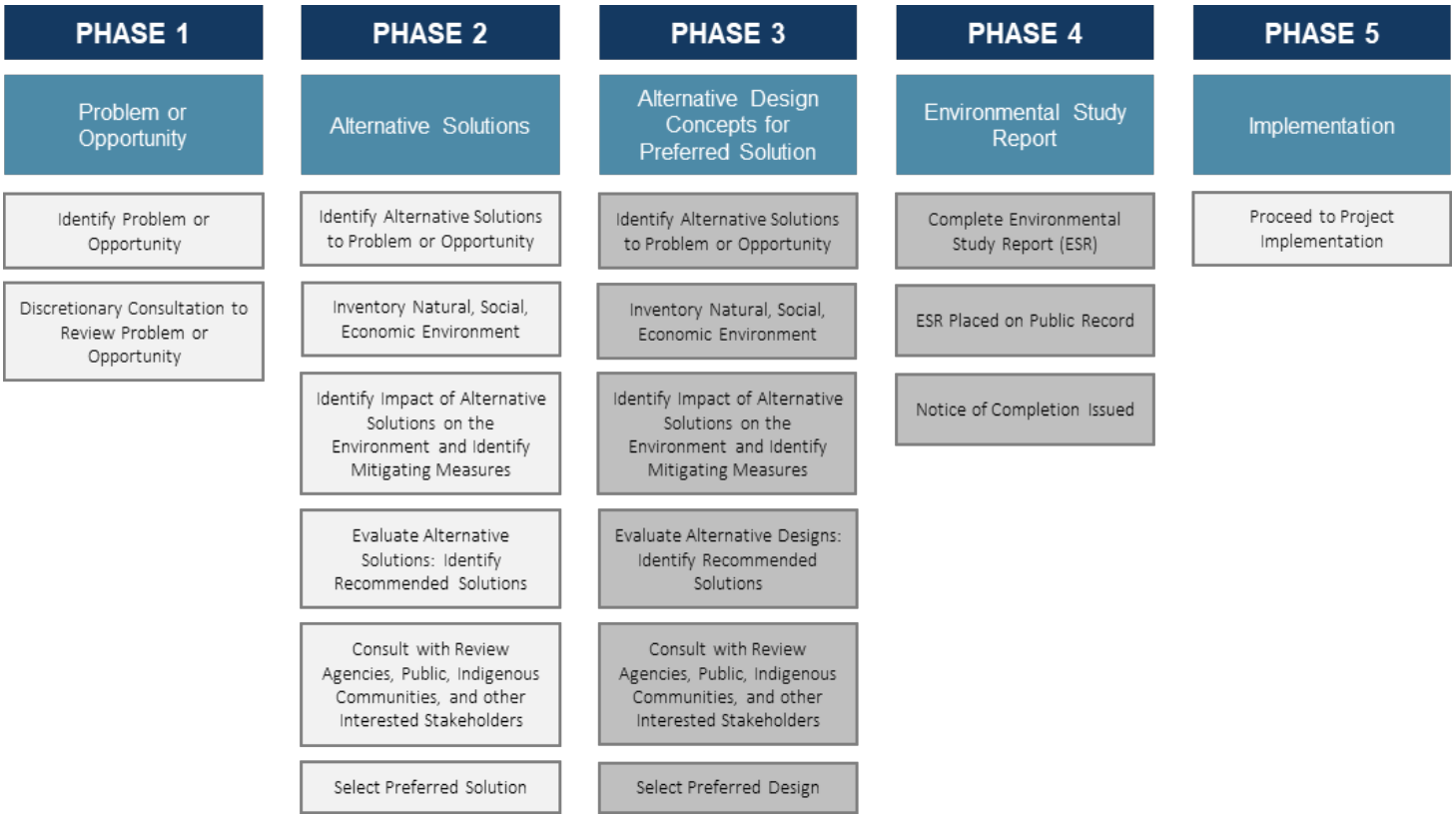


Figure 1. Outline of the MEA* MCEA *Process

Projects subject to the MCEA process are classified into the following four "schedules" depending on the degree of the expected impacts.

Schedule 'A' projects are minor or emergency operational and maintenance activities and are approved without the need for further assessment. These projects are typically smaller in scale and do not have a significant environmental effect.

Schedule 'A+' projects are also pre-approved; however, the public is to be advised prior to the project implementation. Although projects of this class do not usually have the potential for adverse environmental impacts, they tend to be broader in scale in comparison to Schedule 'A' projects.

Schedule 'B' projects require a screening of alternatives for their environmental impacts and Phases 1 and 2 of the MCEA planning process must be completed. The proponent is required to consult with the affected public, review agencies, Indigenous Communities, and other interested stakeholders. If there are still outstanding issues related to Indigenous and treaty rights not resolved through discussion with the project team, requests may be made to the Minister of the Environment for a Section 16 Order. A Section 16 Order, formerly known as a Part II Order or a "bump up", requires the project to undergo a Schedule 'C' MCEA or an Individual EA if the request is approved. Provided that no significant impacts are identified and no requests

for a Section 16 Order are received, Schedule 'B' projects are approved, and work may proceed directly to implementation.

Schedule 'C' projects must satisfy all five phases of the MCEA process. These projects have the potential for greater environmental impacts. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 normally includes the preparation of an ESR that is filed for public review. Provided no significant impacts are identified, and no requests for a Section 16 Order are received, Schedule 'C' projects are approved, and work can proceed to implementation.

Given the nature of this project, the MCEA for the East Side SPS Forcemain Replacement is classified as a Schedule 'B' undertaking and includes Phases 1 and 2 of the MCEA process.

2.3 Notice of Completion

At the conclusion of Phase 2 of the MCEA process for Schedule B projects, a Project File is prepared and a Notice of Completion is issued. The Project File report (PFR) for the New Wastewater Forcemain from East Side SPS to the Seaway WWTP in the City (i.e., this report) documents the decision-making process during the MCEA. The Notice of Completion of this MCEA (issued on July 23 2022) notifies members of the public and agencies that the PFR would be available for public review for a thirty-day period. The PFR was made available for public review at the following locations during normal business hours:

Clerk's Department
Regional Municipality of Niagara
1815 Sir Isaac Brock Way, P.O. Box 1042
Thorold, ON L2V 4T7
Tel: (905) 980-6000, ext. 3222
Monday-Friday 8:30 a.m. – 4:30 p.m.

Clerk's Department
City of Port Colborne
66 Charlotte Street, Port Colborne
Ontario, Canada L3K 3C8
Tel: (905) 835-2900
Monday-Friday 8:30 a.m. – 4:30 p.m.

A copy of the Notice is included in Appendix A of this Project File.

2.4 Project File Outline

This report was prepared to meet the requirements of the Ontario MEA MCEA Planning Process (2000, as amended in 2007, 2011, and 2015; and considering the 2020 addendum currently under review). This report combines all phases of the planning process under one cover and includes steps that are considered essential for meeting the requirements of the EAA. The report is divided into 9 subsections plus appendices and references, structured as follows:

- Section 1 provides background information for this project;
- Section 2 details the MCEA process;
- Section 3 defines the MCEA's problem and opportunity statement;
- Section 4 describes the MCEA area and related studies;

- Section 5 describes policies and legislations that are relevant to the completion of this MCEA
- Section 6 describes the existing conditions and design basis for the new forcemain;
- Section 7 summarizes the alternative forcemains, the evaluation processes and the preferred solution;
- Section 8 summarizes the implementation plan, potential impacts and mitigation measures for the recommended solution
- Section 9 describes the public and agency consultation process undertaken as part of the MCEA
- Section 10 details permits and approvals anticipated; and
- Section 11 concludes the Project File.

3 PHASE 1 – PROBLEM AND OPPORTUNITY STATEMENT

Phase 1 of the MCEA planning process requires the proponent of an undertaking to first document factors leading to the conclusion that the improvement is needed and develop a clear statement of the problem/opportunity to be investigated.

The problem and opportunity statement for the East Side SPS Forcemain MCEA aims to achieve the following goals:

- Provide infrastructure capacity and flexibility to meet future capacity demands identified in the Region's 2021 Master Servicing Plan (MSP)
- Decrease the potential for future service disruptions
- Maximize possible shared crossings for all potential services crossing the Welland Canal
- Minimize total capital, operation and maintenance, and lifecycle costs; and,
- Minimize environmental impacts including natural and socio-economic.

The problem/opportunity statement for the MCEA has been defined as follows:

> *"To provide sufficient capacity to accommodate the future flows generated by growth within the City of Port Colborne, as identified in the Region's 2016 Water and Wastewater Master Servicing Plan, and update aging infrastructure to provide long-term sanitary servicing for the community. In addition, provide the opportunity for a joint crossing of the canal with future planned infrastructure which includes the Regional watermain and East Side Employment Lands forcemain."*

Over recent years, the East Side SPS forcemain has experienced several breaks. There is concern that with only one canal crossing servicing the east side of the City, possible future disruptions to wastewater conveyance are likely to increase. Furthermore, the existing forcemain crosses the Welland Canal in proximity to the Port Colborne WTP intake, which presents a possible contamination risk to the water supply.

An opportunity exists to provide a joint crossing of the Welland Canal with additional services and utilities; for example, the Region has identified the need to improve the reliability and security of the water supply system in the area as there is currently only one watermain crossing of the Welland Canal to service the east side of the City. The addition of a Regional watermain at this crossing along with the East Side SPS forcemain will

be a consideration of the MCEA. Additionally, the City has identified the need for a new forcemain to provide sanitary service to an area known as the ESEL. Given this, the potential for a shared canal crossing will be a key consideration in the evaluation process.

New forcemain alternative solutions have been developed and evaluated on the basis of their ability to meet the Problem and Opportunity Statement, while minimizing impact on the natural and socio-economic environment in the study area.

4 STUDY AREA OVERVIEW

4.1 Study Area Location

The study area boundary was set to be large enough to maximize the potential alternatives and to include both sides of the canal to capture the East Side SPS and the Seaway WWTP which is the destination of sanitary flows from the East Side SPS. Figure 2 presents the study area for this MCEA and is generally bounded by:

- Barrick Road/Second Concession Road to the north,
- Highway 140/Elizabeth Street to the east,
- Clarence Street/Fraser Street to the south, and
- Elm Street to the west.

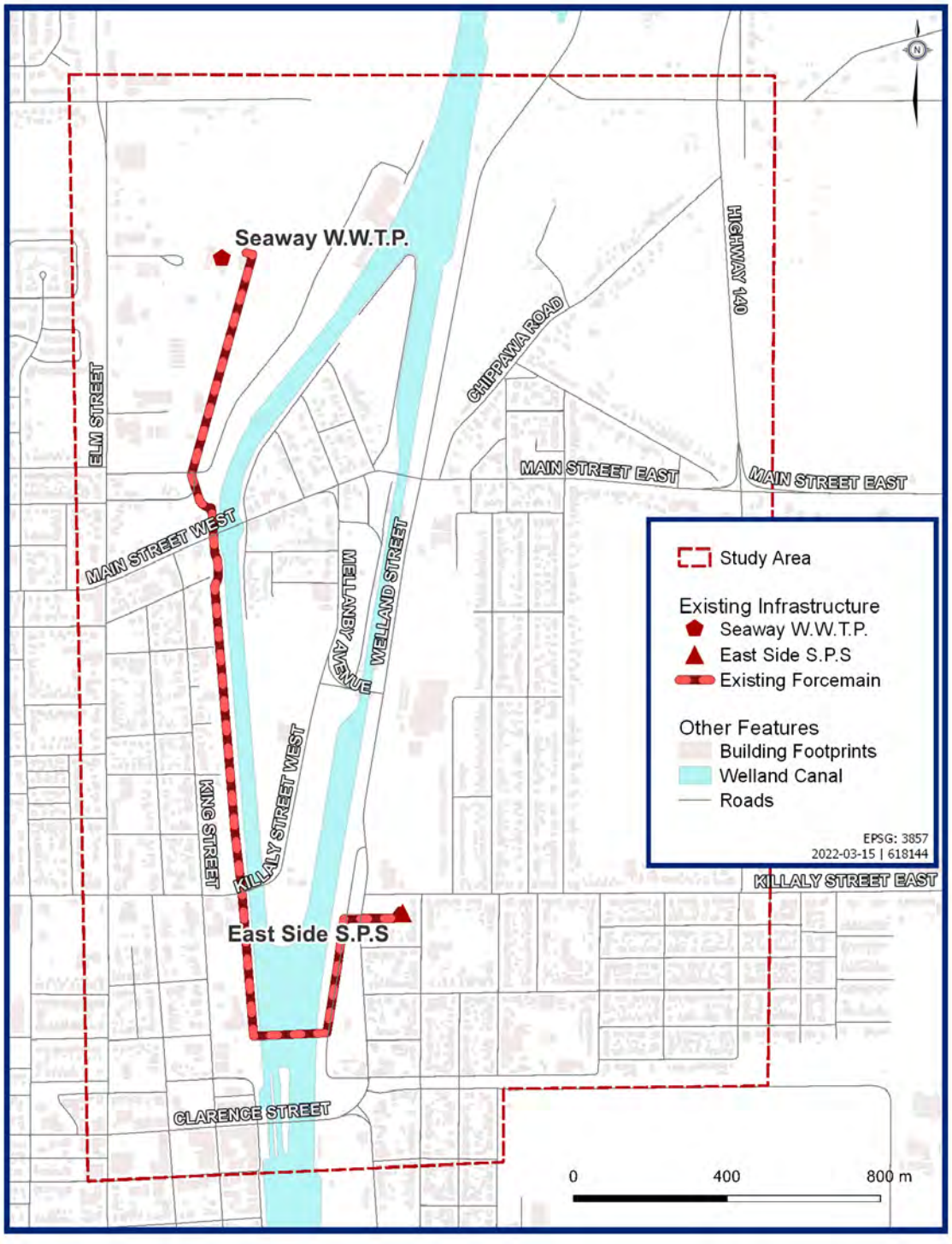


Figure 2. Study Area

The catchment area for the East Side SPS is illustrated in Figure 3. As shown, there are four different SPS catchment areas that make up the East Side SPS catchment area. The Clarke Street SPS, Fretz Street SPS, Nickle SPS and Fares SPS flows are directed to the East Side SPS, which then directs all flows to the Seaway WWTP.

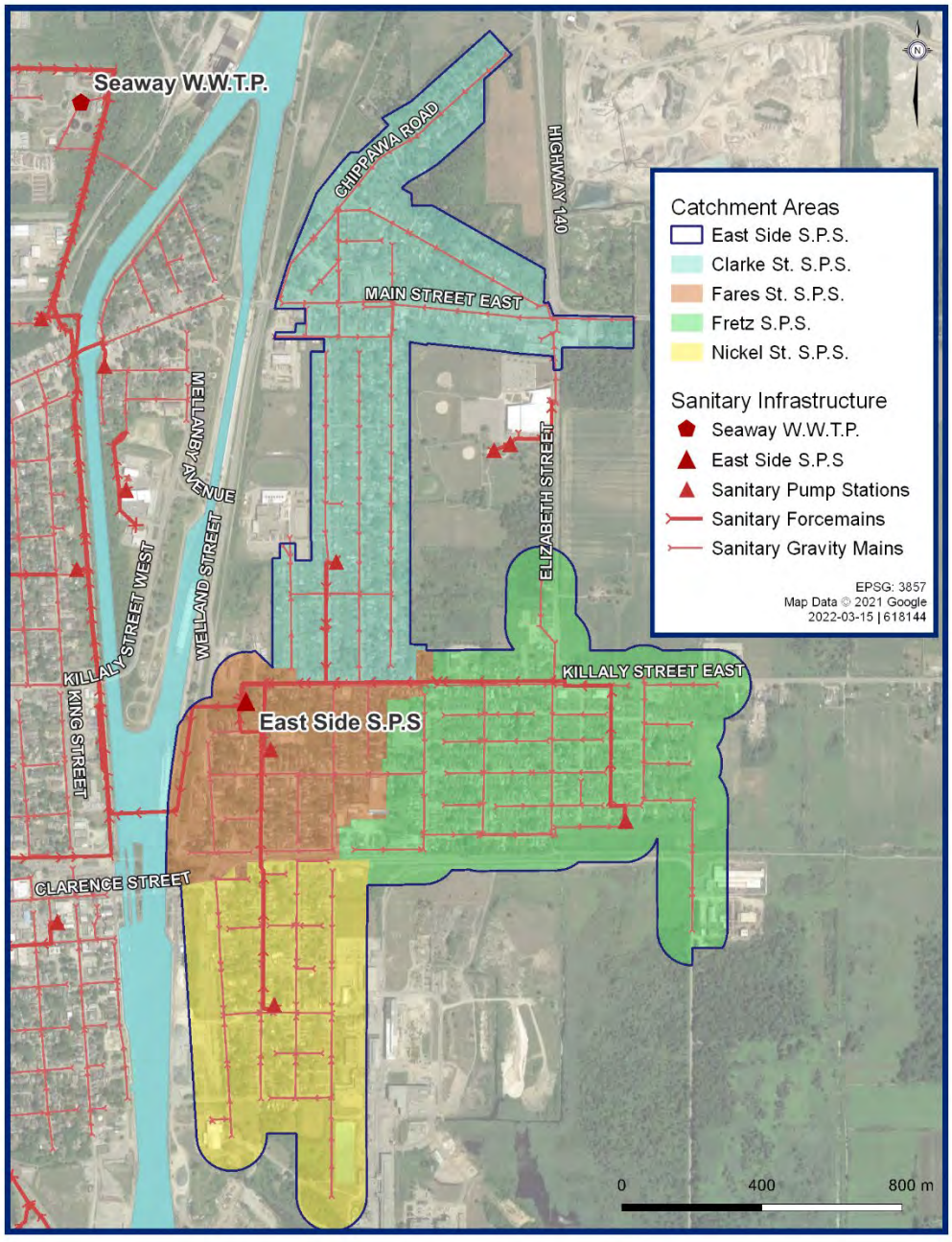


Figure 3. Study Area: Various SPS Catchment Areas

5 OVERVIEW OF RELATED STUDIES AND POLICIES

The purpose of this section is to describe policies and legislation that are relevant to the completion of this MCEA. Each is described below.

5.1 Niagara Region Official Plan

The Niagara Region Official Plan (OP) is a set of policies that define how Niagara will use its available land to shape the physical, economic and social development of the Region over the next 30 years. The document describes the Region's objectives for development and conservation, as well as policies that implement provincial legislation and provide planning context to lower tier municipalities. The OP allows the Region to:

- Determine how and where growth will happen, shaping Niagara into the community we want
- Make sure Niagara has an adequate and diverse supply of attainable housing
- Plan for future infrastructure needs and ensure they are properly funded
- Create the right conditions to attract and retain jobs in Niagara
- Help protect Niagara's natural environment and address changing climate through policies

The OP includes land-use policies that cover topics including Niagara Natural environment, land needs, growth allocations, housing, transportation, urban design, employment lands and agriculture. It also establishes the foundation for population and employment growth in the Region as well as urban boundaries.

The Region's 2014 OP has been updated and is currently under public review. The new 2022 OP is expected to be finalized based on public comments by June 2022.

5.2 City of Port Colborne Official Plan

Similar to the Region's OP, the City's OP is described as council's land use policies that are prepared from gathering input from members of the community to ensure that future planning and development will meet the specific needs of the community. The OP has a number of purposes including:

- Informs the public of the City's general land use planning policies
- Ensures growth happens in a coordinated manner and meets the needs of the community
- Helps citizens know how their land should be used
- Helps determine where roads, watermains, sewers, garbage dumps, parks and other services should be built
- Provides a framework for establishing the City's Zoning By-laws
- Provides a way to evaluate and settle conflicting land use while meeting local, regional and provincial interests

5.3 Region of Niagara Master Servicing Plan

The East Side SPS consists of four main sub-catchment areas including Nickle SPS, Fares SPS, Fretz SPS and Clarke Street SPS, totaling a catchment area of 219.4 ha. To understand future demands on the Eastside SPS and forcemain, planning projections were reviewed for the Eastside SPS from the Wastewater MSP

Update completed by GM BluePlan in 2016. This plan provides 2014 and 2041 values for the Peak Wet Weather Flow (PWWF) for Eastside SPS but does not consider the full build out potential of the lands on the east side of the canal.

The Region's MSP also documented the area to experience high wet weather flows and system overflows, which will need to be managed to allow for growth. Additionally, it was noted that the sewer network has the capacity to meet the design criteria wet weather flows, but the actual wet weather flows exceed sewer capacity in several areas.

The Region is currently undergoing an update to the MSP (2021). This update is near completion and incorporates all aspects of the management, expansion and funding of the water and wastewater systems within the Region to the year 2051. The results indicate an increase in total flows for the East Side SPS catchment due to the anticipated growth to 2051, however, these projected flows will remain below the Region's existing Environmental Compliance Approval (ECA) and will not require the station to undergo an upgrade to increase capacity. Further, this does not impact the design requirements of the forcemain as proposed through this MCEA.

5.4 Barrick Road Watermain Crossing Environmental Assessment Study

The Region's 2011 and 2016 MSP identified the need for a new 450 mm diameter watermain to Port Colborne east of the canal to improve the reliability and security of the water supply system. The 2021 MSP Update also supports this decision. A separate MCEA and a conceptual design report by RVA in 2012 recommended a new watermain crossing of the canal located at the terminus of Barrick Road to the west and Second Concession Road to the east.

The recommended route of the 450 mm regional watermain crossing was identified in the 2016 MSP, along with a new elevated tank on Barrick Road and watermain improvements along Barrick Road and Elm Street (north and west of the Seaway WWTP). It is understood that the elevated tank at Barrick Road and associated watermain improvements were constructed in 2017 and are currently in service. However, the design and construction of the watermain crossing at the canal is understood to be on hold pending the outcome of the East Side SPS forcemain MCEA.

5.5 East Side Employment Lands Environmental Assessment Study

In January 2017, the City completed a MCEA for site servicing of the ESEL, located between Second Concession Road to the south, Third Concession Road to the north, the canal to the west, and Highway 140 to the east. The ESEL have been identified by the City as a priority for investment to enable and support development for these lands.

The recommended servicing strategy includes, among other infrastructure improvements, construction of a new City owned and managed SPS discharging directly to the Seaway WWTP on the west side of the canal via a new forcemain crossing from Second Concession Road. Design and construction of the ESEL SPS and forcemain is understood to be on hold pending the outcome of the East Side SPS forcemain MCEA, similar to the Barrick Road Regional watermain crossing.

5.6 East Side Sewage Pumping Station Upgrades

RVA is currently developing the final design of upgrades to the East Side SPS. Station upgrades include civil, electrical, mechanical, instrumentation, and control improvements to meet the Region and industry standards to extend the useful life of the facility. The SPS design was based on maintaining the station's firm capacity at 252 L/s. Pump selection was based on the premise that the existing forcemain would be replaced with a new 500mm diameter PVC DR25 forcemain, similar in length to the existing forcemain.

6 EXISTING CONDITIONS

The following provides an overview of the existing and planned land uses, policies affecting the study area, and planning and servicing considerations that could potentially affect future infrastructure improvements.

6.1 Land Uses

The lands in the study area, are largely urbanized residential with some recreational open space and commercial uses as well. Running through the middle of the study area is the Welland Canal, which on either side consists of a variety of wooded vegetation areas. Notable features within the study area include Derek Point Memorial Garden (located north on the canal island) and the former Robin Hood Flour Plant which was built in the mid 1940s (located at 2 Sherwood Forest Lane). Figure 4 illustrates the land uses within the project study area. As shown, the surrounding area is mainly comprised of residential land with large areas of vacant land surrounding the canal.

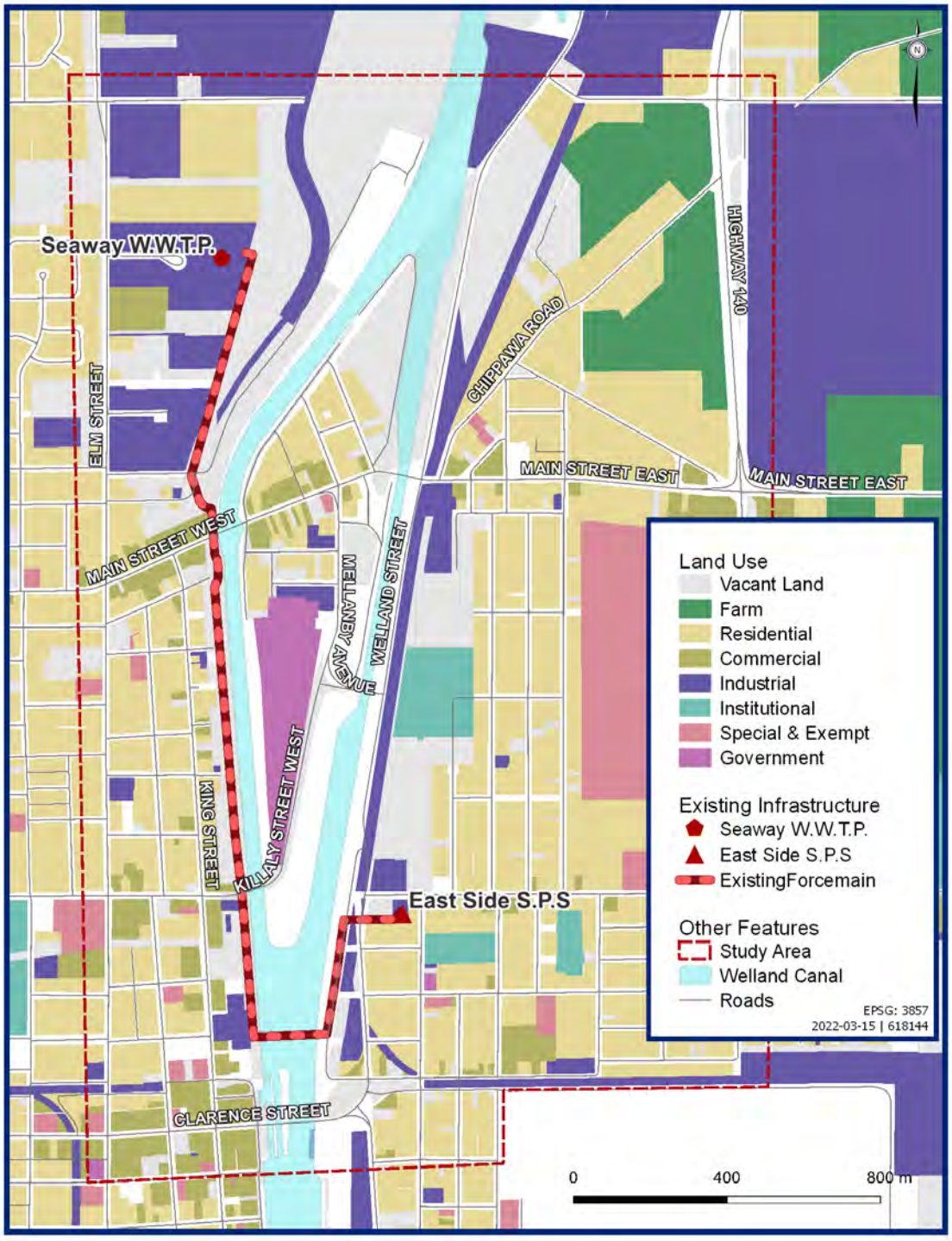


Figure 4. Study Area Land Uses

Detailed reviews of the study area were carried out to provide information with respect to the natural environment, archaeological, cultural heritage and social characteristics that could be used to support the evaluation of alternative servicing strategies. The documents and information that were prepared include the following:

1. Natural Environmental Assessment prepared by Terrastory Environmental Consulting Inc. (Appendix B);
2. Stage 1 Archaeological Assessment prepared by Golder (Appendix C); and
3. Cultural Heritage Landscapes & Built Heritage Resources assessment prepared by Golder (Appendix D).

The information from these reports was used to populate the evaluation matrix in Section 7. High-level information on these assessments is summarized in the following sections, however additional information can be found in the appendices noted above.

6.2 Existing Facility and Wastewater Infrastructure

The East Side SPS and associated forcemain have been in service since 1980. The station has a firm capacity of 252 L/s and receives sewage flows from four other sanitary pumping stations including the Fretz, Nickel, Clarke and Fares SPS, all which service the east side of the canal in the City's urban area.

The current route of the East Side SPS forcemain is shown in Figure 2 in Section 4. The forcemain extends west of the East Side SPS and crosses the canal north of Clarence Street near the intake of the Port Colborne WTP. On the west side of the canal, the forcemain extends north to the discharge point at the Seaway WWTP along an easement shared with the Elm Street SPS and Union Street SPS forcemains. The diameter of the existing forcemain is 500 mm, with a 450 mm diameter crossing under the canal, according to the as-constructed drawings. The total forcemain length is 2,754 m and consists of polyethylene pipe with a 175m section of 450mm CPP which crosses the Welland Canal. The condition of the forcemain is unknown, however, there have been several pipe breaks in recent years that have led to concerns about the security of sanitary flow conveyance across the canal.

Within the study area, the City owns and operates the local wastewater collection system, while the Region owns and operates the transmission and treatment infrastructure consisting of forcemains, trunk sewers and the local WWTP. Similarly, the City owns and operates the local water distribution system, while the Region owns and operates the treatment and transmission infrastructure.

6.3 Transportation Infrastructure

The East Side SPS and associated forcemain are located within the developed area within the City and adjacent to the canal. Niagara Regional Road 3 (Main Street East), and Ontario Highway 140 (under the jurisdiction of the Ministry of Transportation – MTO) are located approximately 1.5 km away from the East Side SPS. A railroad located on the east bank of the canal is owned by the City.

The canal, located immediately west of the East Side SPS, is a major shipping route managed by the St. Lawrence Seaway Management Corporation (SLSMC). The canal can be crossed at Clarence Street to the south and at Main Street East (Regional Road 3) to the north. Access to the centre island is possible via

Mellanby Avenue and Killaly Street West. Ownership mapping of the area indicates that a portion of the east bank of the lift bridge of Mellanby Avenue is under the jurisdiction of the MTO.

6.4 Growth Area and Projections

In order to understand future demands on the East Side SPS and forcemain, planning projections were reviewed for the Eastside SPS from the 2016 MSP. This plan provides 2014 and 2041 values for the PWWF for Eastside SPS but does not consider the full build out potential of the lands on the east side of the canal. To provide further insight into the PWWF values post 2041, an analysis was completed to determine the estimated flows if the growth areas on the east side of the canal were fully developed. Based on the analysis, the operational capacity of the pump station was deemed to meet the demands up to the full build out of the upstream growth areas, excluding the ESEL lands. The total PWWF for the Eastside SPS can be found in Table 1 below. Of note, these projections for ESEL build out may not be required if a future pumping station north of Second Concession Road is constructed.

Table 1. East Side SPS Current and Future PWWF

		PWWF (L/s)			
Contributing Catchments	**Operational Capacity (L/s)**	**2014 Design PWWF**	**2041 Design PWWF**	**Build Out**	**Build Out + ESEL**
Eastside SPS Nickel SPS Fares SPS Fretz SPS Clarke Street SPS	252.0	143.7	155.3	237.2	294.5

Based on the current and future flows outlined above, the following table outlines the velocities expected for each flow scenario at the different internal forcemain diameters.

Table 2. Estimated Velocities for Various Flow and Internal Forcemain Diameter Scenarios

Internal Diameter (mm)	Velocities (m/s)		
	Operational Capacity	Build Out	Build Out + ESEL
300	3.57	3.36	4.17
350	2.62	2.47	3.06
400	2.00	1.89	2.34
450	1.58	1.49	1.85
500	1.28	1.21	1.50

Internal Diameter (mm)	Velocities (m/s)		
	Operational Capacity	Build Out	Build Out + ESEL
550	1.06	1.00	1.24

Based on the information provided and analyzed above, the current project is targeting velocities between 1.0 m/s and 1.5 m/s, with a recommended forcemain internal diameter size between 500 mm and 550 mm, to be confirmed during the detailed design stage.

As indicated earlier, the Region is currently undergoing the 2021 MSP update, which will include updated growth projections. These projections were not included within the original analysis; however, it has been confirmed the growth projections to 2051 do not require capacity upgrades of the station or proposed forcemain.

6.5 Geotechnical and Hydrogeological Conditions

The physiography of the City generally reflects the topography of the local bedrock surface. The area is flat, except for an irregular bedrock feature known as the Onondaga Escarpment which acts as a groundwater divide. The overburden soils are underlain by Paleozoic sedimentary rocks consisting of the surficial Bois Blanc bedrock formation, underlain by the Bertie-Akron formation, followed by the Salinan formation.

The above information was provided by Terraprobe Inc. and further details on the existing conditions can be found in Appendix E.

6.6 Archaeological Conditions

A Stage 1 Archaeological Assessment was conducted of the study area by Golder Associated Ltd. Field work for this assessment was conducted on August 19, 2020 in compliance with Section 1.2 of the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) (2011) (See Appendix C). Results from this assessment identified portions of the study area that could possibly retain archeological potential and are shown in Figure 5 and detailed below:

- Grassed margins west of the East Side SPS
- Woodlot and areas of overgrown vegetation at the north east portion of the study area
- Woodlot at the north end of the project area
- Grassed margins and overgrown vegetation along Barrick Road and Elm Street
- Overgrown lands flanking the west side of the Welland Canal
- Woodlot, overgrown vegetation and grassed margins east and north of the Seaway Water Pollution Control Plant.

If the preferred solution impacts any of these areas, a Stage 2 Archaeological Assessment was recommended in these above areas.

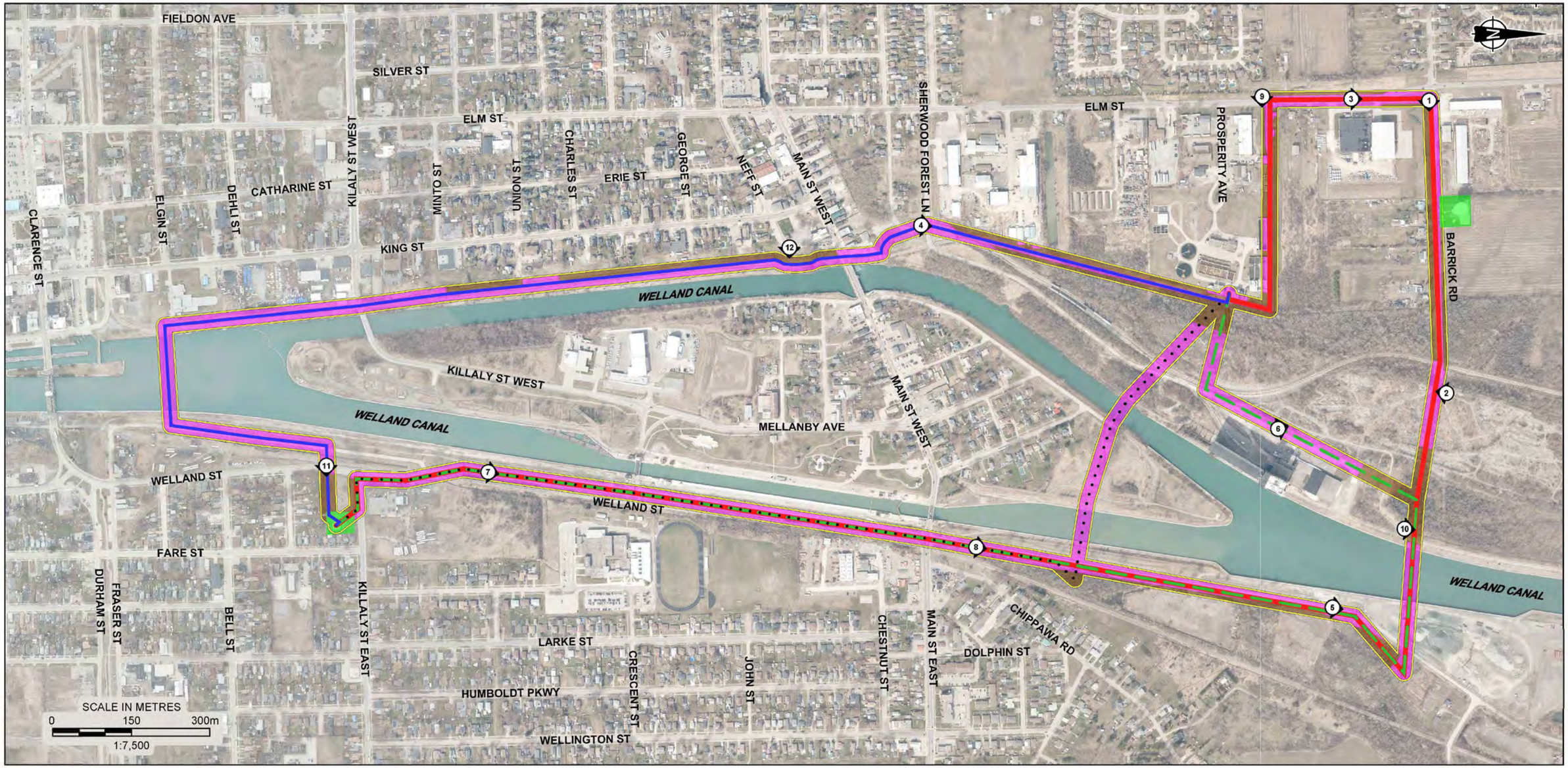
Client: Regional Municipality of Niagara

Original Format is Tabloid 279mm x 432mm

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Feb 23, 2021 – 9:33am

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LEGEND

15m BUFFER FROM ALTERNATIVES (APPROXIMATE PROJECT AREA)

ROUTE ALTERNATIVES

- 1 - DO NOTHING / 4 - REHAB
- 2A - BARRICK ROAD CROSSING - ROW
- 2B - BARRICK ROAD CROSSING - SEAWAY
- 3 - NORTH ISLAND CROSSING

STAGE 1 METHODS AND RESULTS:

- DISTURBED; NO FURTHER ARCHAEOLOGICAL CONCERN
- STAGE 2 TEST PIT SURVEY AT 5m INTERVALS RECOMMENDED
- PREVIOUSLY ASSESSED; NO FURTHER ARCHAEOLOGICAL CONCERN
- PHOTOGRAPH LOCATION, VIEWING DIRECTION, AND PLATE NUMBER

REFERENCE

DRAWING BASED ON AERIAL IMAGERY AND PARCEL DATA PROVIDED BY THE REGION OF NIAGARA; ROUTE ALTERNATIVES PROVIDED BY GM BLUEPLAN, SEPTEMBER 29 - 2020;

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

STAGE 1 ARCHAEOLOGICAL ASSESSMENT
PORT COLBORNE QUARRY EXPANSION
CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

TITLE

STAGE 1 ARCHAEOLOGICAL ASSESSMENT RESULTS

GOLDER

PROJECT No.		20139291	FILE No.	20139291-1000-R01008
			SCALE	AS SHOWN
CADD	AMS/DCH	Feb 24/21	REV.	
CHECK				

Figure 5

6.7 Natural Heritage Review

Overall, the lands within the study area have been converted into residential purposes or are heavily disturbed by construction of the Welland Canal. Soils within natural areas are managed by the SLSMC. Lands on either side of the Welland Canal consist of a variety of woody vegetation. Residential lands generally surround the study area to the west, south, and east while agricultural and other SLSMC lands occur to the north of Barrick road.

A Natural Heritage review was conducted by Terrastory Environmental Consulting Inc. of the study area which included several site assessments and surveys between May and July 2020. The site investigations and surveys were centred around characterizing land use, physiographic, ecological conditions, and features of the study area. Listed below are the types of assessments that were done under this review:

- Breeding bird Surveys
- Vascular plant survey
- Summer vascular plant survey
- Incidental observations
- Natural feature mapping
- Ecological Land classifications

Based on the background review, site assessments and surveys, several natural features were identified and include the following:

- Identified wetlands, primarily deciduous / thicket swamp along with a small meadow marsh.
- Regionally Significant Woodland and other identified forests/woodlands.
- Confirmed Significant Wildlife Habitat (SWH) including deer wintering habitat and probable/possible breeding habitat for Easter Wood-pewee (Special Concern species).
- Candidate SWH for bat maternity colonies, hibernating snakes, wintering raptors, nesting raptors, breeding amphibians, and species of conservation concern (Monarch, Yellow-banded Bumblebee, Snapping Turtle).
- Confirmed nesting habitat for the provincially Threatened Barn Swallow and candidate roosting habitat for the three provincially and federally Endangered bats (Little Brown Myotis, Northern Myotis, and Tri-colored Bats).
- Confirmed fish habitat in the Welland Canal and the potential (seasonal) fish habitat in the watercourse flowing southward just east of 138 Barrick Road and the Seaway WWTP.

Mapping of the identified significant features are shown in Figure 6. For additional details on the Natural Heritage review, please refer to Appendix B.

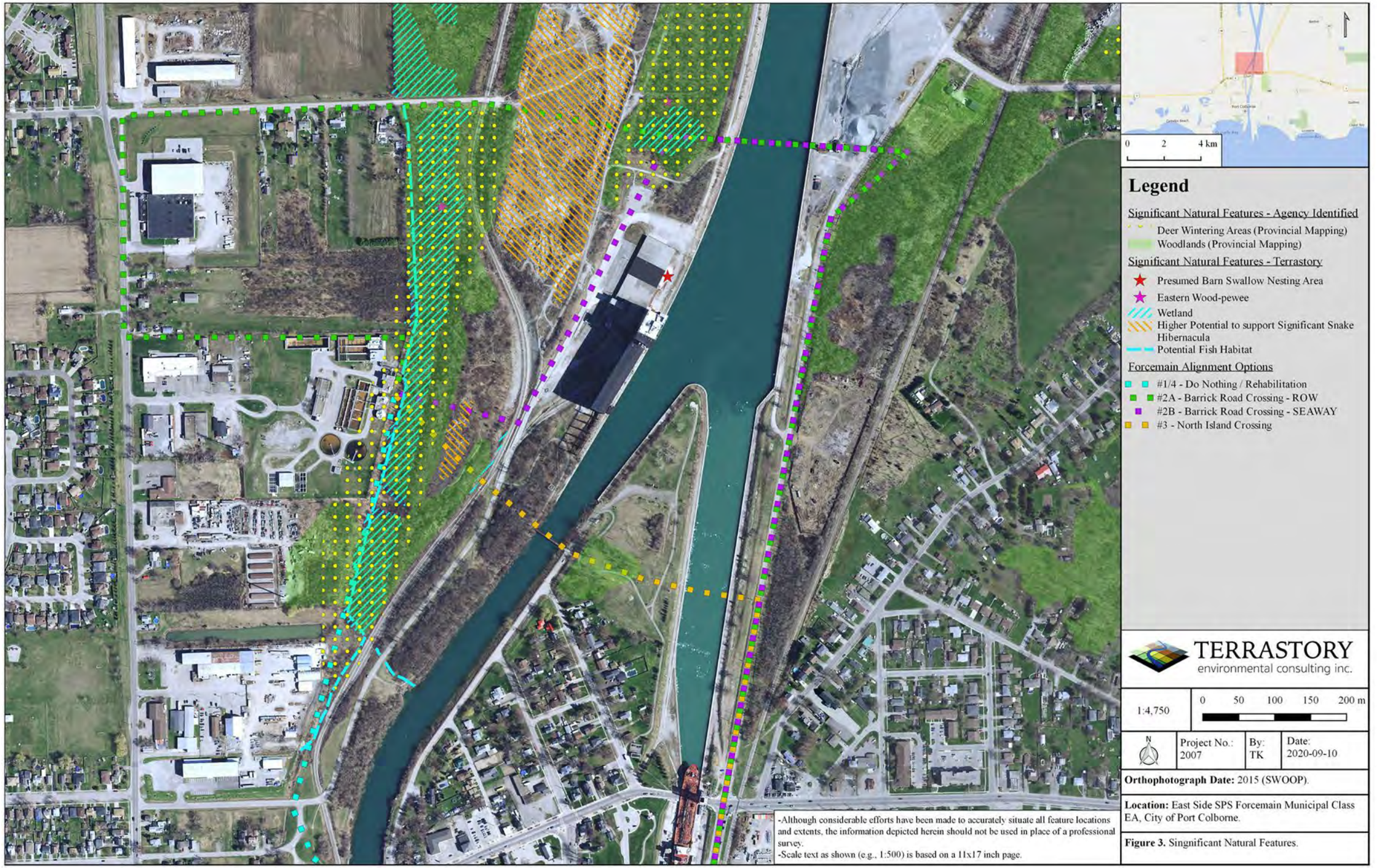


Figure 6. Significant Natural Features

6.8 Cultural Heritage Conditions

A Cultural Heritage Study was completed by Golder Associates Ltd. in August 2020 which included a desktop and field review of Cultural Heritage Existing Conditions and Preliminary Impact Assessment within the study area. The assessment found that there are several sites within the study area that are identified known or have potential for cultural heritage value or interest which are mapped on Figure 7: The following table details the resource type and civic addresses and various mitigation measures that are recommended.

Table 3. Cultural Heritage Conditions

Resource Type & Civic Address	Mitigation Measures
Potential Cultural Heritage Value or Interest – 72 Killaly Street East	• Monitor resource for vibration impacts during disturbance associated with the rehabilitation of the existing forcemain route
Potential Cultural Heritage Value or Interest – 2 Sherwood Forest Lane, former Robin Hood Flour Plant	• Monitor resource for vibration impacts during disturbances associated with the rehabilitation of the existing forcemain route
Potential Cultural Heritage Value or Interest – 401 Weir Road, Derek Point Memorial Gardens	• To reduce temporary impacts, any vegetation clearance required should be limited. Where vegetation removal is unavoidable, incorporate into the detailed design a strategy for replacement planting
Property listed on City Heritage Property Registry – 110 Saint Arnaud Street	• Monitor resource for vibration impacts during disturbances associated with the rehabilitation of the existing forcemain route
Potential Cultural Heritage Value or Interest – 183 Main Street West	• Monitor resource for vibration impacts during disturbances associated with the rehabilitation of the existing forcemain route

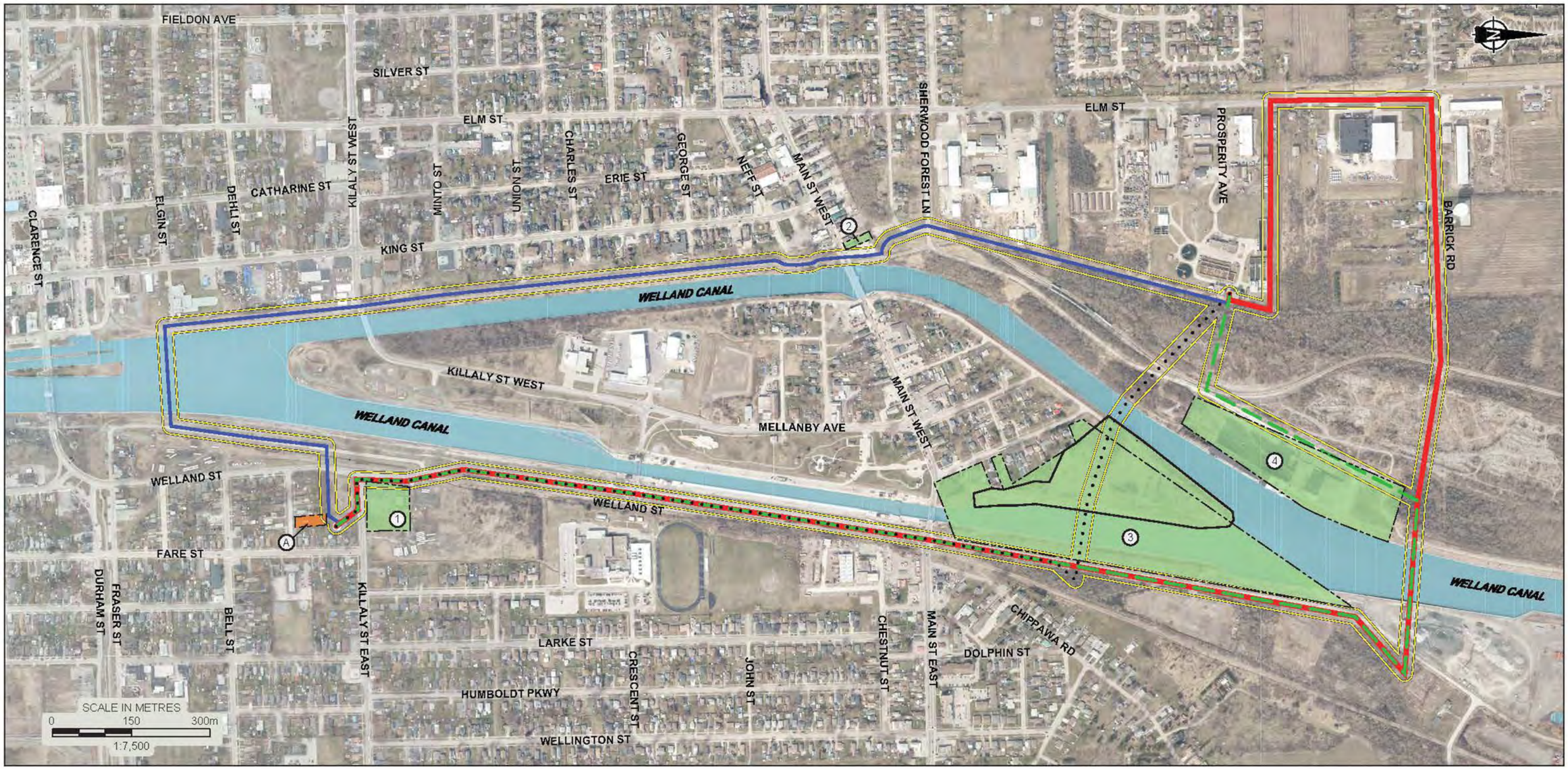
For additional details on the study, please refer to Appendix D.

Client: Regional Municipality of Niagara

Original Format is Tabloid 279mm x 432mm

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LEGEND

- PARCEL IDENTIFIED WITH HERITAGE STATUS
- 15m BUFFER FROM ALTERNATIVES

ROUTE ALTERNATIVES
- 1 - DO NOTHING / 4 - REHAB
- 2A - BARRICK ROAD CROSSING - ROW
- 2B - BARRICK ROAD CROSSING - SEAWAY
- 3 - NORTH ISLAND CROSSING

- NATIONAL HISTORIC EVENT - WELLAND CANAL
- DEREK POINT MEMORIAL GARDEN

CULTURAL HERITAGE STATUS
- LISTED
  - (A) MN: 110 Saint Arnaud ST
- POTENTIAL CHVI
  - (1) MN: 72 Kilally St East
  - (2) MN: 183 Main St West
  - (3) MN: 401 Weir Road (Derek Point Memorial Garden)
  - (4) MN: 2 Sherwood Forest Lane (Robin Hood Flour Plant)
  - (5) MN: 975 Elm St

REFERENCE

DRAWING BASED ON AERIAL IMAGERY AND PARCEL DATA PROVIDED BY THE REGION OF NIAGARA; ROUTE ALTERNATIVES PROVIDED BY GM BLUEPLAN, SEPTEMBER 29 - 2020;

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
CULTURAL HERITAGE EXISTING CONDITIONS AND PRELIMINARY IMPACT ASSESSMENT REPORT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE
OVERVIEW OF CULTURAL HERITAGE SITES

GOLDER

PROJECT No.		20139291	FILE No. 20139291-2000-R01015
			SCALE -S SHOWN REV.
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FIGURE 7

7 PHASE 2 - ALTERNATIVE SOLUTIONS AND EVALUATION METHODOLOGY

Phase 2 of the MCEA process identifies alternative solutions to address the problem and opportunity statement by considering the existing environment from a natural, social, legal/jurisdictional, technical and economic perspective. This Phase also includes the evaluation of alternatives and identification of a recommended solution. After consultation with the public, Indigenous Communities, agencies, and other interested stakeholders, the preferred solution is developed and reflects input received.

This section describes the process undertaken to identify, develop and evaluate alternative solutions to address the problem and opportunity statement.

7.1 Overview of Evaluation Approach

A well-structured comprehensive evaluation methodology provides the foundation for a decision-making process that is sound, defensible, traceable and consistent with the project objectives. The proposed decision-making methodology for this project comprises the following major sequential steps:

1. Development of a long list of alternative solutions.
2. Preliminary screening of alternative solutions endorsed by a set of preliminary screening criteria. Preliminary screening criteria were developed to reflect major goals and objectives of the MCEA.
3. Detailed evaluation of the feasible short-listed alternative solutions using a multi-criteria decision analysis based on technical, environmental, social, legal/jurisdictional and economic considerations grouped in categories and scored comparatively using an evaluation matrix.
4. Identification of the recommended alternative solution to be presented to the public and stakeholders.
5. Finalize the preferred alternative based on input received, and develop the conceptual design.

The activities involved in each of the steps listed above and the summary of the results of those activities completed to date are described in the following sections.

7.2 Long List of Alternative Solutions

In accordance with Phase 2 of the MCEA process, alternative solutions have been identified to address the need for the replacement of the 500 mm forcemain to convey raw sewage from the East Side SPS to the Seaway WWTP for treatment.

The evaluation methodology is essential in guiding the decision-making process. The key guiding elements for evaluating the alternatives utilized in this MCEA were:

- Consideration of the effects of each alternative on all aspects of the environment;
- Systematic evaluation;
- Traceable decision-making process; and
- Public and review agency input in the evaluation.

Five potential alternative solutions, including the “Do Nothing” alternative, were identified as possible solutions for the new forcemain from the East Side SPS to the Seaway WWTP. The long list of alternatives is detailed in Table 4 below.

7.3 Long List Screening Criteria

Five potential alternative solutions, including the “Do Nothing” alternative, were identified as possible routes for the forcemain replacement. The long list of alternatives is visually represented in Figure 8, and includes the following:

- Alternative 1 - Do Nothing
- Alternative 2 – Barrick Road Crossing – Elm Street
- Alternative 3 – Barrick Road Crossing – Seaway
- Alternative 4 – North Island Crossing
- Alternative 5 – North Island Crossing - Extended Northern Crossing

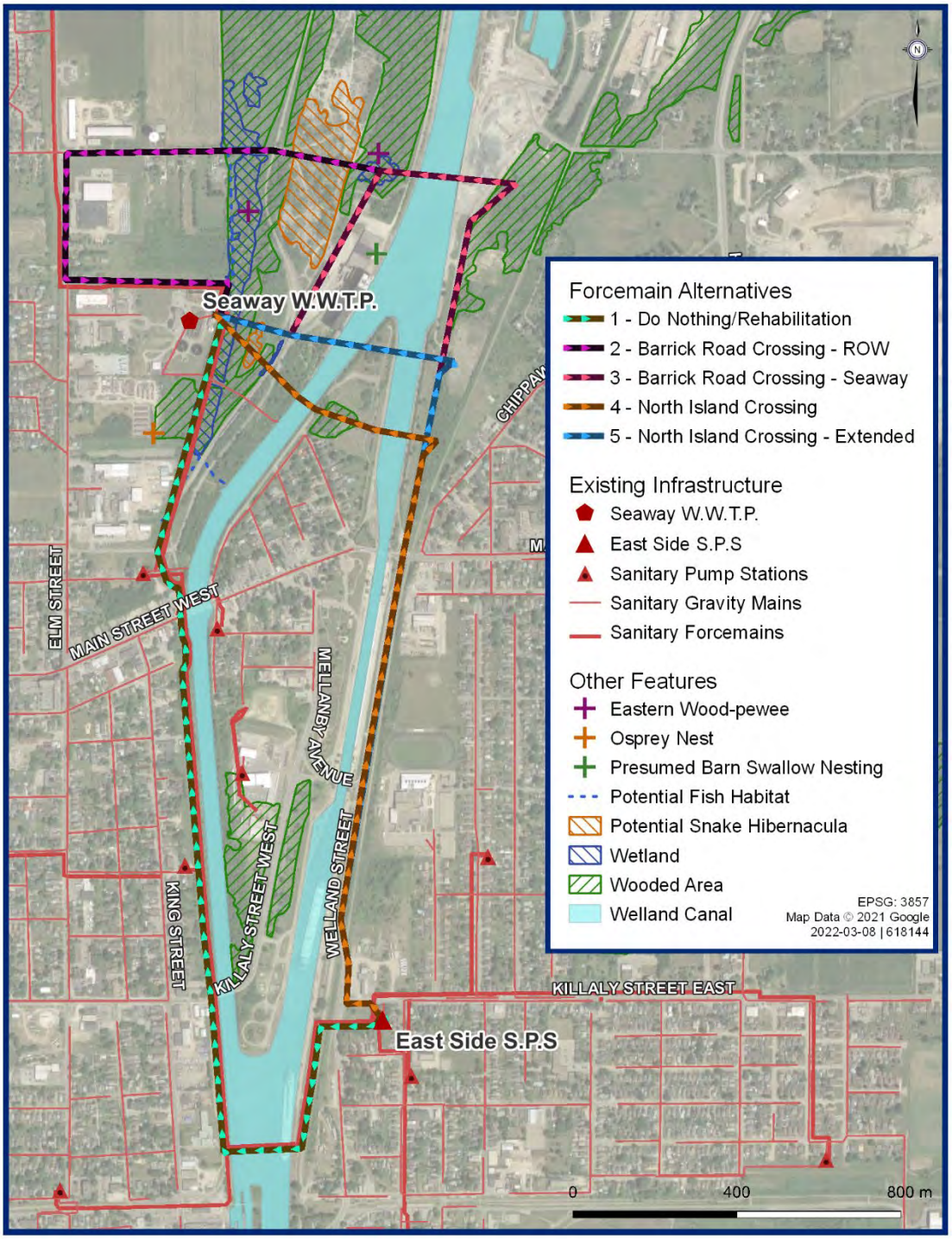


Figure 8. Long List of Alternatives

To identify a short list of forcemain alternatives to be carried forward for detailed evaluation, each of the alternatives on the long list is subject to a feasibility assessment to evaluate its ability to meet the initial screening criteria. For an alternative to be carried forward, it must pass all three (3) of the following criteria:

Screening Criteria #1 – Effectiveness and Reliability: Can the alternative effectively and reliability meet 2041 capacity requirements?

Screening Criteria #2 – Compatibility with Existing System: Is it compatible with the existing wastewater system such that it will not require major changes if implemented?

Screening Criteria #3 – Implementation Challenges: Can it be implemented without facing major constraints or time delays, including regulatory, technical, land availability, environmental and social constraints?

Table 4 presents the assessment of the long list of forcemain alternatives against the screening criteria.

Table 4. Screening of Long List of Alternatives

Alternative	1 – Effectiveness and Reliability		2 – Compatibility with Existing System		3 – Implementation Challenges		Carry / Not Carry Forward
	Assessment	Pass/ Fail	Assessment	Pass / Fail	Assessment	Pass/ Fail	
1. Do Nothing	No new forcemain does not provide effective and reliable means to meet the 2041 capacity requirements	✗	No new forcemain means no major changes to the existing wastewater system will be required	✓	No new forcemain means greater potential risk to the environment in the event of disruption	✗	Not Carry Forward
2.Barrick Road Crossing – Elm Street	Replacement would provide effective and reliable means to meet 2041 capacity requirements	✓	New forcemain would require minimal changes to the existing wastewater system	✓	Alternative can be implemented without any constraints or delays including regulatory, technical (construction) , land	✓	Carry Forward

Alternative	1 – Effectiveness and Reliability		2 – Compatibility with Existing System		3 – Implementation Challenges		Carry / Not Carry Forward
	Assessment	Pass/ Fail	Assessment	Pass / Fail	Assessment	Pass/ Fail	
					availability, environmental and social constraints		
3.Barrick Road Crossing - Seaway	Replacement would provide effective and reliable means to meet 2041 capacity requirements	✓	New forcemain would require minimal changes to the existing wastewater system	✓	Alternative can be implemented without any constraints or delays including regulatory, technical (construction), land availability, environmental and social constraints	✓	Carry Forward
4.North Island Crossing	Replacement would provide effective and reliable means to meet 2041 capacity requirements	✓	New forcemain would require minimal changes to the existing wastewater system	✓	Alternative can be implemented without any constraints or delays including regulatory, technical (construction), land availability, environmental and social constraints	✓	Carry Forward
5.North Island Crossing – Extended	Replacement would provide effective and	✓	New forcemain would require minimal	✓	Construction of forcemain alternative is not	✗	Not Carry Forward

Alternative	1 – Effectiveness and Reliability		2 – Compatibility with Existing System		3 – Implementation Challenges		Carry / Not Carry Forward
	Assessment	Pass/ Fail	Assessment	Pass / Fail	Assessment	Pass/ Fail	
Northern Crossing	reliable means to meet 2041 capacity requirements		changes to the existing wastewater system		technically feasible by drilling or tunneling construction techniques		

Based on the results of the screening, the following three alternatives were carried forward for detailed evaluation as follows:

- Alternative 2: Barrick Road Crossing – Elm Street
- Alternative 3: Barrick Road Crossing – Seaway
- Alternative 4: North Island Crossing

7.4 Short List of Alternative Solutions

The three short-listed alternatives are illustrated in Figure 9 with various icons marked along the lengths of the proposed routes to enable description of key features of the route.

7.4.1 Alternative 2: Barrick Road Crossing – Elm Street

This alternative will follow Welland Street and Barber Drive, cross the canal at Barrick Road, follow Barrick Road to Elm Street, then Elm Street to the Seaway WWTP. The estimated forcemain length associated with this option is approximately 4.1 km. Crossing of the canal would be achieved using trenchless construction methods.

7.4.2 Alternative 3: Barrick Road Crossing – Seaway

This alternative will follow Welland Street and Barber Drive, cross the canal at Barrick Road, then follow Sherwood Forest Lane and cross the Seaway-owned, undeveloped land towards the Seaway WWTP. The estimated forcemain length associated with this option is approximately 3.2 km. Crossing of the canal would be achieved using trenchless construction methods.

7.4.3 Alternative 4: North Island Crossing

This option involves a canal crossing utilizing tunneling or drilling construction techniques and requires two canal crossings on either side of the island. One tunnel crossing will be located on the east side of the island and another aerial crossing located along the pedestrian bridge on the west side of the island.

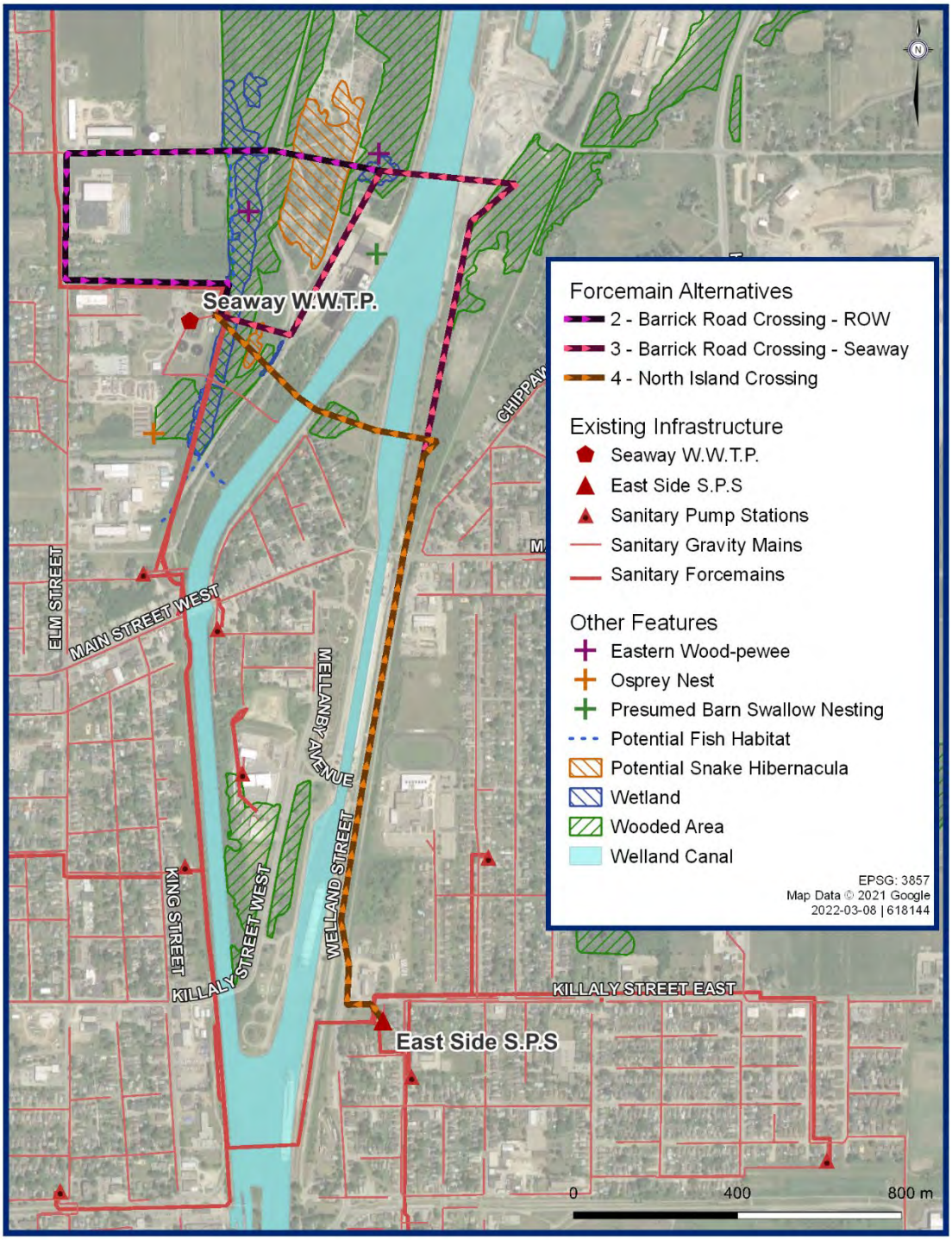


Figure *9*. Short List of Alternatives Solutions

7.5 Evaluation of the Short-Listed Alternatives

The three short-listed forcemain alternatives were then subjected to a detailed comparative evaluation using an evaluation matrix that enables a systematic and rational comparison and focuses on a set of criteria for six (6) main categories: technical constructability, technical flexibility, environmental, social/cultural, legal/jurisdictional and economic.

- **Technical Constructability -** Short-term impacts during construction including minimize higher risk construction methods, conflicts with existing infrastructure/ utilities, crossings and to maximize accessibility and safety.
- **Technical Flexibility –** Short and long-term impacts on the infrastructure's ability to be compatible with existing infrastructure, capacity for future growth, system security and ease operation and maintenance.
- **Environment -** Short and long-term impacts to the existing and surrounding natural environment including terrestrial and aquatic features/ habitat, soil, groundwater, species at risk, source water protection, air quality and environmental risk.
- **Socio/Culture -** Impacts on terrestrial and aquatic features/ habitat, soil, groundwater, species at risk, source water protection, air quality and environmental risk.
- **Economic -** Construction costs as well as the long-term impact to the facility's lifecycle cost and financial risk/costs during construction.
- **Legal/Jurisdictional –** Impacts obtaining land acquisitions and compliance with relevant planning policies.

The sub-criteria for each category are presented and described inTable 5 below.

Table 5. Detailed Sub-Criteria for Evaluation

Category	Sub-Category Criteria	Rationale / Indicators
Technical Constructability	Constructability Risk	• Ability to minimize length and size of trenchless construction challenges • Ability to minimize potential schedule/timing risk during construction
	Existing/Planned Infrastructure	• ·Ability to minimize conflicts with existing infrastructure • Ability to maintain existing services during and following construction
	Existing Utilities	• Significance of existing utilities and infrastructure and ability to maintain utilities • Ability to avoid utility easements within or in close proximity to alignment

Category	Sub-Category Criteria	Rationale / Indicators
	Crossing	• Ability to minimize major environmental, sewer, railway and highway crossings and address any applicable mitigation actions
	Accessibility	• Ability to minimize construction in areas with limited access • Ability to maximize accessibility and safety • Ability to maximize routes along road right of way and/or easements
Technical Flexibility	Compatibility with Existing and Future Infrastructure	• Ability to maximize use of existing infrastructure • Ability to minimize capital upgrades • Opportunity to coordinate planned infrastructure improvements
	Capacity for Future Growth	• Ability to meet future servicing needs for new growth and 2041* projections and beyond • Flexibility with future servicing requirements
	System Security	• Durability of infrastructure • Flexibility of system operations and operational security
	Operations and Maintenance	• Ease of access to maintain • Provision of emergency access
Environmental	Environmentally Sensitive Features	• Proximity to environmentally sensitive features (e.g. wetlands, ESAs, ANSIs, woodlots, creeks, designated natural areas, source water protection areas)
	Climate Change	• Climate change consideration (e.g. GHG emissions, impact to the environment) • Vulnerability to climate change effects • Flexibility to incorporate climate change adaptation measures in design
	Species at Risk	• Ability to minimize potential impacts to Species at Risk and sensitive species habitat (e.g., proximity to vulnerable/ threatened/ endangered or locally/regionally rare amphibians, birds, wildlife or fish)
	Soil/Land Contamination Considerations	• Requirement for contamination review/ investigation/ remediation

Category	Sub-Category Criteria	Rationale / Indicators
	Water Features / Resources	• Level of short or long term anticipated impact on surface water features. • Ability to minimize potential impacts to source water protection areas
	Geology, Hydrogeology Considerations	• Consideration for subsurface soils and rock characteristics, groundwater levels and water table levels • Level of short or long term anticipated ground water impacts (e.g. drilling through water table)
	Air Quality	• Ability to minimize potential life cycle impacts on air quality associated with overall servicing strategy
	Environmental Risk	• Ability to minimize potential environmental risk during construction and operation
Socio/Cultural	Community Impact (Residents and Local Businesses)	• Ability to minimize potential community resistance to alternative/ options • Ability to minimize resident real or perceived impact • Ability to minimize visual (aesthetic) impact • Access to property or public spaces
	Existing Infrastructure	• Ability to minimize adverse effects on roadways • Coordination with planned road work improvements
	Noise, Vibration, Odour and Dust Impact	• Ability to minimize and/or mitigate noise, vibration, and dust impacts (potential impacts major, moderate, minor)
	Built Heritage / Cultural Impact	• Ability to avoid known heritage sites, potential impacts on them and ability to mitigate • Degree of mitigative measures required
	Archaeological Impact	• Ability to avoid known archaeological resources/sites, potential impacts on them and ability to mitigate • Number of known archeological sites affected
	Traffic & Canal Operations Impact	• Relative length of construction time and impact to travel time and canal access

Category	Sub-Category Criteria	Rationale / Indicators
		• Nature of temporary local disruption to road, canal and public transit traffic • Anticipated degree of construction truck traffic management issues during construction and maintenance
Financial	Capital Cost	• Total capital (construction) cost for new infrastructure • Cost of required / needed property acquisition/ easements • Funding opportunity through joint utility crossing
	Operations and Maintenance Cost	• Cost of operation and maintaining the infrastructure • Ease of access to maintain Level of energy efficiency • Provision of emergency access
	Financial Risk	• Ability to minimize potential financial risk during construction (cost increase / uncertainty
Legal/ Jurisdictional	Property Acquisition	• Land requirement issues and agency concerns that may arise related to project routes, siting and land acquisition • Degree of complexity relating to availability of land, current designated land use, current ownership, property acquisition • Land requirement issues and agency concerns that may arise related to planning permits and crossings • Ability to minimize potential property acquisition risk during construction
	Compliance with Applicable Planning Policies	• Potential conflicts or conformity with Niagara Region and City of Port Colborne Official Plan policies, including Secondary Plans, Master Servicing Plans, Provincial Policy Statement, Greenbelt Plan, Growth Plan, NPCA, SLSMC regulations and any other relevant policies

To clearly differentiate the potential positive and negative impacts or outcomes of each alternative on the identified criteria, an impact rating scale was developed. The rating scale is defined as follows in Table 6, with 5 being the most positive impact and 1 being the most negative impact. The symbols were used for public

consultation purposes to clearly depict the impacts of each alternative. Alternative impacts for each criterion were scored by a team of engineers, scientists and planners based on the existing conditions and inventories presented in Section 6, and on based on evaluations of technical and costs considerations.

The alternative with the highest summed score (or symbolically with the most positive full circles) was selected as the preferred as the lowest potential net effects (i.e. impacts are short term and can be mitigated). Alternatives with lower scores (or symbolically with the least positive full circles) had higher potential net effects (impacts are long lasting, and mitigation may not eliminate the impact entirely). The results of the detailed evaluation and recommended alternative were presented to the public for input at the Public Information Centre (PIC). The preferred alternative was confirmed based on comments and feedback received from project stakeholders including the public and review agencies. A summary of the evaluation of alternatives in provided in Table 7, further details of the evaluation is provided in Appendix F.

Table 6. Evaluation Scoring Scale

Scoring Scale	Impact Score	Symbol
Major Positive	5	
Minor Positive	4	
Neutral	3	
Minor Negative	2	
Major Negative	1	

Table 7. Summary of Evaluation Criteria and Scoring Rationale for Each Short-Listed Alternative

Alternatives	Technical Constructability	Technical Flexibility	Environment	Socio/Cultural	Financial	Legal/ Jurisdictional
2. Barrick Road Crossing – Elm St.	• Proposed alternative follows developed right-of-way resulting in neutral impacts related to constructability	• Proposed alternative results in longest forcemain length (approximately 4.1 km) • Ability to accommodate future growth	• Minimal environmental impacts • Ability to adapt climate change considerations and design measures and con	• Indirect impacts to surrounding properties as a result of noise and vibration during construction • Impacts to existing infrastructure	• Most expensive alternative due to forcemain length	• Aligns with the Region's strategic and planning initiatives
						
3. Barrick Road Crossing – Seaway	• Proposed alternative utilizes undeveloped Seaway owned lands avoiding construction complications with existing and planned infrastructure	• Compatible with recent upgrades to the SPS • Allows for capacity for future growth • Proposed alternative results in shorter forcemain length (approximately 2.5 km)	• Mitigates potential for contamination to water sources	• Surrounding disturbances reduced as alternative is going through Seaway lands • Indirect impact to surrounding properties due to construction noise and vibrations	• Least expensive alternative	• Aligns with the Region's strategic and planning initiatives
						
4. North Island Crossing	• Increased constructability risk • Ability to construct with existing and planned infrastructure	• Compatible with recent upgrades to the SPS • Allows for capacity for future growth • Proposed alternative results in shortest forcemain length (approximately 1.6 km)	• Required tree removal within City land to facilitate laydown area for tunneling on the east side of the canal	• Surrounding disturbances reduced as alternative is going through Seaway lands • Indirect impacts to surrounding properties as a result of noise and vibration during construction • Disruption of existing parks and trails	• Less expensive alternative	• Aligns with the Region's strategic and planning initiatives
						

7.6 Preferred Alternative

Following the PIC and considering the comments received from the public, agencies, Indigenous communities and other interested stakeholders, the preferred alternative was identified to be Alternative 3, the Barrick Road Crossing, Seaway location. The timing for the proposed work is initiation of detailed design in Spring of 2022 with tender completion by Spring 2023 and construction initiating in 2026.

This alternative solution satisfies the problem and opportunity statement given:

- The installation of a new forcemain will address concerns regarding service disruptions as a result of main breaks which are experienced with the existing forcemain,
- This alternative is compatible with future shared crossings, such as a new regional watermain and forcemain to service the proposed ESEL SPS,
- It is compatible with upgrades that are anticipated in 2022 to the East Side SPS,
- Impacts to surrounding properties can be well mitigated as long as proper measures are taken, and
- This alternative will provide infrastructure capacity and flexibility to meet future capacity demands identified in the Region's 2041 Master Servicing Plan.

Additional benefits of this alternative include:

- On the west side of the canal, the alternative crosses undeveloped Seaway owned lands as opposed to a developed right-of-way, minimizing disruptions to residents and businesses in the area.
- This alternative results in reduced impact to existing trails and park land compared to Alternative 2 – Barrick Road Crossing – Elm Street
- This option results in reduced impact to existing business and residential properties along the west side of the canal compared to Alternative 4 – North Island Crossing.
- On the east side of the canal where Welland St / Barber Drive will be impacted, impacted road surfaces will be resurfaced.

This work is recommended to be completed using a small diameter tunnel boring machine in order to cross the Welland Canal.

Figure 10 shows the preferred alternative for the forcemain from the East Side SPS, crossing the Welland Canal along Barrick Road to the Seaway WWTP.

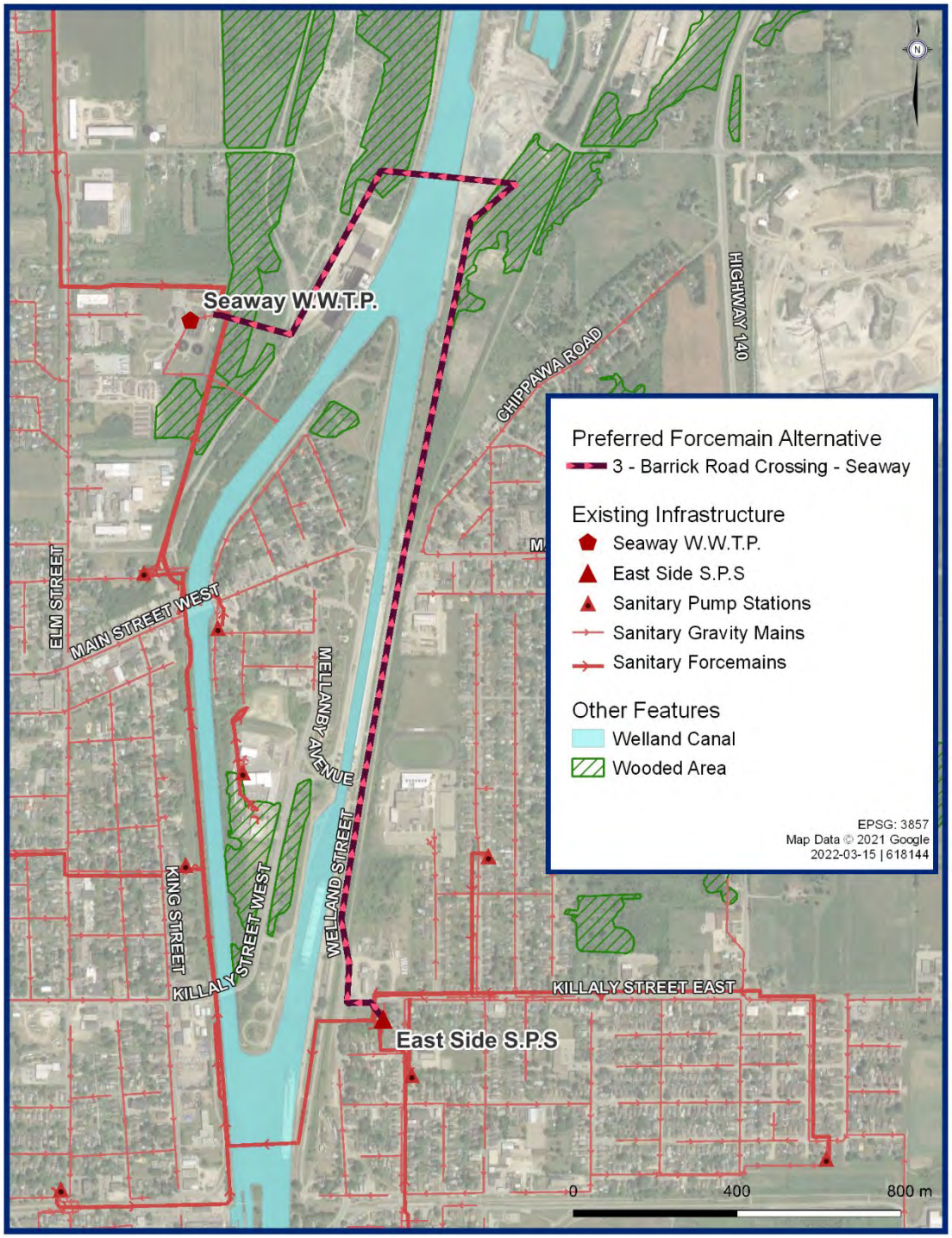


Figure 10. Preferred Alternative

8 IMPACTS AND MITIGATIONS

The Region plans to start construction of a Welland Canal forcemain crossing in 2026 to replace the forcemain connecting the East Side SPS to the Seaway WWTP. The following subsections provide a description of potential impacts associated with design, construction and operation of the proposed preferred alternative, and measures the Region will undertake to mitigate possible impacts.

8.1 Traffic Impact and Mitigation Measures

Construction of the preferred alternative will impact traffic along Welland Street and surrounding areas. Table 8 summarizes some potential impacts and the associated mitigation measures that should be employed during the design and construction phases of the project.

8.2 Watercourse Protection

Construction of the preferred alternative may result in potential impacts to the aquatic features and habitat. Table 8 details the potential impacts and corresponding mitigation measures that should be implemented during the design phase and construction phase of the project.

8.3 Hydrogeological Impact Analysis

As part of the analysis conducted by Terraprobe, two different shoring scenarios were examined to determine the estimated dewatering amounts and impacts. The two scenarios are described below:

Scenario 1 – Shoring system perched in bedrock above the excavation base with an exposed bedrock face

Scenario 2 – A permanently lined and relatively impermeable shaft that extends either to the base of the excavation or into a deeper, less-fractured (i.e., intact) bedrock stratum

Scenario 1, due to the expected daily dewatering volumes exceeding 400,000 L/d, would likely require a Permit to Take Water (PTTW). Based on available information, Scenario 2 is expected to require less than 50,000 L/d dewatering and so it is not expected to require a PTTW and may also not require registration of the dewatering activity to the Environmental Activity and Sector Registry (EASR). However, EASR registration has been recommended as a precaution to account for unanticipated potential flows through shoring systems as well as upwelling from the excavation base and the accumulation of precipitation within the plan area of the shafts. From a hydrogeological perspective, it has been recommended that both scenarios be considered for further investigation.

A dewatering impact analysis completed by Terraprobe concluded that the potential impacts to local users of groundwater resources and to geotechnical conditions (e.g. settlement) were considered negligible. It was determined that a sediment control system will be required for the duration of the construction in order to mitigate any dewatering impacts to the receiving surface water body.

Table 8 below details the potential impact and mitigation measure that should be followed during the design phase of the project. For more details on the Hydrogeological Assessment, please refer to Appendix E.

8.4 Construction Dust, Vibration and Noise Control

Noise, dust and vibration are likely to occur during construction of the preferred alternative. Table 8 below outlines some of these impacts and the associated mitigation measures that should be employed.

8.5 Archaeological Results

As noted within Section 6 - Existing Conditions, a Stage 1 Archeological assessment was completed for this MCEA in August 2020. Based on the findings from the Stage 1 assessment, parts of the alternative routes retained archaeological potential. Results from this assessment identified portions of the study area that could possibly retain archeological potential and are shown in Figure 5 in Section 6 - Existing Conditions and detailed below:

- Grassed margins west of the East Side SPS
- Woodlot and areas of overgrown vegetation at the north east portion of the study area
- Woodlot at the north end of the project area
- Grassed margins and overgrown vegetation along Barrick Road and Elm Street
- Overgrown lands flanking the west side of the Welland Canal
- Woodlot, overgrown vegetation and grassed margins east and north of the Seaway Water Pollution Control Plant.

These findings triggered the recommendation of completing a Stage 2 assessment, which was completed in October 2021 for the preferred route. During the Stage 2 assessment, test surveys were completed at 5m and 10m intervals within the areas of archaeological potential. Based on the results of the tests, it was concluded that the study area is considered free of archaeological concern and no further archeological investigation is recommended.

During the Stage 1 and 2 Archaeological assessment, Indigenous communities were contacted to participate in the MCEA and ensure that the interests and rights of the Indigenous communities are protected. The Stage 1 Archaeological Reports were made available to review and comments were received by MCFN. The MCFN, HDI and Six Nations expressed interest in having a representative during the Stage 2 archeological field work. Field work was scheduled for July 27, 2021 but due to weather constraints the field work was re-scheduled and occurred July 28, 2021. As mentioned, it was found that the sites were considered free of any archeological potential.

8.6 Cultural Heritage Results

As noted within Section 6 – Existing Conditions, there are sites nearby the preferred forcemain alternative route that have potential cultural heritage resources. The study noted that the following sites have potential for cultural heritage resources requiring a measure of mitigation, which are mapped in Figure 7 in Section 6 - Existing Conditions:

- 72 Killaly Street, East
- 2 Sherwood Forest Lane, Former Robin Hood Flour Plant

Table 8 below identifies the sites with potential for cultural heritage resource and the appropriate mitigation measures.

8.7 Natural Heritage Results

As noted within Section 6 – Existing Conditions, a Natural Heritage investigation was completed within the study area which identified various regulatory and review considerations with each proposed alternative. The study identified that regardless of the alternative, all would be subjected to several regulatory considerations at the Municipal, Provincial and Federal level since part of the study area intersects with federal lands managed by the SLSMC. Applicable legislation that should be considered are listed below:

- A request of project review to the Fisheries and Oceans Canada (DFO) so that the proposed project design and construction mitigation will not result in Harmful Alternation, Disruption or Destruction (HADD) of fish habitat within the Welland Canal
- Confirmation of whether the surface water feature (east of 138 Barrick Road shown in Figure 6) directly supports fish to clarify regulatory requirements through electrofishing methods.
- Subjected timing of vegetation removal to protect nesting birds and bird nests which will likely extend from April 1st to August 31st
- Confirmation with Environment Canada regarding regulatory requirements related to the endangered bat species. This is likely to result in a timing restriction on tree clearing during the active bat season between October 1st and April 30th.
- Due to some degree of wetland loss/disturbance, the Federal Policy on Wetland Conservation (1996) may be applicable to the undertaking and requirement of “no net loss” of wetland area. Thus, wetland compensation may be requested by the applicable federal agencies
- Communicate with the Niagara Peninsula Conservation Authority (NPCA) as it is recommended, they act as a commenting agency on the MCEA
- Review with the City’s Drainage Superintendent to confirm if any Drainage Act implications are expected with the preferred solution

Table 8 details additional studies that will need to be carried out during the detailed design to confirm applicable regulatory requirements and support agency review processes. For additional detail on the Natural Heritage investigation, please refer to Appendix B.

Table 8- Impact and Mitigation Measures for the Design and Construction Phases

Project Phase	Category	Impact	Mitigation Measure
Design	Watercourse	Erosion and sediment into the Welland Canal during the construction process	• Develop an erosion and sediment control plan to minimize sedimentation into the Welland Canal. The control plan should include: o Installation of sediment barriers on all catch basin and maintenance holes; o Silt fence barriers; and o Stabilization of exposed soils if above the high-water mark.
		Potential of sediment release or spill of a hazardous substance into the Welland Canal	• Develop a contamination and spill management response plan in the event of a sediment release or spill of a hazardous substance.
	Hydrogeological/ Geotechnical	Direct and indirect impacts to the Welland Canal as a result of dewatering activities	• Carry out additional detailed level hydrogeological investigations. • Provide recommendations for a monitoring and contingency plan for groundwater control activities. • Carry out more refined dewatering assessments of the launch and extraction shafts and recommend either a PTTW or EASR as part of detailed design. • Carry out additional ground water quality assessments to verify the level of ground water treatment that would be required to meet discharge criteria. • Preparation of a geotechnical base line report to set dewatering baseline parameters for bidding.
	Natural Heritage	Potential of direct or indirect impacts to the surrounding fish community	• Fish community survey of the watercourse via electrofishing to confirm presence/absence of fish and by extension regulatory requirements associated with the Fisheries Act during the detailed design phase of the project.
		Potential of direct or indirect impacts to SWH within the wooded areas	• Tree survey to identify any SWH within the wooded areas and to develop a tree saving plan (TSP) Snake emergency survey to clarify whether the selected alternative is expected to adversely affect this SWH. In the event SWH is documented within the preferred alternative / construction area, appropriate mitigation measures can be applied or incorporated into the detailed design.
		Potential of direct or indirect impacts to the breeding anurans	• Anuran calling surveys to confirm if early season breeding anurans occupy construction areas.
		Potential of direct or indirect impacts to bat roosting habitat within construction corridor	• An assessment of bat roosting habitat quality (i.e., density of snags/cavity trees) should occur through the construction corridor (and other treed areas to be disturbed). A survey to confirm the presence/absence of raptor stick nests (protected by the Fish and Wildlife Conservation Act (FWCA) and considered SWH) can be undertaken concurrently. Further correspondence with Environmental Canada and MECP may be necessary to confirm requirements and suitability of mitigation recommendations. It is expected that a tree removal timing window would be established to avoid impacting roosting bat maternity colonies or individuals (i.e., tree removal to occur only between October 1 and April 30).
		Impacts to the surrounding woodland if tree removal is required to provide construction laydown area	• Develop a Tree Saving Plan (TSP) as required by Regional Official Plan Policy.

Project Phase	Category	Impact	Mitigation Measure
Construction	Traffic	Impact to pedestrian accessibility and nearby businesses	• Provide adequate and clear construction signage and maintain clear and safe pedestrian pathway. • Public outreach and communication including regular status updates and a hotline for the general public and surrounding businesses to report any concerns.
		Local Traffic delays	• Maintain a Traffic Management Plan throughout the construction period with dedicated flag persons to ensure at least one lane of traffic is maintained at all times.
	Watercourse	Impact to the fish habitat and watercourse as a result of machinery and equipment	• Ensure all operation of machinery is done on land above the high-water mark where possible. Refueling, washing and servicing machinery shall be completed outside of the 30 m water course boundary where fish are present.
	Construction Dust, Vibration and Noise Control	Dust and debris as a result of construction	• Use water or calcium chloride to control dust. • Provide regular road sweeping to maintain public road free of mud.
		Noise as a result of construction	• Restrict working hours for construction, in accordance with the City's Noise Control By-law.
	Cultural Heritage Value or Interest	Potential for indirect impacts from vibration during construction works associated with the alternative, to nearby built heritage resources or property of potential Cultural Heritage Value or Interest	• Monitor the built heritage resource for vibration impacts during ground invasive works

9 PUBLIC AND AGENCY CONSULTATION

Consultation with potentially affected or interested stakeholders, such as the public, review agencies, Indigenous communities, and other stakeholders, is an integral component of the MCEA process, enabling the Region to inform the general public about the MCEA while eliciting input from potentially interested and affected parties during the MCEA process.

At the outset of the public consultation process, the Region undertook a consultation and communication program with a goal to effectively obtain feedback from members of the public. The primary objective of the plan was to encourage two-way communication with the relevant agencies and local community, more specifically, the plan was designed to:

- Present clear and concise information to stakeholders at key stages of the MCEA process.
- Build on past communication protocols and consultation plans from previous MCEAs and municipal planning initiatives for consistency and continuity purposes.
- Contact external agencies to obtain legislative or regulatory approvals, and to collect pertinent technical information.
- Provide opportunities for the general public, local councilors, stakeholders, external agencies (including federal, provincial and regional) and special interest groups to participate in the MCEA process.
- Meaningfully engage and consult with Indigenous communities in Ontario.
- Provide relevant information to interested and affected stakeholders early and often throughout the planning process.
- Consider feedback and comments when evaluating alternative solutions and in developing a preferred solution.,
- Comply with MCEA consultation requirements.

Comments received throughout the course of the MCEA were considered and are documented in 9.1.5 below and further documentation related to the consultation activities undertaken during this MCEA is included in Appendix A.

9.1 Communication and Consultation Overview

The MCEA specifies two mandatory points of contact for Schedule B projects:

- An invitation for the public, Indigenous communities, agencies and other stakeholders to comment on the alternative solutions under consideration.
- A Notice of Completion for the project and an opportunity for the public, Indigenous communities, agencies and other stakeholders to review the Project File.

The following sections document how the Region has met MCEA consultation requirements.

9.1.1 Stakeholder Mailing List

A direct mailing list was developed at the initiation of the project to invite participation in the planning process and was continually updated throughout the course of the project. Direct mailings were made to notify residents, landowners, politicians, municipalities, school boards, Indigenous communities, Provincial and Federal agencies, interest groups and utilities of the project.

Residents along each of the forcemain alternative routes as well as within a 500 m radius of both the Seaway WWTP and the East Side SPS sites were included on the mailing list to inform residents of the project and allow their concerns to be heard through the MCEA process. The mailing list that was developed and maintained is included in Appendix A1 with sensitive information redacted.

9.1.2 Project Website

A link to the project website (https://www.niagararegion.ca/projects/eastside-sewage/default.aspx) was provided in the notices that were sent out. Notices, PIC materials, relevant information, and a copy of this Project File have been posted on the project website.

9.1.3 Notice of Commencement

A Notice of Commencement was issued in local newspapers to inform the public that a MCEA was being conducted to review potential alternatives of the new wastewater forcemain from the East Side SPS to the Seaway WWTP located in the City. The Notice was issued May 23, 2019, and advertised in the Niagara this Week, Zone 5 newspaper and on the Region's project website as follows:

- Mailed to stakeholders included in the mailing list on June 3, 2019
- Advertised in the Niagara This Week, Zone 5 on Thursday May 23, 2019
- Posted on the Region's project website:
- https://www.niagararegion.ca/projects/eastside-sewage/default.aspx

A copy of the Notice is included in Appendix A2.

9.1.4 Public Information Centre

As required under the MCEA process, a PIC for this project was held as a virtual session to encourage attendees to review the presentation and display boards. The MCEA's PIC was intended to elicit input on the MCEA process, constraints and opportunities, alternative concepts and strategies to address the problem and opportunity statement; specifically:

- Obtain input on the alternative routes investigated for the new forcemain from the East Side SPS to the Seaway WWTP;
- Obtain input on the evaluation criteria utilized to determine the recommended alternative of the new forcemain; and
- Obtain input on the recommended alternative for the new forcemain from the East Side SPS which would travel along Welland Street and Barber Drive and cross the canal at Barrick Road.

The Notice of PIC was communicated by the following means:

- Mailed to the stakeholders listed in the contact list,
- Mailed to residential and commercial properties in proximity to the study area, and
- Advertised in the Welland Tribune (August 21, 2021), Niagara This Week (August 26, 2021), and on the Region website (https://www.niagararegion.ca/projects).

The PIC was conducted via a virtual recorded presentation with audio and transcribed as shared online. This video was made available on the Region's project website beginning September 8, 2021. This was followed by a two-week period to submit comments to the Project Team through the Region's project website.

The public meeting materials included:

- Display panels: Including information about the project using both text and visuals.
- Comment Sheets: Participants could fill out a comment sheet online as an opportunity to provide comments, make suggestions or ask questions about the project and/or the MCEA process.

Copies of the Notice, display panels and other material available at the meeting are included in Appendix A3.

9.1.5 Public Comments Received and Responses

In general, there was support for the preliminary preferred alternative, however there were some key issues raised by the members of the public through the PIC and MCEA process. Table 9 below provides a summary of issues raised by the public and the responses provided by the Region to mitigate these issues through the proposed project implementation. A more detailed list of issues raised is provided in Appendix A4.

Table 9. Summary of Comments Raised by the Public

Stakeholder	Date Received	Summary of Comment/Concern	Region's Response/ Action
Resident	May-2019	Requested to be added to the stakeholder list	• Region added contact to the stakeholder list to receive upcoming project information and notices
Local Business Owner	May-2019	Requested to be added to the stakeholder list	• Region added contact to the stakeholder list to receive upcoming project information and notices
Utilities	July-2019	Stakeholder noted interest in joining a new crossing	• Region provided contact with the NOC, added contact to the list to receive upcoming project information, notices, and noted they will be contacted during the detailed design phases of the project. Region provided continuous

Stakeholder	Date Received	Summary of Comment/Concern	Region's Response/ Action
			conversation throughout the duration of the project
Utilities	July-2019	Stakeholder noted interest in joining a new crossing	• Region provided contact with the NOC, added contact to the list to receive upcoming project information, notices and noted they will be contacted during the detailed design stages of the project • Region provided continuous conversation throughout the duration of the project
Resident	February-2021	Resident owns parcel of land that would be used as a temporary contractor laydown area. Resident noted interest in providing land for contractor laydown area.	• Region emailed and arranged meeting to provide resident in background information regarding MCEA and limits of contractor laydown area on property. • Region added contact to the stakeholder list to receive upcoming project information and notices
Local Business Owner	September-2021	Concerns regarding access to properties, resident safety and traffic control during construction	• All construction will adhere to strict safety guidelines. Traffic control measures will be developed to mitigate any potential traffic disturbance during construction of the forcemain. • Standard best practices for vehicle and pedestrian safety will be used during construction.

9.1.6 Notice of Completion

A Notice of Completion was published on July 23, 2022 to notify the public that this Project File was being placed on the "public record" for the required 30-day public and agency review period. Agencies, local businesses and residents were informed of the Notice of Completion by the following means:

- Mailed copy of the notice and letter addressed to the agencies within the mailing list;
- Mailed copy of the notice and letter addressed to local businesses and residential properties within the study area;
- Advertised in the local newspapers, the Welland Tribune and Niagara This Week; and
- Advertised on the Region's website at https://www.niagararegion.ca/projects.

This notice satisfies the final consultation point of contact in the MCEA process. A copy of the notice and mailed letters are provided in Appendix A2.

During the review period, the MCEA entitles interested persons, Aboriginal communities, or government agencies who has significant concerns, which cannot be resolved, to request the MECP to issue a Part II Order under the EA Act. If there are no Part II Order requests, and following the receipt of other required approvals, the proposed wastewater forcemain may proceed to design and construction.

9.2 Agency Consultation

Consultation with review agencies is also essential to the communication component of the MCEA process. Agencies were consulted in an effort to gain valuable information they may have, obtain their feedback on alternatives and how to best proceed with the project. Relevant agencies were notified of project commencement, PIC and project completion. A Technical Advisory Committee (TAC) was formed including Great Lakes SLSMC, the City and the Region to regularly meet and discuss during the EA process.

The following agencies were circulated Notices and PIC details related to this MCEA:

- MECP
- Ministry of Indigenous Affairs
- Ministry of Economic Development, Job Creation and Trade
- Niagara Peninsula Conservation Authority
- Ministry of Transportation
- Ministry of Natural Resources and Forestry
- DFO
- Various Utilities – Bell Canada, Hydro One Inc., Union Gas Limited, Canadian Niagara Power, Trillium Railway
- Niagara District School Board and Niagara Catholic District School Board
- Niagara Peninsula Conservation Authority
- City of Port Colborne*
- Great Lakes SLSMC*

*The City and the Great Lakes SLSMC actively participated in this project as described above. Comments were also received from the Ontario Ministry of the Environment, Conservation and Parks (MECP).

In response to the Notice of Commencement and PIC, an email correspondence was received from the MECP West Central Region, EA/Planning Coordination Section, dated June 5, 2019. The letter provided preliminary

comments and a document outlining “Areas of Interest” to provide guidance regarding the ministry’s interests with respect to the MCEA process. Additional guidance was also provided with respect to the Ministry’s internal protocol for Aboriginal consultation. The MECP provided a list of three (3) Aboriginal communities that should be notified of the project and participate in consultation activities. The 3 listed communities were all previously included on the consultation list. A copy of the letter can be found in Appendix A6.

Ontario Ministry of Natural Resources and Forestry (MNRF)

On January 12, 2021, correspondence was initiated with the MNRF to inquire about the restrictions on the discharge of groundwater to the Welland Canal, specifically the appropriate water quality standard to apply and the threshold of maximum discharge rate to the Welland Canal. This was based on the fact that some alternatives require construction of a tunnel beneath the Canal resulting in construction discharges.

In response, the MNRF noted that the MECP would be the appropriate Ministry for questions surrounding the discharge of groundwater. The MNRF provided additional information in identifying and assessing natural features and resources, which had already been considered within the MCEA. A copy of the email correspondence can be found in Appendix A2.

Fisheries and Oceans Canada (DFO)

On January 12, 2021, correspondence was also initiated with the DFO to inquire about the restrictions on the discharge of groundwater to the Welland Canal, specifically the appropriate water quality standard to apply and the threshold of maximum discharge rate to the Welland Canal.

On January 20, 2021, DFO followed up with a phone call to note that responsibilities of environmental considerations from discharges from construction dewatering systems are the responsibility of the MECP. A copy of the email correspondence can be found in Appendix A2.

9.3 Indigenous Communities Consultation

Indigenous Communities were consulted to build meaningful dialogue with Indigenous Communities and government agencies, and to ensure consultation is satisfied through this MCEA process.

At the onset of the project, the MCEA team consulted the guidelines available on the Ontario Ministry of Indigenous Affairs website to determine Indigenous Communities consultation requirements (Environmental assessments: consulting Indigenous communities | ontario.ca). The project team used the Indigenous and Northern Affairs Canada (INAC) Aboriginal and Treaty Rights Information System (ATRIS) to help identify which Indigenous Communities may be interested in or potentially impacted by the proposed project. Additionally, the project team contacted MECP to request feedback on the list of Indigenous Communities generated using ATRIS. A response was provided from MECP, and as a result these Indigenous Communities were added to the project contact list.

By searching a 100 km radius around the City in ATRIS, and with the additional input of MECP, the following Indigenous Communities were included on the project contact list:

- MCFN
- Six Nations of the Grand River
- Haudenosaunee Confederacy Chiefs Council
- Metis Nation of Ontario
- Region Metis Council
- The Chiefs of Ontario

Letters were mailed to all communities to advise of the project and the PIC. No responses were received from any of the Indigenous Communities. Follow up phone calls were also made to confirm receipt of the notice and letter and the invitation for a consultation meeting. There was, however, interest and involvement in the Stage 2 Archeological Assessments by field representatives from the MCFN, HDI and Six Nations as detailed in Section 8 and Appendix C.

There were no concerns identified through these methods of communication. A detailed list of Indigenous Communities contacted and a consultation log documenting all correspondences are included in Appendix A5.

10 AGENCY APPROVAL REQUIREMENTS

Compliance with the EAA and the MCEA does not preclude the Region from additional agency approvals for the recommended project. Following the completion of the MCEA process, the Region must undertake discussions with relevant agencies to ensure that all applicable approvals are received prior to implementing projects.

The following list highlights approvals which may be necessary to carry out the proposed project. Additional approvals may become applicable or be specified by affected agencies at any time.

Table 10. Permits and Approvals

Required Permit / Approval	Timing during Detailed Design for Notification / Coordination / Approval	Notes
MECP Environmental Compliance Approval	After Region Approval of 90% Design	As part of the approval process with the MECP, it is anticipated that discussions will be held to establish the basis of design and to identify approval requirements. • A separate application will be required for both the proposed forcemain and watermain • The Transfer of Review program can be considered for approval of the proposed forcemain • The proposed 450mm diameter watermain will be pre-approved with a Form 1 requirement • Amendment to the existing Environmental Compliance Approval (ECA) for the Seaway WWTP site to reflect the changes to the East Side SPS and the addition of the new forcemain. • PTTW – the need for a permit to take water will be determined during detailed design, upon the completion of further geotechnical and hydrogeological work to determine the level of water taking required for construction. A Permit to Take Water is required for any water takings over 50,000 L/day. For a taking of greater than 50,000 L/day, but less than 400,000 L/day, the Permit should be obtained via the Environmental Activity and EASR. For takings greater than 400,000 L/day, a PTTW shall be required via the conventional application process.

Required Permit / Approval	Timing during Detailed Design for Notification / Coordination / Approval	Notes
MTO Input and Approval	Throughout Detailed Design, including early engagement for proposed watermain to be constructed along Highway 140	• The proposed watermain is required to connect to the existing watermain located on MTO-owned Highway 140 and engagement with MTO and approval of works within the Highway 140 ROW will be required. • The area Municipal Corridor Officer should be engaged as part of the preliminary design to better understand requirements and constraints. • 60% Detailed Design Drawings for the proposed watermain should be submitted to MTO for review and approval after review and approval by the Region.
Railway Crossing Approvals • City (and Port Colborne Harbour Railway) • SLSMC (and Trillium Railway)	Throughout Detailed Design, including early engagement for proposed forcemain and watermain crossings of respective railways	• Coordination with the City (and operator Port Colborne Harbour Railway) will be required to determine permitting and flagging for the watermain crossing on 2nd Concession Road and the forcemain crossing on Welland Street. • Coordination with the SLSMC (and operator Trillium Railway) will be required to determine permitting and flagging for the watermain crossing on Barrick Road and the forcemain crossing on Sherwood Forest Land. • Engagement should commence at the preliminary design stage to understand overall design and construction requirements • 60% Detailed Design Drawings for the proposed watermain should be submitted to the rail corridor owners and operators for review and approval after review and approval by the Region. • Flagging and construction requirements should be incorporated into the Contract Documents.

Required Permit / Approval	Timing during Detailed Design for Notification / Coordination / Approval	Notes
Utilities	Throughout Detailed Design	• Detailed plans and specifications must be submitted to the local office of the Hydro authority and other utilities for review and approval prior to construction, particularly for the alternative sections within the road right-of-way.
Property Acquisition and Temporary Construction Access • SLSMC • Residential Property at 211 Second Concession Road • NPCA	Throughout Detailed Design	• Permanent and temporary construction easements will be required for both the forcemain and watermain works. • Tree removal and clearing and grubbing will be required on SLSMC Lands. • Tunnelling works under the Welland Canal will require approval and appropriate precondition survey and monitoring of conditions. • The Region will need to coordinate with the SLSMC (and operator Trillium Railway) to determine permitting and flagging for the watermain crossing on Barrick Road and the forcemain crossing on Sherwood Forest Land. • Since the extent of the vegetation clearing will not be determined until the detailed design phase, a tree preservation plan is likely to be required by NPCA as part of the detailed design stage. NPCA's landscaping and vegetation plan guidelines should be consulted for further assistance in this regard at detailed design.
The Region • Construction Encroachment Permit	90% Detailed Design	• Construction of the proposed forcemain and proposed watermain within Welland Street.

Required Permit / Approval	Timing during Detailed Design for Notification / Coordination / Approval	Notes
The City • Road Occupancy Permit	90% Detailed Design	• Construction of the proposed forcemain and proposed watermain within Barber Drive, Second Concession Road and Barrick Road. The Region will require approvals from the City for road works within road right of ways within the City boundary. Permits expected to be required include: ➢ Municipal Consent Permit ➢ Road Cut Permit
DFO Project Review	Throughout Detailed Design, including early engagement to ensure that any required additional studies can be completed ahead of 40% Design Submission	• The north-south watercourse located immediately east of the Seaway WWTP within SLSMC Lands has been noted as having potential for fish habitat. • There may be timing restrictions for construction within the SLSMC Lands. The new crossing of the Welland Canal will require consultation with DFO. As well, once the construction design details are confirmed during the detailed design phase for the forcemain across the Welland Canal, project works can be assessed to determine whether they can adhere to the DFO 'Measures to avoid causing harm to fish and fish habitat including aquatic species at risk', and thereby comply with the Fisheries Act.

Required Permit / Approval	Timing during Detailed Design for Notification / Coordination / Approval	Notes
MNRF	Throughout Detailed Design, including early engagement to ensure that any required additional studies can be completed ahead of 40% Design Submission	The Natural Environment Report (see Appendix B) provides examples of potential mitigation approaches for natural features. The Natural Environmental report notes Species at Risk (SAR) identified for the project study area. This includes Little Brown Myotis, Northern Myotis, Tri-colored Bat and Barn Swallow. Based on the planned trenchless construction method for the canal crossing portion of the work, it is anticipated that impacts to SAR will be mitigated, however, once more detail is available regarding the construction methods during detailed design, further consultation with the MNRF will be necessary to ensure project compliance under the *Endangered Species Act (ESA).* Approvals required: • Consultation with MNRF during detailed design. o Wildlife relocation permits may be required if wildlife removals are needed during construction. o Fish relocation permits may be required if fish salvage or relocations are needed during construction. • Permit or other authorization may be required to conduct an activity that could impact an endangered or threatened plant or animal or its habitat.

11 SUMMARY AND CONCLUSIONS

During this MCEA, the Regional Municipality of Niagara worked closely with key stakeholders to address and resolve key issues and challenges associated with evaluating alternative servicing needs for the East Side SPS Forcemain.

Based on the comprehensive review of four different alternative solutions against a multiple bottom line evaluation process which took into consideration environmental, social, constructability, financial, and operational factors, Option 3 – Barrick Road Crossing – Seaway was identified as the preferred solution to the problem and opportunity statement for this MCEA. The preferred solution offers the best asset value to

the Region from an operations, maintenance and lifecycle perspective whilst having the least overall impact to the natural and social environment.

Provided no comments or Part II orders are received during the 30-day review process, it is recommended that the Region proceed with design of the new forcemain as outlined herein.

11.1 Public Review Period

At the conclusion of Phase 2 of the MCEA process for Schedule B projects, a Project File is prepared, and a Notice of Completion is issued. The PFR for the East Side SPS Forcemain Replacement in the City (i.e., this report) documents the decision making process during the MCEA. The Notice of Completion of this MCEA (issued on July 23, 2022) notifies members of the public and agencies that the PFR would be available for public review for a thirty day period (30-days). The PFR was made available for public review at the following locations during normal business hours:

Clerk's Department
Regional Municipality of Niagara
1815 Sir Isaac Brock Way, P.O. Box 1042
Thorold, ON L2V 4T7
Tel: (905) 980-6000, ext. 3222
Monday – Friday 8:30 a.m. – 4:30 p.m.

Clerk's Department
City of Port Colborne
66 Charlotte Street, Port Colborne
Ontario, Canada L3K 3C8
Tel: (905) 835-2900
Monday – Friday 8:30 a.m. – 4:30 p.m.

Written comments on this Project File should be submitted to:

Michelle Miller, C.E.T
Project Manager, Water and Wastewater Services Niagara Region
3501 Schmon Pkwy., PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000 ext. 3737
Toll-free: 1-800-263-7215
michelle.miller@niagararegion.ca

In accordance with the Municipal Class Environmental Assessment (2000, as amended in 2007, 2011, and 2015; and considering the 2020 addendum currently under review), if no concerns are expressed by the conclusion of the specified review period, the Region may proceed with the design and construction of the project as described in this Project File.

APPENDIX A: PUBLIC CONSULTATION

APPENDIX A1: STAKEHOLDER REGISTER

East Side Sewage Pumping Station Forcemain Replacement
Schedule B Municipal Class Environmental Assessment
Stakeholder Register

S/N	First Name	Last Name	Organization	Organizational Position	Location	Role in the Project	Email	Phone Number	Alternate Phone Number
Niagara Region & GMBP									
1	Michelle	Miller	RMoN	Project Manager	Environmental Center Public Works Facility (3501 Schmon Pkway. Thorold, ON L2V 4Y6	Project Mgt Team Member	michelle.miller@niagararegion.ca	905 658 6000, Ext. 3737	905 658 1004
2	Richard	Gabel	RMoN	Senior Project Manager	Environmental Center Public Works Facility (3501 Schmon Pkway. Thorold, ON L2V 4Y6	Project Mgt Team Member	Richard.Gabel@niagararegion.ca	905 980 6000, Ext. 3209	
3	Tony	Cimino	RMoN	Associate Director, Water and Wastewate Engineering	Environmental Center Public Works Facility (3501 Schmon Pkway. Thorold, ON L2V 4Y6	Region Senior Management	Tony.Cimino@niagararegion.ca	905 980 6000, Ext. 3235	
4	Joe	Tonellato	RMoN	Director, Water and Wastewater Services	Environmental Center Public Works Facility (3501 Schmon Pkway. Thorold, ON L2V 4Y6	Region Senior Management	Joseph.Tonellato@niagararegion.ca	905 980 6000, Ext. 3244	
5	Amanda	Beattie	GMBP	Consultant (GMBluePlan Engineering Limited)	410 Lewis Road, Unit 18 Stoney Creek, ON, L8E 5Y7	Project Mgt Team Member	Amanda.Beattie@gmblueplan.ca	905 643 6688, Ext 6205	905 932 4844
6	Rafiq	Qutub	GMBP	Consultant (GMBluePlan Engineering Limited)	410 Lewis Road, Unit 18 Stoney Creek, ON, L8E 5Y7	Project Mgt Team Member	Rafiq.Qutub@gmblueplan.ca	905 643 6688	
7	John	McPherson	RMoN	Manager - Wastewater Operations (Area 2)	Welland WWTP	Project Support - Operations	John.MCPherson@niagararegion.ca	905 980 6000, Ext. 5452	
8	Frank	Vasko	RMoN	Manager, Wastewater Maintenance (Area 2)	Welland WWTP	Project Support - Maintenance	Frank.Vasko@niagararegion.ca	289 668 0698	
9	Frank	Fucile	RMoN	Real Estate Officer	RON, Headquaters Campbell East	Project Support - Real Estate	Frank.fucile@niagararegion.ca	905 980 6000, Ext. 3327	
10	Taurins	Normans	RMoN	Manager of Surveys and Property Information	RON, Headquaters Campbell East	Project Support - Surveying and Ppty Info	normans.taurins@niagararegion.ca	905 980 6000, Ext. 3325	
11	Ken	Scholtens	RMoN	Manager, Business Development & Expedited Services	RON, Headquaters Campbell East	Project Support - Economic Development	Ken.Scholtens@niagararegion.ca	905-980-6000 Ext. 3710	905-401-8209
12	Mike	Janas	RMoN	Associate Director, Water Operations		Project Support - Water Ops			
13	Jeff	Carl	RMoN	Area 2 Water Operations Manager		Project Support - Water Ops			
14	Mod	Zoltan	RMoN	Area 2 Water Maintenance Manager		Project Support - Water Maintenance			
Port Colborne									
15	Steve	Shypowskyj	City of Port Colborne	Manager of Projects & Design	City of Port Colborne	Project Support - LAM	projectmanager@portcolborne.ca	905-835-2901, Ext. 220	
16	Julian	Douglas-Kameka	City of Port Colborne	Economic Development Officer	City of Port Colborne	Project Support - LAM	JulianDouglas-Kameka@portcolborne.ca	905-835 2901, Ext. 502	
17	Dan	Aquilina	City of Port Colborne	Director of Planning and Development	City of Port Colborne	Land Acquisition	Dan.Aquilina@portcolborne.ca		
Utilities / Other									
18	Lisa	Allen	St. Lawrence Seaway Management Corporation	Real Property Management Officer	St. Lawrence Seaway Management Corporation, 508 Glendale Avenue, P.O. Box 370 St. Catharines, ON L2R 6V8	Project Support - Property Mgt Seaway	LAllen@seaway.ca	905-641-1932, Ext. 5068	
19	Cassie	Kelly	St. Lawrence Seaway Management Corporation	Manager of Engineering	St. Lawrence Seaway Management Corporation, 508 Glendale Avenue, P.O. Box 370 St. Catharines, ON L2R 6V8	Project Support - Engineering Seaway	ckelly@seaway.ca	905-641-1932, ext 5391	
20	Sam	Larosa	St. Lawrence Seaway Management Corporation	Senior Civil Engineer	St. Lawrence Seaway Management Corporation, 508 Glendale Avenue, P.O. Box 370 St. Catharines, ON L2R 6V8	Main Seaway Contact Project Support - Engineering Seaway	slarosa@seaway.ca	905-641-1932, ext 5424	
21	Glenn	Rutherford	St. Lawrence Seaway Management Corporation	Process Support Coordinator - Canal Services	St. Lawrence Seaway Management Corporation, 508 Glendale Avenue, P.O. Box 370 St. Catharines, ON L2R 6V8	Project Support - Operations Seaway	grutherford@seaway.ca	905-641-1932, ext 5433	
22	Pat	Beaudoin	St. Lawrence Seaway Management Corporation	Senior Inspection Engineer	St. Lawrence Seaway Management Corporation, 508 Glendale Avenue, P.O. Box 370 St. Catharines, ON L2R 6V8	Project Support - Engineering Seaway	PBeaudoin@seaway.ca		
23	William	McKenzie	Bell Canada	905 West R-O-W Manager	Bell Canada, Fl. 3, 63 King Street., P.O Box 190, St. Catharines, ON, L2R 6S9	Project Support/Partner	william.mckenzie@bell.ca	289-219-1413	905-988-9904
24	Craig	Stratychuk	Bell Canada	Engineering Manager for the Port Colborne area	Bell Canada, Fl. 3, 63 King Street., P.O Box 190, St. Catharines, ON, L2R 6S10	Project Support/Partner	craig.stratychuk@bell.ca		
25	Don	Gilbert	Canadian Niagara Power	Regional Manager, Niagara, Corporare	1130 Bertie Street Fort Erie, Ontario	Project Support/Partner		905.871.0330	
26	Jeff	Hoover	Canadian Niagara Power	Planning Supervisor	1130 Bertie Street P.O Box 1218 Fort Erie, Ontario	Project Support/Partner	Jeff.Hoover@cnpower.com	905-871-0330 Ext. 3217	
27	Aaron	White	Trillium Railway	Administration Officer	265 King Street, PO Box 218 Port Colborne, Ontario L3K 5V8		Aaron.White@trilliumrailway.com		
28									

East Side Sewage Pumping Station Forcemain Replacement
Schedule B Municipal Class Environmental Assessment
Stakeholder Register

S/N	First Name	Last Name	Organization	Organizational Position	Location	Role in the Project	Email	Phone Number	Alternate Phone Number
29									
30			Ministry of the Environment, Conservation and Parks (MECP)				eanotification.wcregion@ontario.ca		
31	Barbara	Slattery	Ministry of the Environment, Conservation and Parks (MECP)	EA/Planning Coordinator			barbara.slattery@ontario.ca	(905) 521-7864	
32	Sean	Roelofsen	Ministry of the Environment, Conservation and Parks (MECP)				Sean.Roelofsen@ontario.ca		
33	Kim	Groombridge	Ministry of the Environment, Conservation and Parks (MECP)	District Manager	Garden City Tower 301 St Paul St, 9th Fl, Suite 15 St Catharines, ON L2R 7R4		kim.groombridge@Ontario.ca	905-704-3914	
34	Shawn	Batise	Ministry of Indigenous Affairs	Assistant Deputy Minister	4th Flr, 160 Bloor St E, Toronto, ON M7A 2E6		shawn.batise@ontario.ca	416-325-0304	
35	Michael	Reid	Ministry of Economic Development, Job Creation and Trade	Assistant Deputy Minister	4th Flr, 400 University Ave, Toronto, ON M7A 2R9		michael.reid@ontario.ca	647-273-0785	
36	Renee	Bisson	Niagara Peninsula Conservation Authority (NPCA)	Community Engagement Manager & Interim Manager of Communications	250 Thorold Road West; 3rd Floor		rbisson@npca.ca	905-788-3135	
37	Antoinette	Karner	Minitry of Transportation	Manager, Policy and Programs/Executive Assisstant	Garden City Tower 6th Flr, 301 St. Paul St, St Catharines, ON L2R 7R4		antoinette.karner@ontario.ca	905-704-2034	
38	Sharon	Rew	Ministry of Natural Resources and Forestry	Regional Director	4th Flr S, 300 Water St, Peterborough, ON K9J 3C7		sharon.rew@ontario.ca	705-755-3235	
39			Fisheries and Oceans Canada (DFO)			Contact to discuss discharing groundwater into Welland Canal	info@dfo-mpo.gc.ca		
40	Karina	Cerniavskaja	Ministry of Natural Resources and Forestry (MNRF)	District Planner		Contact to discuss discharing groundwater into Welland Canal	karina.cerniavskaja@ontario.ca	519-200-2276	
First Nations/Indigenous Communities									
41	Ava	Hill	Six Nations of the Grand River Territory	Chief	Six Nations of the Grand River Territory, P.O Box 5000, 1695 Chiefswood Road, Ohsweken, Ontario, N0A 1M0	Consult	avahill@sixnations.ca	519-445-2201	(fax) 445-4208
42	Lonny	Bomberry	Six Nations of the Grand River Territory	Director, Lands and Resources	Six Nations of the Grand River Territory 1695 Chiefswood Road, P.O. Box 5000 Oshweken, Ontario N0A 1M0	Consult	lonnybomberry@sixnations.ca	519-445-2201	(fax) 519-445-4208
43			Six Nations of the Grand River Territory		Six Nations of the Grand River Territory 1695 Chiefswood Road, P.O. Box 5000 Oshweken, Ontario N0A 1M1	Consult	arleenma@sixnations.ca		
44	Bryan	Laforme	Mississaugas of the New Credit First Nation		Mississaugas of the New Credit, 2789 Mississauga Road, RR #6, Hagersville, ON, N0A 1H2	Consult	bryanlaforme@newcreditfirstnation.com	905-768-1133	(fax) 768-1225
45	Margaret	Sault	Mississaugas of the New Credit First Nation	Director	Mississaugas of the New Credit, 2789 Mississauga Road, RR #6, Hagersville, ON, N0A 1H1	Consult		905-768-1133	(fax) 905-768-1225
46	Fawn	Sault	Mississaugas of the New Credit First Nation	Consultation Manager	Mississaugas of the New Credit, 2789 Mississauga Road, RR #6, Hagersville, ON, N0A 1H0	Consult	Fawn.Sault@newcreditfirstnation.com		
47	Hohahes Leroy	Hill	Haudenosaunee Confederacy Chiefs Council	Secretary to Haudenosaunee Confederacy	Haudenosaunee Confederacy Chiefs Council, 2643 6th Line Road, R.R. #2 Ohsweken, ON, N0A 1M0	Consult	jocko@sixnations.com	519-717-7326	
48	Hazel	Hill	Haudenosaunee Confederacy Development Institute		Haudenosaunee Confederacy Development Institute 16 Sunrise Court, Suite 407 Ohsweken, Ontario N0A 1M0	Consult			
49			Haudenosaunee Confederacy Development Institute		16 Sunrise Court, Suite 600 P.O. Box 714 Ohsweken, Ontario N0A 1M0	Consult	hdi2@bellnet.ca	519-445-4222	
50	Stephen	Quesnelle	Niagara Region Métis Council	President	Niagara Region Métis Council 3250 Schmon Parkway, Unit 1A Thorold, ON L2V 4Y6	Consult		905-714-9756	(fax) 905-735-1161
51			Métis Nation of Ontario Head Office Métis Consultation Unit		Métis Nation of Ontario Head Office Métis Consultation Unit Suite 1100 - 66 Slater Street Ottawa, ON K1P 5H1	Consult			(fax) 613-725-4225
52	Kathleen	Padulo	The Chiefs of Ontario		The Chiefs of Ontario 111 Peter Street, Suite 804 Toronto, ON M5V 2H1	Consult			

East Side Sewage Pumping Station Forcemain Replacement
Schedule B Municipal Class Environmental Assessment
Stakeholder Register

S/N	First Name	Last Name	Organization	Organizational Position	Location	Role in the Project	Email	Phone Number	Alternate Phone Number
Local Residents/Local Businesses									
53			N/A	N/A	138 Barrick Rd Port Colborne, ON L3K 4B4	Inform			
54			N/A	N/A	160 Barrick Rd Port Colborne, ON L3K 4B4	Inform			
55			N/A	N/A	172 Barrick Rd Port Colborne, ON L3K 4B4	Inform			
56			N/A	N/A	178 Barrick Rd Port Colborne, ON L3K 4B4	Inform			
57			N/A	N/A	186 Barrick Rd Port Colborne, ON L3K 4B4	Inform			
58			N/A	N/A	987 Elm St Port Colborne, ON L3K 4R8	Inform			
59			N/A	N/A	958 Elm St Port Colborne, ON L3K 4N3	Inform			
60			N/A	N/A	950 Elm St Port Colborne, ON L3K 4R9	Inform			
61	[redacted]		Ceres Global	Facility Manager	2 Sherwood Forest Lane, P.O. Box 190, Port Colborne, ON L3K 5V8	Consult	[redacted]		
62			Port Colborne Quarries Inc.		Corner of Chippawa Road & Hwy. 140 Port Colborne, Ontario P.O. Box 275, L3K 5W1	Consult	pcq@pcquarry.com	Sales: (905) 834-3647 Plant: (905) 834-3692 Scalehouse: (905) 834-3600	
63			Fontaine Transport		72 Killaly St E Port Colborne, ON L3K 1N4	Inform			
64			Barber Hymac Hydro		239 Barrick Rd Port Colborne, ON L3K 5Z5	Inform			
65			Thurston Machine Co.		995 Elm St Port Colborne, ON L3K 5X9	Inform			
66	[redacted]		Local Resident	Owner of Laydown Area for Tunneling	211 Second Concession Road Port Colborne, ON L3K 5V5	Property owner of laydown area for tunneling	[redacted]		
67			Niagara College	Professor					

APPENDIX A2: PUBLIC NOTICES

PUBLIC NOTICE

THE REGIONAL MUNICIPALITY OF NIAGARA
NOTICE OF STUDY COMMENCEMENT

Eastside Sewage Pumping Station
Forcemain Replacement
Municipal Class Environmental Assessment
City of Port Colborne

WHAT

Niagara Region has begun a Municipal Class Environmental Assessment Study to assess alternative routes for the Eastside Sewage Pumping Station forcemain in the City of Port Colborne. The existing route of the forcemain is to the west of the Eastside Sewage Pumping Station and crosses the Welland Shipping Canal (the canal) north of Clarence Street. On the west side of the canal, the forcemain extends north to the Seaway Wastewater Treatment Plant. This project will evaluate options for crossing the canal together with other planned infrastructure, specifically a Regional watermain to Barrick Road and the City of Port Colborne's sanitary forcemain for the future East Side Employment Lands Sewage Pumping Station.

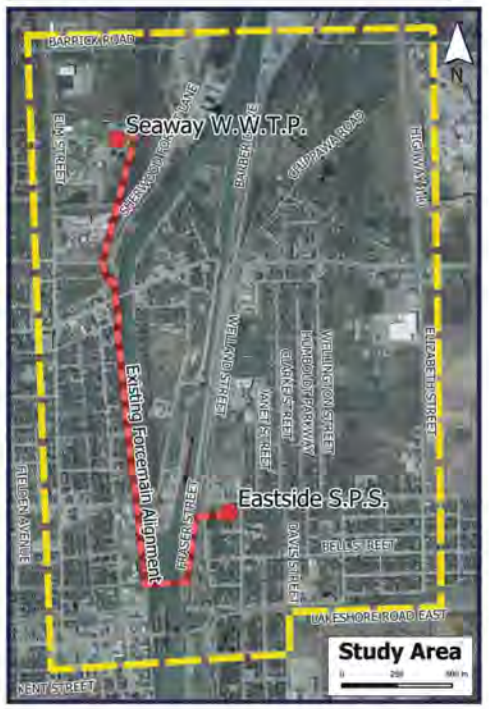
WHY

The Eastside Sewage Pumping Station forcemain is the only sewer crossing servicing the east side of the City, and the location of the existing forcemain crossing at the canal near the Port Colborne Water Treatment Plant is not ideal. In addition, crossing the canal is a key component of future site servicing of the East Side Employment Lands and maintaining security of the water supply to the east side of Port Colborne.

HOW

This study is being planned as a Schedule "B" Class EA, satisfying Phases 1 and 2 of the Municipal Engineers Association Class Environmental Assessment process, which is a planning process approved under Ontario's Environmental Assessment Act. This study will define the problem(s) / opportunities associated with the forcemain, develop and evaluate alternative strategies, determine the most feasible solution, and minimize effects to the community and natural environment.

WHERE



GET INVOLVED

Niagara Region encourages the public and stakeholders to actively participate in this planning process. Niagara Region will be hosting a Public Information Centre later this year to obtain input on the preliminary results of the study. Notification of the Public Information Centre will be advertised in the local community newspaper, and notices will be mailed to businesses located within the immediate study area. Additional project information is located at niagararegion.ca. Upon completion of the study, a Project File Report documenting the study process will be prepared and made available for public review and comment. Anyone who wishes to comment on or to be involved in this study should indicate their interest, preferably in writing to:

Amanda Beattie, EIT., C.E.T., EP., PMP©
Project Manager
GM BluePlan Engineering Limited
410 Lewis Rd.
Unit 18
Stoney Creek, ON L8E 5Y7
905-643-6688
amanda.beattie@gmblueplan.ca

Mike Ogunlaja, PhD., P.Eng., PMP©
Project Manager
Water and Wastewater Services Division
Niagara Region
3501 Schmon Pkwy., PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000 ext. 3456 TTY: 905-984-3613
Toll-free: 1-800-263-7215
mike.ogunlaja@niagararegion.ca

Information collected will be used in accordance with the Freedom of Information and Protection of Privacy Act. With the exception of personal information, all comments will become part of the public record.

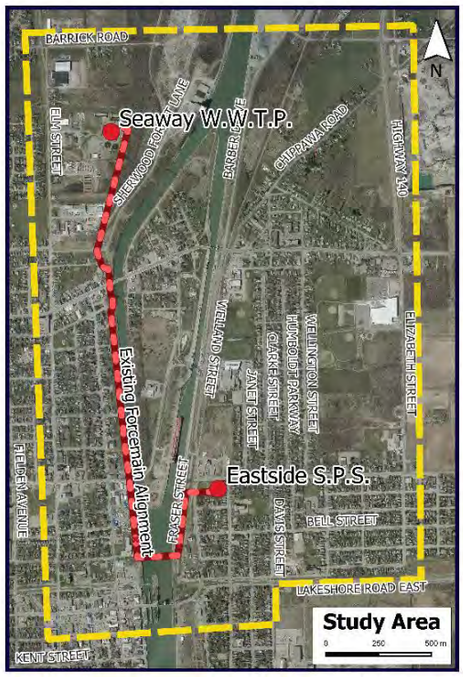
This notice was first issued on May 18, 2019.

THE REGIONAL MUNICIPALITY OF NIAGARA
NOTICE OF STUDY COMMENCEMENT
Eastside Sewage Pumping Station
Forcemain Replacement
Municipal Class Environmental Assessment
City of Port Colborne

WHAT

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WHERE



WHY

The Eastside Sewage Pumping Station forcemain is the only sewer crossing servicing the east side of the City, and the location of the existing forcemain crossing at the canal near the Port Colborne Water Treatment Plant is not ideal. In addition, crossing the canal is a key component of future site servicing of the East Side Employment Lands and maintaining security of the water supply to the east side of Port Colborne.

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Amanda Beattie, P.Eng., P.Geo., CRL, PMP©
Project Manager
GM BluePlan Engineering Limited
1266 South Service Road
Unit C31
Stoney Creek, ON L8E 5R9
905-643-6688
amanda.beattie@gmblueplan.ca

Michelle Miller, C.E.T
Project Manager
Water and Wastewater Services Division
Niagara Region
3501 Schmon Pkwy., PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000 ext. 3737 TTY: 905-658-1004
Toll-free: 1-800-263-7215
michelle.miller@niagararegion.ca

Information collected will be used in accordance with the Freedom of Information and Protection of Privacy Act. With the exception of personal information, all comments will become part of the public record.

This notice was first issued on May 18, 2019.

MOVING WATER FORWARD

Notice of Completion

Eastside Sewage Pumping Station

Forcemain Replacement

Municipal Class Environmental Assessment

City of Port Colborne

The Study

Niagara Region has completed a Municipal Class Environmental Assessment Study to assess alternative alignments for the East Side Sewage Pumping Station forcemain. The project evaluated options for crossing the canal together with other planned infrastructure, specifically a Regional watermain to Barrick Road and the City of Port Colborne's sanitary forcemain for the future East Side Employment Lands Sewage Pumping Station. The East Side Sewage Pumping Station forcemain is the only sewer crossing servicing the east side of the City, and the location of the existing forcemain crossing at the canal near the Port Colborne Water Treatment Plant is not ideal.



Study Recommendations

In accordance with Ontario's Environmental Assessment Act, Niagara Region has planned this project under Schedule "B" of the Municipal Class Environmental Assessment. A Public Information Centre was held on Sept. 8, 2021, to present and obtain comments on the problem statement, identified solutions, and preliminary design concepts. Interested members of the public, local business communities, and agencies were encouraged to attend. Information pertaining to the Study was presented and interested members were encouraged to submit questions or concerns. Through an extensive evaluation process that included public engagement with local residents and businesses, the City of Port Colborne and Niagara Region, a preferred solution has been identified. The study recommends a new forcemain alignment along Welland Street, which will cross the canal near Barrick Road and be directed to the Seaway Wastewater Treatment Plant.

For More Information

A Project File Report, documenting the planning process undertaken, key elements of the preferred design is available for public review online at niagararegion.ca/projects/eastside-sewage and on display for review at the following location for 30 calendar days beginning on July 23, 2022 and ending on August 22, 2022.

The Project File Report will be made available for public review at the following locations during normal business hours:

Clerks Department
Niagara Region
1815 Sir Isaac Brock Way, PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000, ext. 3222
Toll-free: 1-800-263-7215
Monday - Friday 8:30 a.m. – 4:30 p.m.

Clerks Department
City of Port Colborne
66 Charlotte St.,
Port Colborne, ON, L3K 3C8
905-835-2900
Monday - Friday 8:30 a.m. – 4:30 p.m.

Written comments on this Project File should be submitted to:

Michelle Miller, C.E.T
Project Manager
Water and Wastewater Services
Niagara Region
3501 Schmon Pkwy., PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000 ext. 3737
Toll-free: 1-800-263-7215
michelle.miller@niagararegion.ca

Amanda Beattie, P.Eng., P.Geo., CMRP, PMP©
Project Manager, Partner
GM BluePlan Engineering Limited
1266 South Service Rd., Unit C31
Stoney Creek, ON, L8E 5R9
905-643-6688
amanda.beattie@gmblueplan.ca

In addition, a request may be made to the Ministry of the Environment, Conservation and Parks for an order requiring a higher level of study (i.e. requiring an individual/comprehensive Environmental Assessment approval before being able to proceed), or that conditions be imposed (e.g. require further studies), only on the grounds that the requested order may prevent, mitigate or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Requests on other grounds will not be considered. Requests should include the requester contact information and full name for the Ministry.

Requests should specify what kind of order is being requested (request for additional conditions or a request for an individual/comprehensive environmental assessment), how an order may prevent, mitigate or remedy those potential adverse impacts, and any information in support of the statements in the request. This will ensure that the Ministry is able to efficiently begin reviewing the request.

Requests should be sent by email or in writing to:

Minister of the Environment, Conservation and Parks
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto, ON, M7A 2J3
minister.mecp@ontario.ca

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto, ON, M4V 1P5
EABDirector@ontario.ca

Personal information collected or submitted in writing at public meetings will be collected, used and disclosed by members of Regional Council and Regional staff in accordance with the Freedom of Information and Protection of Privacy Act. The written submissions including names, contact information and reports of the public meeting will be made available. Questions should be referred to the Privacy Office at 905-980-6000, ext. 3779 or **FOI@niagararegion.ca.**

If you require any accommodations for a disability in order to attend and participate in meetings or events, please let us know in advance so that arrangements can be made in a timely manner. Please contact the Accessibility Advisory Coordinator at 905-980-6000 ext. 3252 or **accessibility@niagararegion.ca.**

This notice was first issued on July 23, 2022.

APPENDIX A3: PUBLIC INFORMATION CENTRE

MOVING WATER FORWARD

Public Information Centre No.1

Eastside Sewage Pumping Station

Municipal Class Environmental Assessment

Town of Port Colborne

The Study

Niagara Region has begun a Municipal Class Environmental Assessment (EA) Study to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain. This project will evaluate options for crossing the canal together with other planned infrastructure, specifically a Regional watermain to Barrick Road and the City of Port Colborne's sanitary forcemain for the future East Side Employment Lands Sewage Pumping Station.



The Eastside Sewage Pumping Station forcemain is the only sewer crossing servicing the east side of the City, and the location of the existing forcemain crossing at the canal near the Port Colborne Water Treatment Plant is not ideal.

The Process

This study is being planned as a Schedule "B" Class EA, satisfying Phases 1 and 2 of the Municipal Engineers Association (MEA) Class EA process, which is a planning process approved under Ontario's Environmental Assessment Act. This study will define the problem(s) / opportunities associated with the forcemain, develop and evaluate alternative strategies, determine the most feasible solution, and identify methods to avoid or minimize impacts to the community and natural environment

MOVING WATER FORWARD

Niagara Region encourages the public and stakeholders to actively participate in this planning process. Information about the project will be available on Niagara Region's website as part of Public Information Centre (PIC) No. 1. You can learn about how this project will contribute to Niagara's overall growth plan, key servicing issues being considered, and how you can have your voice heard.

Public Information Centre No. 1 Details

A recorded video and information regarding the Eastside SPS Forcemain Replacement Study will be made available on the project website (access using the link below) beginning **Wednesday, Sept. 8, 2021**. This will be followed with a two-week period to submit PIC No. 1 related comments to the Project Team. Responses will be posted **Wednesday, Sept. 29, 2021.** **niagararegion.ca/projects/eastside-sewage/**
Upon completion of the study, a Project File Report documenting the study process will be prepared and made available for public review and comment. Anyone who wishes to comment on or to be involved in this study should indicate their interest, preferably in writing to:

Michelle Miller, CET
Project Manager
Water-Wastewater Services Division,
Niagara Region
3501 Schmon Pkwy., PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000 ext. 3737
Fax: 905-685-5205
michelle.miller@niagararegion.ca

Amanda Beattie, P.Eng.,P.Geo.,CMRP, PMP
Project Manager, Partner
GM Blue Plan Engineering Limited
1266 South Service Rd.,
Unit C31 Stoney Creek,
ON L8E 5R9
905-643-6688
amanda.beattie@gmblueplan.ca

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If you require any accommodations for a disability in order to attend and participate in meetings or events, please let us know in advance so that arrangements can be made in a timely manner. Please contact the Accessibility Advisory Coordinator at 905-980-6000 ext. 3252 or accessibility@niagararegion.ca.

This notice was first issued on Aug. 21, 2021



BILL SIKES THE ASSOCIATED PRESS FILE PHOTO

United Way Niagara is seeking donations to provide school supplies for 2,000 local children and youths who head back to school next month.

United Way seeks help to give Niagara kids good start to school year

Annual backpack program has helped 47,000 students in the region over the years; donations can be made online

THE ST. CATHARINES STANDARD

United Way Niagara hopes residents will step up to help 2,000 local kids from low-income families get ready for the new school year.

The agency is appealing for donations through its Backpacks for Kids program – modified this year for COVID safety – to help provide those children with supplies as they head back to school in early September.

Since 2002, it has distributed backpacks to more than 47,000 children and youths across Niagara. In a release, the United Way said a $25 donation will help equip a student for the new year, but donations of any size are welcome.

"Sometimes something that may seem so small, like not having to spend on a new lunch bag or pencil crayons, can make all the difference for a family in Niagara," said United Way Niagara executive director Frances Hallworth, in a release.

"The school supply kits allow kids and teens the chance to be excited for the new school year while alleviating the financial burden for their family."

Hallworth noted the past year and a half has been especially hard on children. Families' lives were disrupted during the COVID-19 pandemic and children spent much of the past two school years studying from home.

One in three Niagara children live in poverty, the United Way said, and last year 7,648 children and youths visited a local food bank.

For COVID safety reasons, instead of a backpack this year, children and youths will receive a pencil case full of supplies plus a $25 gift card to purchase more essentials for school.

Donations can be made online at UnitedWayNiagara.org.

Murdoch's
TIRE & AUTOMOTIVE
SAVE $40 ON A SET OF 4 TIRES

Hercules Road Tour 455
P205/55R16 Regular Price $120 Each
NOW ONLY $440 PLUS TAX FOR SET OF 4
IN-STORE ONLY

Hercules Terra Trac A/T II
P235/75R15 Regular Price $174 Each
NOW ONLY $656 PLUS TAX FOR SET OF 4
IN STORE ONLY
SAFETY CHECKS $89 MOST VEHICLES
COMPLETE INSPECTION $39.95 AND UP 26 POINT INSPECTION INCLUDES LUBE OIL FILTER
LIFETIME WARRANTY ON BRAKES 10% OFF PARTS & LABOUR
THREE EASY WAYS TO SHOP
PHONE (905) 835-8832
ON LINE www.murdochstire.com
OR IN PERSON BY APPOINTMENT at
285 KILLALY ST W, PORT COLBORNE

MOVING WATER FORWARD

PUBLIC INFORMATION CENTRE NO. 1
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT
CITY OF PORT COLBORNE

THE STUDY

Niagara Region has begun a Municipal Class Environmental Assessment (EA) Study to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain. This project will evaluate options for crossing the canal together with other planned infrastructure, specifically a Regional watermain to Barrick Road and the City of Port Colborne's sanitary forcemain for the future East Side Employment Lands Sewage Pumping Station.

The Eastside Sewage Pumping Station forcemain is the only sewer crossing servicing the east side of the City, and the location of the existing forcemain crossing at the canal near the Port Colborne Water Treatment Plant is not ideal.

THE PROCESS

This study is being planned as a Schedule "B" Class EA, satisfying Phases 1 and 2 of the Municipal Engineers Association (MEA) Class EA process, which is a planning process approved under Ontario's Environmental Assessment Act. This study will define the problem(s)/opportunities associated with the forcemain, develop and evaluate alternative strategies, determine the most feasible solution, and identify methods to avoid or minimize impacts to the community and natural environment.

FOR MORE INFORMATION

Niagara Region encourages the public and stakeholders to actively participate in this planning process. Information about the project will be available on Niagara Region's website as part of Public Information Centre (PIC) No. 1. You can learn about how this project will contribute to Niagara's overall growth plan, key servicing issues being considered, and how you can have your voice heard.

Public Information Centre No. 1 Details:
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niagararegion.ca/projects/eastside-sewage

Upon completion of the study, a Project File Report documenting the study process will be prepared and made available for public review and comment. Anyone who wishes to comment on or to be involved in this study should indicate their interest, preferably in writing to:

Michelle Miller, CET
Project Manager, Water and Wastewater
Services Niagara Region
3501 Schmon Pkwy., PO Box 1042
Thorold, ON, L2V 4T7
905-980-6000 ext. 3737
Toll-free: 1-800-263-7215
michelle.miller@niagararegion.ca

Amanda Beattie, P.Eng., P.Geo., CMRP, PMP
Project Manager, Partner
GM Blue Plan Engineering Limited
1266 South Service Rd., Unit C31
Stoney Creek, ON L8E 5R9
905-643-6688
amanda.beattie@gmblueplan.ca

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This notice was first issued on Aug. 21, 2021.

CONNECTING MORE PEOPLE TO MORE POSSIBILITIES
Niagara Region
niagararegion.ca/projects

MOVING WATER FORWARD

PUBLIC INFORMATION CENTRE NO. 1

EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

CITY OF PORT COLBORNE

THE STUDY

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This notice was first issued on Aug. 21, 2021.

CONNECTING MORE PEOPLE TO MORE POSSIBILITIES

Niagara Region

niagararegion.ca/projects

MOVING WATER FORWARD

CONNECTING MORE PEOPLE TO MORE POSSIBILITIES

Niagara Region

East Side Sewage Pumping Station Forcemain Replacement Environmental Assessment

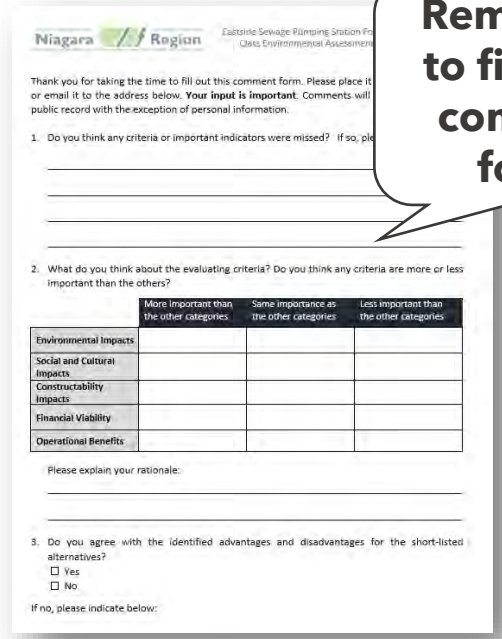
Public Information Centre

September 8th, 2021

Welcome to: Virtual Public Information Centre

The objectives for today's Public Information Centre are:

- Present the study area and objectives
- Present the problem and opportunity statement along with the short list of alternatives
- Provide a clear and transparent process for the evaluation of alternatives
- Receive feedback on the evaluation process and recommended alternative


Niagara Region

Thank you for taking the time to fill out this comment form. Please place it
or email it to the address below. **Your input is important**. Comments will
public record with the exception of personal information.

1. Do you think any criteria or important indicators were missed? If so, ple

2. What do you think about the evaluating criteria? Do you think any criteria are more or less important than the others?

	More important than the other categories	Same importance as the other categories	Less important than the other categories
Environmental Impacts			
Social and Cultural Impacts			
Constructability Impacts			
Financial Viability			
Operational Benefits			

Please explain your rationale:

3. Do you agree with the identified advantages and disadvantages for the short-listed alternatives?
☐ Yes
☐ No

If no, please indicate below:

Remember to fill out a comment form!

Submitting Questions & Comments

[Eastside Sewage Pumping Station Forcemain Replacement - Niagara Region, Ontario]

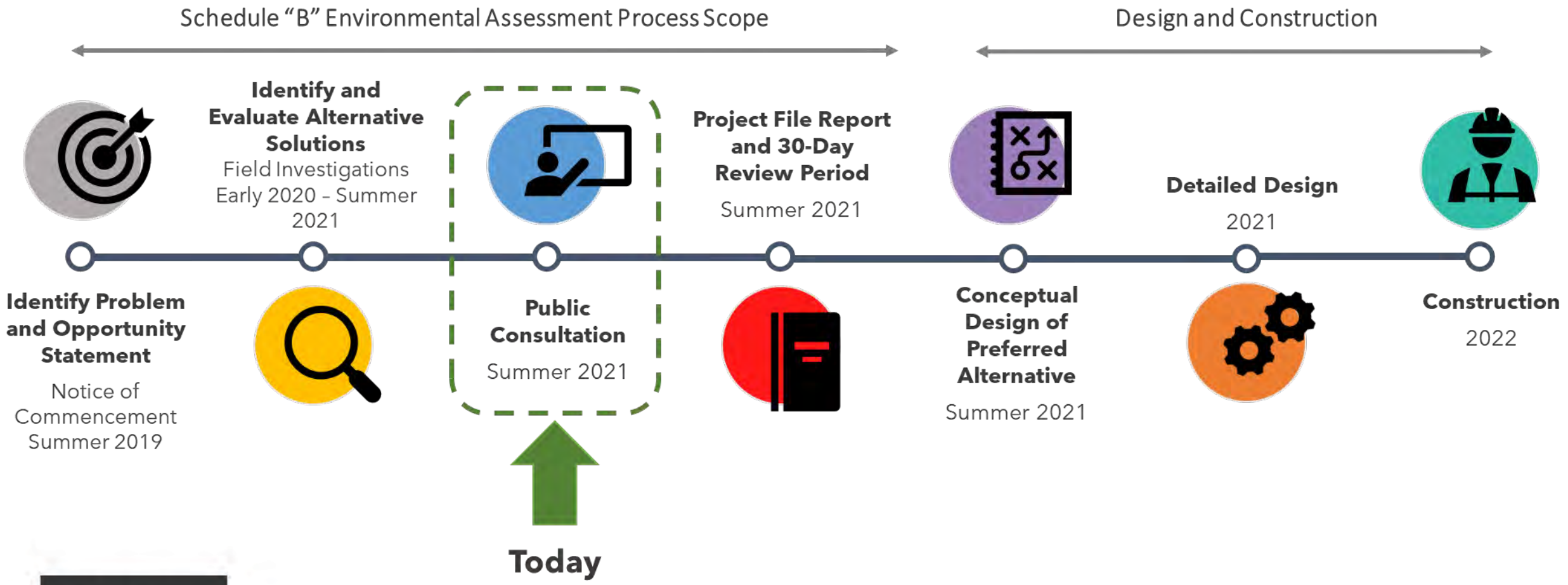
Deadline: September 22nd, 2021

MOVING WATER FORWARD

CONNECTING MORE PEOPLE TO MORE POSSIBILITIES

Niagara Region

Class “B” Environmental Assessment Process



Study Purpose and Objectives

Problem Opportunity/Statement

"To provide sufficient capacity to accommodate the future flows generated by growth within the City of Port Colborne, as identified in the Region's 2016 Water and Wastewater Master Servicing Plan; and update aging infrastructure to provide long-term sanitary servicing for the community. In addition, providing the opportunity for a joint crossing of the canal with future planned infrastructure which includes the Regional watermain and East Side Employment Lands forcemain"

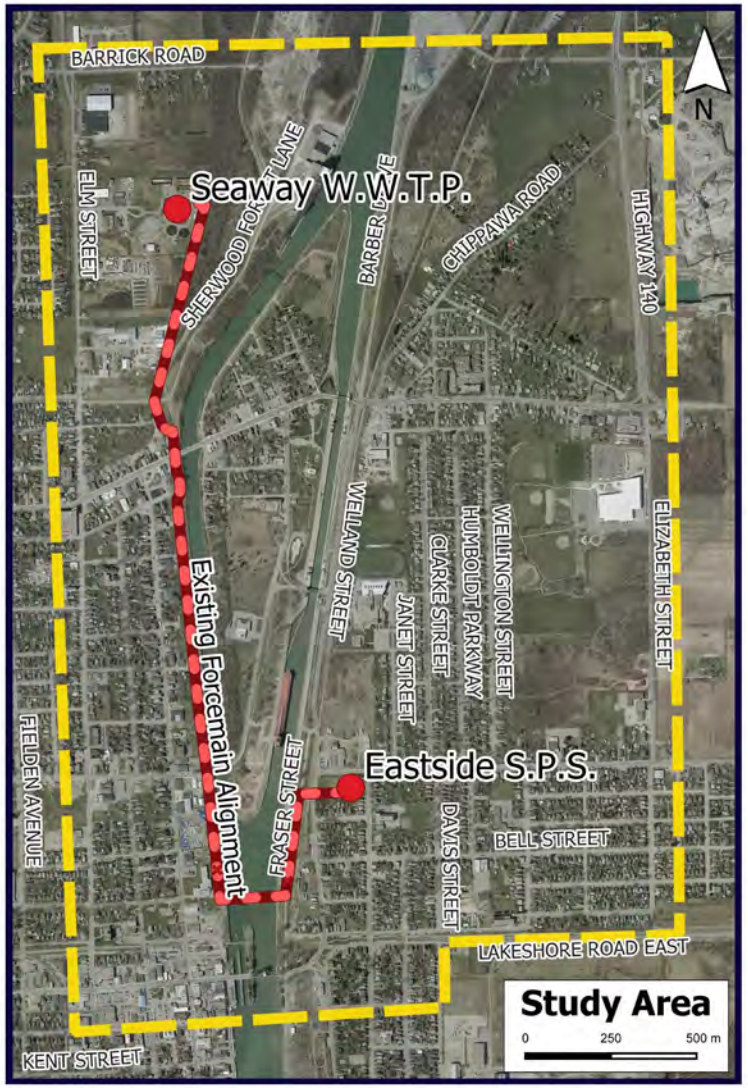
Our mandate will be to ensure the following goals are achieved:

1. Satisfy Schedule B Class EA process
2. Provide infrastructure capacity and flexibility to meet future capacity demands identified in the Region's Master Servicing Plan (MSP)
3. Decrease the potential for future service disruptions
4. Maximize possible joint crossing for services crossing the Welland Canal
5. Minimize total lifecycle costs of the forcemain
6. Minimize environmental impacts including natural and socio-economic

Study Area and Background Details

East Side Pumping Station Background Details:

- The sewage pumping station is located at 53 Killaly Street East in the City of Port Colborne.
- The existing forcemain extends west of the station and crosses the canal north of Clarence Street and continues north along the canal to the Seaway Wastewater Treatment Plant.
- Both the forcemain and the existing station infrastructure have aged as they were constructed in 1980.
- The 2016 Master Servicing Plan identified the need for a new watermain to improve the reliability and security of the water supply system to the East Side of Port Colborne.
- There is a potential to coordinate additional services at this crossing including:
  - Need for a new Regional watermain, identified in the 2016 Master Servicing Plan and,
  - Forcemain to service the proposed East Side Service Lands Sewage Pumping Station.



MOVING WATER FORWARD

CONNECTING MORE PEOPLE TO MORE POSSIBILITIES

Niagara Region

Detailed Evaluation Criteria

FINANCIAL

- Costs associated with the construction, operation and maintenance of the solution
- Financial Risk

SOCIAL /CULTURAL

- Impacts to the community, operations cultural heritage sites and archeological significant sites
- Existing Infrastructure
- Noise, Vibration, Odour and Dust Impacts

ENVIRONMENTAL

- Effects on surrounding habitats including air, water features, soil/land and geology/hydrogeology
- Effects on species at risk and sensitive features
- Climate Change
- Environmental Risk

Detailed Evaluation Criteria

TECHNICAL CONSTRUCTABILITY

- Existing / Planned Infrastructure and Utilities
- Crossings
- Accessibility
- Constructability Risk



TECHNICAL FLEXIBILITY

- Compatibility with Existing and Future Infrastructure
- Capacity for Future Growth
- System Security
- Operation & Maintenance

LEGAL/ JURISDICTIONAL

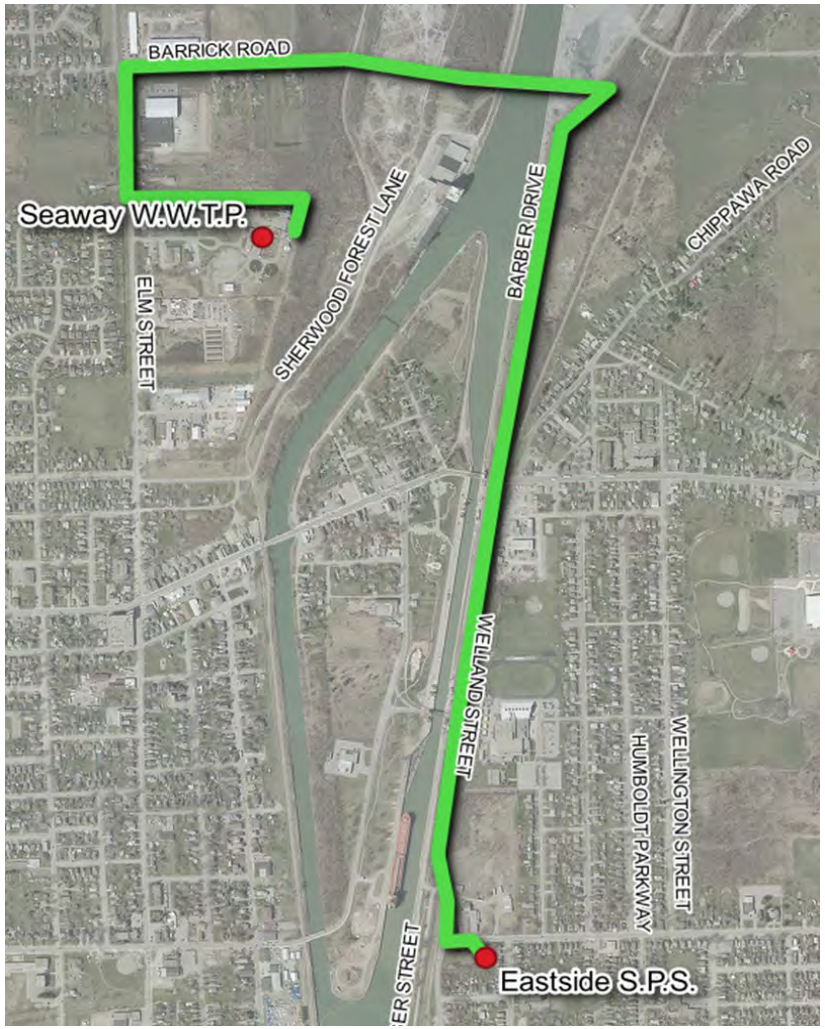
- Property Acquisitions
- Compliance with Applicable Planning Policies

Alternative 1 – Do Nothing



FINANCIAL	✓ Minimal capital costs × High operation and maintenance costs × High financial risk
ENVIRONMENTAL	× Potential for contamination due to aging infrastructure
SOCIAL AND CULTURAL	✓ Minimal social and cultural impacts as the same route would be used
TECHNICAL CONSTRUCTABILITY	✓ No construction = no construction impacts
TECHNICAL FLEXIBILITY	× Does not accommodate the need for potential additional utility crossings × Does not accommodate future growth
LEGAL AND JURISDICTIONAL	× Does not align with existing Regional strategic and planning objectives

Alternative 2 – Barrick Road Crossing – Elm Street



FINANCIAL	× Most expensive alternative
ENVIRONMENTAL	✓ Minimal environmental impacts
SOCIAL AND CULTURAL	× Indirect impacts to surrounding properties as a result of noise and vibration during construction × Impacts existing infrastructure (Right-of-Way)
TECHNICAL CONSTRUCTABILITY	× Follows developed Right of Way
TECHNICAL FLEXIBILITY	× Longest forcemain requirement (~4.1 km)
LEGAL AND JURISDICTIONAL	✓ Aligns with the Regional's strategic and planning initiatives

Alternative 3 – Barrick Road Crossing – Seaway



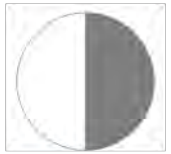
FINANCIAL	✓ Least expensive alternative
ENVIRONMENTAL	✓ Minimal environmental impacts
SOCIAL AND CULTURAL	✓ Surrounding disturbances reduced as alignment going through Seaway lands × Indirect impact to surrounding properties due to construction noise and vibrations
TECHNICAL CONSTRUCTABILITY	✓ Utilizes undeveloped Seaway owned lands
TECHNICAL FLEXIBILITY	✓ Compatible with recent upgrades to the sewage pumping station ✓ Shorter forcemain required (~2.5 km)
LEGAL AND JURISDICTIONAL	✓ Aligns with the Regional's strategic and planning initiatives

Alternative 4 – North Island Crossing



FINANCIAL	✓ Less expensive option
ENVIRONMENTAL	× Required tree removal within City land to facilitate laydown area for tunneling on the East side of canal
SOCIAL AND CULTURAL	✓ Surrounding disturbances reduced as alignment going through Seaway lands × Indirect impact to surrounding properties as a result of noise /vibration during construction × Disruption of existing parks and trails
TECHNICAL CONSTRUCTABILITY	✓ Compatible with recent upgrades
TECHNICAL FLEXIBILITY	✓ Compatible with recent upgrades to the sewage pumping station ✓ Shortest forcemain required (~1.6 km)
LEGAL AND JURISDICTIONAL	✓ Aligns with the Regional's strategic and planning initiatives

Alternatives Evaluation

Alternative	Technical Constructability	Technical Flexibility	Environment	Social / Cultural	Financial	Legal	Summary Score
1 – Do Nothing/ Rehabilitation							
2 – Barrick Road Crossing – Elm Street							
3 – Barrick Road Crossing - Seaway							
4 – North Island Crossing							

Legend:  Major Positive  Minor Positive  Neutral  Minor Negative  Major Negative

Preferred Alternative: Option 3
Barrick Road Crossing - Seaway

Following the evaluation of alternatives, **Option 3: Barrick Road Crossing – Seaway**, was deemed the most appropriate based on the evaluation criteria.

Problem and Opportunity Statement Objectives:

This alternative effectively addresses the components of the problem statement by:

1. Ensuring reliable drainage of sanitary flows from the East to the West side of Port Colborne and across the Welland Canal.
2. Allows for an opportunity to accommodate future utility crossings, including planned infrastructure such as the new Regional watermain and sanitary forcemain servicing the East side Employment Lands.



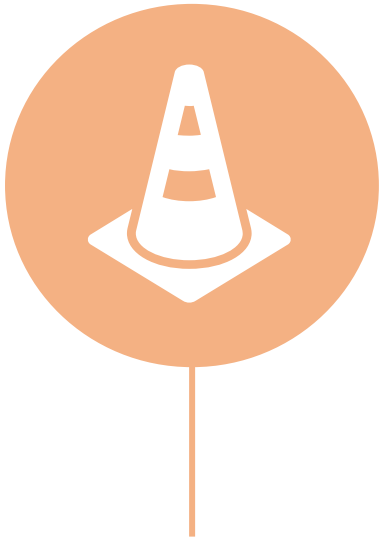
Preferred Alternative:
3 – Barrick Road Crossing – Seaway

- New forcemain will accommodate upgrades recently done and currently underway at the East Side SPS
- Cost-effective alternative
- Shorter forcemain required
- Accommodates future growth and servicing needs
- Reduces disruption to existing infrastructure by utilizing undeveloped Seaway owned lands



Mitigation Measures

The following measures will be taken before and during construction:



Monitor for vibrational impacts with specific attention to the built heritage resources



The project will be reviewed by Fisheries and Oceans Canada (DFO) to ensure the proposed design will not result in the disruption of fish habitat



Timing restrictions of vegetation removal for nesting birds and the development of a Tree Saving Plan

Next Steps

- Incorporate any stakeholder feedback from the PIC
- Finalize the recommended alternative
- Prepare the Project File Report and begin the Conceptual design
- 30-Day Review Period
- Following 30-day review, provided no comments, Region plans to proceed to Design

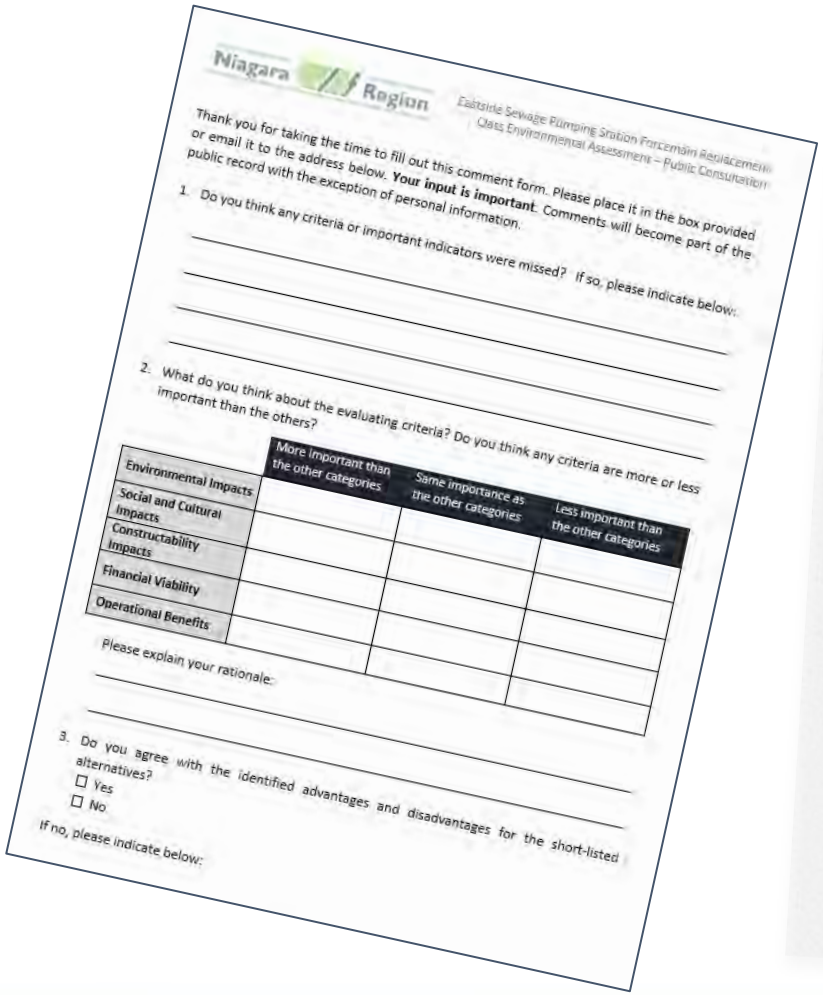
Thank you for your interest!

Questions? Concerns?

Comments?

Fill out a comment form and submit to Michelle Miller or Amanda Beattie by September 22nd, 2021.

Your feedback is valuable and will inform the remainder of the decision-making process!



Niagara Region — Eastside Sewage Pumping Station Forcemain Replacement, Class Environmental Assessment – Public Consultation

Thank you for taking the time to fill out this comment form. Please place it in the box provided or email it to the address below. **Your input is important**. Comments will become part of the public record with the exception of personal information.

1. Do you think any criteria or important indicators were missed? If so, please indicate below:

2. What do you think about the evaluating criteria? Do you think any criteria are more or less important than the others?

	More important than the other categories	Same importance as the other categories	Less important than the other categories
Environmental Impacts			
Social and Cultural Impacts			
Constructability Impacts			
Financial Viability			
Operational Benefits			

Please explain your rationale:

3. Do you agree with the identified advantages and disadvantages for the short-listed alternatives?
   - ☐ Yes
   - ☐ No

If no, please indicate below:

You can also contact the project team at:

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APPENDIX A4: INDIGENOUS AND AGENCY CONSULTATION

East Side Sewage Pumping Station Forcemain Replacement
Schedule B Municipal Class Environmental Assessment
Consultation Tracking Summary

Stakeholder	Agency	From	To	Type	Comment	Date Sent/Received	Status/ Response	Date of Action	Project Stage
Utilities	**Trillium Railway**	Region	Aaron White	Mail	Returned NOC	31-May-19	1. Comment filed 2. Updated address in contact list 3. Resent letter via email	24-Jun-19	NOC
Government Agency	**Ministry of the Environment, Conservation and Parks (MECP)**	GMBP	MECP	Email	Emailed NOC to confirm first nations to consult	31-May-19	1. Comment noted and filed 2. Added following indigenous groups to the contact list and provided NOC (Six Nations of the Grand River Territory, Haudenosaunee Confederacy Chiefs Council, Mississauga of the New Credit)	5-Jun-19	NOC
Indigenous	**Six Nations of the Grand River Territory**	GMBP	arleenma@sixnations.ca	Email	Returned NOC, email address was provided by MECP	6-Jun-19	1. Comment filed 2. Updated contact	6-Jun-19	NOC
Indigenous	**Six Nations of the Grand River**	GMBP	Hohahes Leroy Hill	Email / Mail	Returned NOC, email address was provided by MECP	31-May-19	1. Comment filed 2. Resent email, still undelivered 3. Updated contact and provided NOC via courier mail services	7-Jun-19	NOC
Indigenous	**Mississauga of the New Credit First Nation**	GMBP	Bryan Laforme	Mail , Email	Returned NOC	31-May-19	1. Comment filed 2. Updated contact 3. Sent NOC via email to updated recipient	6-Jun-19	NOC
Indigenous	**Niagara Region Métis Council**	GMBP	Stephen Quesnelle	Mail	Returned NOC	31-May-19	1. Comment filed 2. Updated contact address 3. Re-sent NOC to updated address	7-Jun-19	NOC
Indigenous	**Métis Nation of Ontario Head Office**	GMBP	Métis Consultation Unit	Mail	Returned NOC	31-May-19	1. Comment filed 2. Updated contact address 3. Re-sent NOC to updated address	7-Jun-19	NOC
Interested Resident	**Patrick Robson**	Patrick Robson	Region PM	Email	Requested to be added to the mailing list	24-May-19	1. Comment noted and filed 2. Added to contact list	24-May-19	NOC
Business Owner	**Ceres Global**	Kevin Reles	Region PM / GMBP	Email	Requested to be added to the mailing list	31-May-19	1. Comment noted and filed 2. Added to contact list	31-May-19	NOC
Utilities	**Canadian Nuclear Power**	Jeff Hoover	Region PM	Email	Stakeholder noted interest in joining a new crossing	4-Jul-19	1. Comment noted and filed 2. Added to contact list 3. Noted that they will be contacted during the detailed design phase of the project	4-Jul-19	NOC
Utilities	**Bell**	Bill McKenzie	Region PM	Email	Stakeholder noted interest in joining a new crossing	19-Jul	1. Comment noted and filed 2. Added to contact list 3. Noted that they will be contacted during the detailed design phase of the project	19-Jul	NOC
Local Resident	**Denny Brochu**	Rafiq Qutub	Denny Brochu	Phone Call/Email	Contacting to gage interest regarding using portion of land for contractor access and laydown area	2021-Feb-5	Resident noted interest in discussing with the Regional team regarding land for laydown area and contractor use. 1. Comment noted and filed 2. Added to contact list 3. Continue to update resident on study and schedule meetings accordingly	5-Feb-21	Field Investigations

East Side Sewage Pumping Station Forcemain Replacement
Schedule B Municipal Class Environmental Assessment
Consultation Tracking Summary

Stakeholder	Agency	From	To	Type	Comment	Date Sent/Received	Status/ Response	Date of Action	Project Stage
Local Resident	**Denny Brochu**	Amanda Beattie	Denny Brochu	Email	Contacting to provide project update and inquire about permission regarding land access	11-Jul-21	Resident approved premission for field investigations . No futher action required	12-Jul-21	Field Investigations
Government Agency	**Department of Fisheries of Ontario**	Matt Long	info@dfo-mpo.gc.ca	Email	Inquiring regarding the restrictions on the discharge of groundwater to the Welland Canal to determining scope of additional studies. Questions include: 1. What is the appropriate water quality standard to apply (Provincial Water Quality Objectives of Ontario or CCME Environmental Quality Guidelines)? 2. With regard to discharge rate, would you be able to provide a threshold of maximum discharge to the Canal, a value that if not exceeded would ensure no negative impacts to the Canal environment due to excessive increased flow?	20-Jan-21	DFO noted that with respect to groundwater discharge, all environmental considerations will be covered under Environmental Canada in which responsibilities have been assigned to the MECP	20-Jan-21	Field Investigations
Government Agency	**Ministry of Natural Resources and Forestry (MNRF)**	Matt Long	Karina Cerniavskaja (MNRF)	Email	Inquiring regarding the restrictions on the discharge of groundwater to the Welland Canal to determining scope of additional studies. Questions include: 1. What is the appropriate water quality standard to apply (Provincial Water Quality Objectives of Ontario or CCME Environmental Quality Guidelines)? 2. With regard to discharge rate, would you be able to provide a threshold of maximum discharge to the Canal, a value that if not exceeded would ensure no negative impacts to the Canal environment due to excessive increased flow?	12-Jan-21	MNRF noted that the appropriate ministry for questions surrounding discharge of groundwater would be the MECP.	14-Jan-21	Field Investigations
Indigenous	**Haudenosaunee Development Institute (HDI)**	Amanda Beattie	Wayne Hill	Email	Contacted to engage interest in involvement during the Stage 2 Archaeological Assessment	9-Jul-21	HDI noted interest in participating in the field investigations	11-Jul-21	Field Investigations
Indigenous	**Six Nations of the Grand River**	Amanda Beattie	Tanya Hill-Montour	Email	Contacted to engage interest in involvement during the Stage 2 Archaeological Assessment	9-Jul-21	Golder Associates Ltd. followed up with Tanya (Six Nations Contact) with a phone call to gage interest on July 23, 2021. Six Nations noted interest in participating in the field investigations	23-Jul-21	Field Investigations
Indigenous	**Mississauga of the Credit First Nation (MCFN)**	Amanda Beattie	Adrian Blake Megan DeVries	Email	Contacted to engage interest in involvement during the Stage 2 Archaeological Assessment	10-Jul-21	MCFN noted interest in participating in the field investigations.	12-Jul-21	Field Investigations
Indigenous	**Haudenosaunee Development Institute (HDI)**	Golder Associates Ltd.	Field Representatives	In-Person	Field representatives attended the in-field investigations for the Stage 2 Archaeological Assessment	28-Jul-21	Stage 2 Archeological Assessment was completed - no archeological sites were identified	28-Jul-21	Field Investigations
Indigenous	**Six Nations of the Grand River**	Golder Associates Ltd.	Field Representatives	In-Person	Field representatives attended the in-field investigations for the Stage 2 Archaeological Assessment	28-Jul-21	Stage 2 Archeological Assessment was completed - no archeological sites were identified	28-Jul-21	Field Investigations
Indigenous	**Mississauga of the Credit First Nation (MCFN)**	Golder Associates Ltd.	Field Representatives	In-Person	Field representatives attended the in-field investigations for the Stage 2 Archaeological Assessment	28-Jul-21	Stage 2 Archeological Assessment was completed - no archeological sites were identified	28-Jul-21	Field Investigations

East Side Sewage Pumping Station Forcemain Replacement
Schedule B Municipal Class Environmental Assessment
Consultation Tracking Summary

Stakeholder	Agency	From	To	Type	Comment	Date Sent/Received	Status/ Response	Date of Action	Project Stage
Business Owner	**Fontaine Transport**	Larry	Public Information Comment Form	Comment Form	Concerns regarding access to property during the construction of the Forcemain	8-Sep-21	Noted the following regarding the traffic impacts for the construction • All construction will adhere to strict safety guidelines. Traffic control measures will be developed to mitigate any potential traffic disturbance during construction of the Forcemain. • Standard best practices for vehicle and pedestrian safety will be used during construction.	5-Oct-21	PIC

APPENDIX B: NATURAL HERITAGE REPORT (PREPARED BY TERRASTORY ENVIRONMENTAL CONSULTING INC)









NATURAL HERITAGE REVIEW

Eastside SPS Forcemain Municipal Class EA

City of Port Colborne

July 2021

TERRASTORY
environmental consulting inc.

NATURAL HERITAGE REVIEW

Eastside SPS Forcemain Municipal Class EA
City of Port Colborne

Prepared for:

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Prepared by:

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Tristan Knight, M.E.S., M.Sc.
Senior Ecologist | President

Project No.: 2007
22 July 2021

This report has been prepared by Terrastory Environmental Consulting Inc. (hereinafter "Terrastory") for the client. All information, conclusions, and recommendations contained in this report are subject to the scope and limitations set out in the agreement between Terrastory and the client and qualifications contained in this report. This report shall not be relied upon by any third parties without the prior written consent of Terrastory. Terrastory is not responsible for any injury, loss, or damages arising from improper use of this report by third parties. Excerpts of this report or alterations to this report taken without the authorization of Terrastory invalidates the report and any conclusions therein.

TERRASTORY
environmental consulting inc.

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Appendix 1. Representative Photographs
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1 INTRODUCTION

Terrastory Environmental Consulting Inc. (hereinafter "Terrastory") was retained by the Regional Municipality of Niagara (hereinafter "the Region") to prepare this Natural Heritage Review (NHR) to support a Schedule B Municipal Class Environmental Assessment (EA) in Port Colborne. The purpose of the Municipal Class EA is to evaluate alternative alignments for the Eastside Sewage Pumping Station (SPS) forcemain.

The Eastside SPS is located at 53 Killaly Street East (between Welland Street and Janet Street) occupying the former site of the Eastside Wastewater Treatment Plan (WWTP). The current forcemain alignment extends west of the Eastside SPS and crosses the Welland Canal north of Clarence Street, turning northward to a discharge point at the Seaway WWTP. Per as-built drawings, the nominal diameter of the forcemain is 500 mm with a 450 mm diameter crossing beneath the Welland Canal. The current forcemain alignment, alternative alignment options studied through the Municipal Class EA, and primary Study Area are shown in **Figure 1**. Portions of the Study Area represent federal lands managed by the St. Lawrence Seaway Management Corporation (SLSMC).

The Municipal Class EA process (2015 version as amended) was developed under the authority of section 13 of the provincial *Environmental Assessment Act*. Class EA's represent routine undertakings that have predictable and manageable impacts on the social, cultural, built, and natural environment. It is understood that this NHR will form part of the Municipal Class EA submission to be reviewed by the Ministry of the Environment, Conservation, and Parks (MECP) and relevant municipal, provincial, and federal review agencies.

2 APPROACH AND METHODS

This study is composed of six (6) discrete components which are bulleted below and further described in the following sections.

- **Acquire background biophysical information and mapping** available for the local landscape surrounding the Study Area (see **Section 2.1**).
- **Conduct site assessments and ecological surveys** to field-verify the accuracy of the acquired background biophysical information and collect additional biophysical information as necessary (see **Section 2.2**).
- **Assess the significance** of the biophysical information collected and natural features identified within the context of applicable natural heritage and environmental policies (see **Section 2.3**).
- **Predict the effects** of the alternative forcemain alignments on the identified significant natural features and natural environment (see **Section 2.4**).
- **Outline natural heritage regulatory considerations** for each alternative forcemain alignment based on municipal, provincial, and federal requirements (see **Section 2.5**).
- **Provide recommendations for further study** once the preferred alignment has been selected.

2.1 Background Biophysical Information Assessment

This study is supported by background biophysical information and mapping acquired and reviewed from a variety of sources which are listed below in **Table 1**.

Table 1. Background Biophysical Information Acquired and Reviewed.

Type of Information Acquired	Description
Ortho-rectified Aerial Photographs	• 1934, 1954, 2000, 2002, 2006, 2010 2013, 2015-2018.
Natural Feature Mapping	• City of Port Colborne Official Plan (OP) Schedule B (Natural Heritage). • Regional Municipality of Niagara OP Schedule C (Core Natural Heritage). • Land Information Ontario (LIO) accessed via MNRF's "Make a Map" web-based platform (accessed 9 September 2020). • Niagara Peninsula Conservation Authority (NPCA) regulation mapping (accessed 9 September 2020).
Physiographic Resource Mapping and Datasets	• Ontario Base Maps (1:10,000). • Ontario Well Records (publicly-available). • The Soils of the Regional Municipality of Niagara (Kingston and Presant 1989). • Agricultural Information Atlas (accessed 9 September 2020). • Paleozoic Geology of Southern Ontario(Armstrong and Dodge 2007). • Surficial Geology of Southern Ontario (Ontario Geological Survey 2010). • Physiography of Southern Ontario(Chapman and Putnam 1984).
Ecological Resource Mapping and Datasets	• Natural Heritage Information Centre (NHIC) database accessed via MNRF's "Make a Map" web-based platform (accessed 9 September 2020). • iNaturalist "(NHIC) Rare species of Ontario" project (accessed 9 September 2020). • Ontario Breeding Bird Atlas (OBBA) database and the Atlas of the Breeding Birds of Ontario, 2001–2005 (Cadman et al. 2007) (square: 17PH45). • Ontario Butterfly Atlas database (square: 17PH45; accessed 9 September 2020). • Aquatic Species at Risk Maps by Fisheries and Oceans Canada (accessed 9 September 2020). • Atlas of the Mammals of Ontario (Dobbyn 2005).
Natural Heritage Objectives and Strategies	• NPCA Natural Areas Inventory Volumes 1 and 2, particularly Study Site WE-07 (Canal Lands). • Great Lakes Conservation Blueprint for Terrestrial Biodiversity, Volume 2 (Henson and Brodribb 2005). • Great Lakes Conservation Blueprint for Aquatic Biodiversity, Volume 2 (Phair et al. 2005)

2.2 Site Assessments

The acquired background information per **Table 1** helped direct several site assessments and surveys carried out by Terrastory staff (T. Knight) between May and July 2020. **Table 2** below indicates the primary assessments/surveys performed during each site visit, weather conditions, and time on-site.

Table 2. Site Assessments and Surveys performed on the Study Area.

Date of Site Assessment	Assessments/Surveys Performed	Terrastory Staff	Weather Conditions	Time On-site
27 May 2020	Breeding bird survey #1, vascular plant survey, incidental observations.	T. Knight	Air Temperature 20-27°C; Beaufort Wind 0-3; Cloud Cover 10-60%; No Precipitation.	6:15-13:20
15 June 2020	Breeding bird survey #2, vascular plant survey, preliminary ELC, natural feature mapping, incidental observations.	T. Knight	Air Temperature 9-22°C; Beaufort Wind 0-3; Cloud Cover 0-10%; No Precipitation.	6:15-12:45
13 July 2020	Ecological Land Classification, natural feature mapping, summer vascular plant survey, incidental observations.	T. Knight	Air Temperature 23-25°C; Beaufort Wind 2-3; Cloud Cover 50-100%; Occasional very light precipitation.	9:45-15:15
14 July 2020	Ecological Land Classification, natural feature mapping, summer vascular plant survey, incidental observations.	T. Knight	Air Temperature 20-24°C; Beaufort Wind 0-2; Cloud Cover 0-50%; No precipitation.	8:00-12:00

The site assessments and surveys centred on characterizing the land use (e.g., historical development patterns, existing built structures, land maintenance, etc.), physiographic (e.g., topography, drainage, surface water features, etc.), and ecological (e.g., vegetation, wildlife, habitats, etc.) conditions and features of the Study Area. Permission to enter lands owned by the SLSMC was organized by the Region. All land-use, physiographic, and ecological information described for private lands in which permission to enter was not secured was collected from either current aerial photographs, existing datasets (e.g., Niagara NAI), or accessible lands. The locations and boundaries of significant natural features and/or habitats were recorded on-site with a high-accuracy GPS (Mesa II) supported by representative photographs.

In addition to collecting general biophysical information, the following targeted assessments (i.e., feature- or species-specific surveys) were undertaken:

- **Vegetation Mapping according to Ecological Land Classification (ELC)**: Vegetation communities on the Study Area were characterized and mapped according to Ecological Land Classification (Lee et al. 1998) and the 2008 update to the Vegetation Type List (Lee 2008). Vegetation communities were initially identified based on current aerial photographs and then verified and refined (as necessary) on-site. ELC mapping was scaled to the finest level of resolution deemed appropriate (i.e., either Ecosite or Vegetation Type). Vegetation communities mapped on private lands was delineated predominantly via aerial photograph interpretation and the Niagara NAI.
- **Wetland Boundaries:** Where wetlands were identified via ELC, their boundaries were delineated consistent with the "50% wetland vegetation rule" and presence of hydric soils per the procedures of the Ontario Wetland Evaluation System (OWES) (OMNRF 2014). All wetlands mapped on adjacent private lands were delineated via aerial photograph interpretation and the Niagara NAI.

- **Vascular Plant Survey:** Vascular plants were recorded based on a comprehensive area search ("wandering transects") within naturally-occurring (i.e., non-planted) or naturalizing areas of vegetation. Particular effort was paid to areas with the greatest potential to support significant vascular plants (i.e., designated Species at Risk, provincially rare, etc.) and areas with the greatest potential for impact based on the proposed development plan. Nomenclature and common names for the recorded vascular plant species are generally consistent with the Southern Ontario Vascular Plant Species List (Bradley 2013) except where a name change has more recently been adopted by NHIC.
- **Breeding Bird Surveys according to the Ontario Breeding Bird Atlas Protocol:** Two rounds of breeding bird surveys were conducted in accordance with the Ontario Breeding Bird Atlas (OBBA) protocol (Bird Studies Canada et al. 2001). Surveys occurred within the appropriate season (May 24–July 10), time of day (between dawn and approximately 5 hours after dawn), and weather conditions (no rain, wind speed ≤3 on the Beaufort Wind Scale). While the OBBA protocol recommends that stations be situated at least 300 m apart (to avoid double counting), the stations established herein were often closer together to ensure more comprehensive survey coverage. Surveys occurred for a minimum duration of 10 minutes at each station.

2.3 Significance Assessment

2.3.1 Definitions and Criteria

"Significant natural features" as described herein represent natural features and habitats that have recognized status (and therefore policy significance) within the planning jurisdiction in which an application is proposed. While it is recognized that the Municipal Class EA process is separate and apart from the requirements of the *Planning Act*, significant natural features are defined herein to include those referenced in section 2.1 of the 2020 Provincial Policy Statement (PPS), namely:

- Significant Wetlands;
- Significant Woodlands;
- Significant Valleylands;
- Significant Wildlife Habitat (SWH);
- Significant Areas of Natural and Scientific Interest (ANSIs);
- Habitat of Endangered and Threatened Species; and
- Fish Habitat.

It is noted that the Regional OP (ROP) provides provisions that consider and/or protect additional natural features beyond the requirements of the PPS. These features are also considered "significant" herein and include:

- Other Evaluated Wetlands; and
- Regionally Significant Woodlands.

Criteria used to determine the presence or absence of the above significant natural features within the Study Area were considered from a variety of sources including the local and Regional OPs, Natural Heritage Reference Manual (MNR 2010a), and (for Significant Wildlife Habitat) the Ecoregion 7E Criteria Schedule (MNRF 2015).

Apart from PPS- and ROP-derived significant natural features, this study also seeks to determine whether any natural features or hazards regulated by NPCA pursuant to O. Reg. 155/06 occur within the Study Area. Portions of the Study Area managed by the SLSMC are federal lands in which the *Conservation Authorities Act* is not believed to be applicable; notwithstanding this, NPCA's regulation would apply to non-federal lands and the Authority is expected to act as a commenting agency on the Municipal Class EA submission. NPCA regulated features and hazard lands include:

- Wetlands (significant, evaluated, or identified);
- Watercourses and their associated meanderbelts and floodplains;
- Valleylands;
- Steep slopes; and
- Shorelines.

Like significant natural features, "significant species" represent individuals of wild species which have recognized status (and therefore policy significance) within the planning jurisdiction in which an application is proposed. Significant species are defined herein to include:

- Species designated Endangered, Threatened, or Special Concern under O. Reg. 230/08 pursuant to the provincial *Endangered Species Act, 2007*.
- Species designated Provincially Rare (i.e., S1, S2, or S3) by NHIC.
- Species considered Regionally Rare in Niagara pursuant to the *List of the Vascular Plants of Ontario's Carolinian Zone* (Oldham 2017).

2.3.2 Determination

After collecting the background biophysical information and conducting the ecological surveys and assessment, the data was interpreted to determine whether any significant natural features (i.e., per the PPS and ROP), natural features/hazards regulated by NPCA, and/or significant species occur within the Study Area. If a natural feature or species met the significance criteria, it is considered "confirmed". If a natural feature or species may be present on the Study Area given the prevailing biophysical or habitat conditions but was not confirmed based on either background or site-specific biophysical data, it is considered potential or "candidate". Candidate significant natural features and species are treated as confirmed where no additional information is available.

2.4 **Effects Assessment**

The potential ecological effects of an application can be understood spatially as zones that radiate outward from the direct project footprint (e.g., building envelope, etc.) and associated areas of site alteration (e.g., grading, etc.). While the greatest potential for effects typically occurs within areas directly subject to development or disturbance, surrounding areas may also be affected indirectly. Such indirect effects can include light or noise pollution that affects wildlife communities on Adjacent Lands, or degradation of water quality within a downstream receptor resulting from sediment runoff during construction.

A general effects assessment is provided as part of the evaluation of forcemain alternatives in **Section 5**. A more detailed effects assessment (with appropriate mitigation) is expected to be prepared through detailed design once the preferred alternative is selected.

2.5 Natural Heritage Policy Context

There is an overlapping municipal, provincial, and federal policy framework respecting the protection of natural heritage features and areas across southern Ontario. These requirements include objectives, policies, and directives which are principally contained in federal and provincial statutes, regulations, policy statements, Official Plans, and guidance documents. The overarching natural heritage policy framework applicable to the alternative forcemain alignments considered herein is described in **Section 6**.

Although the Municipal Class EA process is separate and apart from the requirements of the *Planning Act*, the Region is acting as project proponent. It is unknown if Regional Environmental Planning staff will comment on the undertaking in the context of ROP policies respecting natural heritage (i.e., OP Chapter 7). It is further recognized that while the requirements of the *Conservation Authorities Act* (and NPCAs regulation) are not believed to be applicable to federal lands managed by the SLSMC, the Authority has regulatory jurisdiction on other private/municipal lands within the Study Area and is expected to act as a commenting agency on the Municipal Class EA submission.

3 EXISTING BIOPHYSICAL CONDITIONS

The following is a description of the biophysical features and conditions of the Study Area, which are shown spatially on **Figure 2**. Representative photographs are provided in **Appendix 1**.

3.1 Land-use and Landscape Setting

The Study Area is situated near the northern urban limit of Port Colborne. Overall, the Study Area lands have been converted to residential purposes or were heavily disturbed by construction of the Welland Canal. Soils within natural areas managed by the SLSMC likely partly represent materials dredged during Canal construction (i.e., spoils). The Seaway WWTP (where the Eastside SPS forcemain terminates) is situated in the northwest portion of the Study Area, while lands on either side of the Welland Canal consist of a variety of woody vegetation communities. Derek Point Memorial Garden (municipal park) is situated at the northern tip of the Port Colborne "island". Residential lands generally surround the Study Area to the west, south, and east, while agricultural and other SLSMC lands occur to the north of Barrick Road.

3.2 Physical Setting

3.2.1 Bedrock Geology

The bedrock underlying the Study Area is characterized as Silurian-aged (i.e., 419 to 443 million-year-old) dolostones of the Bertie Formation (Armstrong and Dodge 2007). The Bertie Formation subcrops (i.e., exists as the highest bedrock surface but beneath the ground) across much of southern Niagara. The southern portion of the Study Area is underlain by the Devonian-aged Bois Blanc Formation with a primary lithology consisting of limestone. Publicly-accessible water well records near the Study Area indicate the bedrock is likely about 10 m beneath the surface in this area, though this depends on the depth of previous fill activities and other local factors.

3.2.2 Surficial Geology and Soils

Surficial deposits within the Study Area are predominantly of glaciolacustrine origin and consist of clays and silts laid down in a deepwater environment associated with Lake Warren (precursor to Lake Erie). Such deposits form part of a broad region known as the Haldimand Clay Plain

(Chapman and Putnam 1984). Notwithstanding this, the native soil and pre-settlement topography of the Study Area has been modified through fill activities associated with construction of the Welland Canal.

3.2.3 Topography, Drainage, and Surface Water Features

The Study Area appears to sit between approximately 175-185 metres above sea level (masl). The topographic height (around 185 masl) of the Study Area is associated with a plateau interpreted as the crest of a filled area just west of the railway lands.

The Study Area is drained by a variety of surface water features, the most prominent of which is the Welland Canal. Surface water base-mapping shown in **Figure 2** is understood to have been originally prepared by the Region (i.e., Contemporary Mapping of Watercourses layer), with some modifications based on fieldwork undertaken through this study. It is noted that several surface water features in the basemap appear to reflect roadside ditches and may not be considered "watercourses" pursuant to NPCAs regulation.

A watercourse with a relatively defined channel flows southward just east of the Seaway WWTP and 138 Barrick Road. Overall, this feature is underlain by mucky clay substrates and appears to have an intermittent flow regime (mostly drying by mid-summer), although more substantial flows would be expected during the spring freshet or following storm events. The channel (bankfull) was assessed as 2 m downstream of the culvert at Barrick Road, though channel dimensions are variable and generally narrow further downstream. No fish were observed in this watercourse during any site visit in 2020; however, seasonal use of this feature by fish may be possible.

A Municipal Drain (Central Park Drain) appears to flow westward from subdivisions east of Janet Street, entering the Study Area as a ditch along the east side of Welland Street. Based on existing information, the drain is considered Class F and therefore has an intermittent flow regime and does not contain fish. This feature was not assessed in detail as it primarily occurs on adjacent private lands.

3.3 **Ecological Setting**

3.3.1 Vegetation Communities

Vegetation communities within the Study Area are mapped on **Figure 2** and generally described below. Overall, the Study Area consists of a variable mix of upland (forest, woodland, savannah, thicket, meadow) and wetland (primarily swamp) communities, which partly reflects the varying topography and clayey soils which promote standing water. A nature trail network winds through much of the SLSMC lands (also shown on **Figure 2**). Vegetation communities outside of the SLSMC lands (i.e., private lands and lands not visible from publicly accessible areas) are mapped based on current aerial photographs and the Niagara Natural Areas Inventory (NAI) mapping. It is noted that tree/vegetation removal has occurred in the northeast portion of the Study Area (for what appears to be storage purposes) which is not reflected in the 2015 aerial photograph base.

3.3.1.1 Wetland Communities

Treed and thicket swamp wetlands (SWDM4 / SWTM 5) have emerged in two (2) areas. The westernmost swamp is a long narrow bottomland situated between the toe of slope to the east and Seaway WWTP (and other private lands) to the west. This community is dominated by Freeman's

Maple (*Acer x freemanii*), with occasional Eastern Cottonwood (*Populus deltoides*) and declining Green Ash (*Fraxinus pennsylvanica*) in the canopy. Green Ash likely acted as a dominant canopy constituent but is undergoing significant dieback and death as a result of larval feeding activities by Emerald Ash Borer (*Agrilus planipennis*). European Buckthorn (*Rhamnus cathartica*), Silky Dogwood (*Cornus amomum*), Grey Dogwood (*Cornus sericea*), and Grey Willow (*Salix x atrocinerea*) are dominant in the shrub layer (depending on location) along with regenerating Manitoba Maple (*Acer negundo*), Green Ash, and Freeman's Maple. The herbaceous and groundcover layer is dominated by Fowl Meadow Grass (*Glyceria striata*), Poison-ivy (*Toxicodendron radicans*), Spotted Jewelweed (*Impatiens capensis*), Tall Goldenrod (*Solidago altissima*), and Wild Grape (*Vitis riparia*). Where canopy cover is relatively intact this community is described as deciduous treed swamp (SWDM4); where Green Ash has declined the canopy is more open and is therefore described as deciduous thicket swamp (SWTM5). The soils in this community were found to be clay which promotes standing water, with mottling at 5 cm.

The easternmost swamp occurs just west of the Welland Canal. This community is dominated by a mixture of Bur Oak (*Quercus macrocarpa*), Freeman's Maple, and Green Ash (experiencing dieback), with European Buckthorn dominant in the shrub layer (along with Silky Dogwood and Grey Dogwood). Fowl Meadow Grass (*Poa palustris*), Moneywort (*Lysimachia nummularia*), White Avens (*Geum canadense*), Poison-ivy, and Panicled Aster (*Symphyotrichum lanceolatum*) are abundant in the herbaceous layer. Rice-cut Grass (*Leersia oryzoides*) also dominates in certain areas.

Apart from swamp communities, a small meadow marsh dominated by Common Reed (*Phragmites australis* ssp. *australis*) occurs on the west side of the railway tracks. This marsh appears to be supported by ditch drainage and is heavily disturbed.

3.3.1.2 Upland Communities

Upland communities in the Study Area consist of forests (>60% canopy cover), woodlands (35-60% canopy cover), savannah (25-35% canopy cover), thickets (shrub-dominated), and meadows (grass- and forb-dominated). The following communities are mapped on **Figure 2**:

- FODM9-3: Fresh - Moist Bur Oak Deciduous Forest
- FODM11: Naturalized Deciduous Hedgerow
- WODM5: Fresh-Moist Deciduous Woodland
- SVD: Deciduous Savanna
- THDM5: Fresh - Moist Deciduous Thicket
- THDM4: Dry - Fresh Deciduous Regeneration Thicket
- THDM3: Dry-Fresh Deciduous Hedgerow Thicket
- THDM2: Dry-Fresh Deciduous Thicket
- MEMM3: Dry - Fresh Mixed Meadow
- MEMM4: Fresh - Moist Mixed Meadow

3.3.2 Vascular Plants

A list of 173 vascular plant species is provided in **Appendix 2**. No provincially rare or species at risk (provincial or federal) vascular plants were documented within the areas investigated.

Three (3) locally rare plants were documented: Holmes' Hawthorn (*Crataegus holmesiana*), Pringle's Hawthorn (*Crataegus coccinea* var. *pringlei*), and Rough Fleabane (*Erigeron strigosus*). Based on the

professional experience of this report author, all three (3) of these vascular plant species are more widespread than currently described in Niagara and none are considered candidates for conservation in the context of this application (i.e., construction of critical linear infrastructure).

3.3.3 Breeding Birds

Breeding bird surveys were undertaken at 14 stations on 27 May and 15 June 2020. A total of 49 bird species were recorded during the breeding bird surveys. The assemblage and abundance of birds recorded generally reflects the prevailing structure and composition of on-site vegetation communities and variable habitats within the Study Area (e.g., forest/treed swamp, woodland, thicket/thicket swamp, meadows, disturbed open areas). The locations of each survey station are shown on **Figure 2** while the full survey results indicating each species' breeding status by survey station can be found in **Appendix 3**. The locations of significant bird species recorded are shown on **Figure 3**. An Osprey (*Pandion haliaetus*) nest was documented atop a telecommunications tower south of the Seaway WWTP.

Three (3) significant bird species were recorded during the targeted breeding bird surveys: Barn Swallow (*Hirundo rustica*), Bank Swallow (*Riparia riparia*), and Eastern Wood-pewee (*Contopus virens*). All documented locations of these species within the Study Area along with their habitat requirements are described below. While habitats of several other federally Threatened/Endangered bird species listed on Schedule 1 of SARA are present – including Red-headed Woodpecker (*Melanerpes erythrocephalus*), Canada Warbler (*Cardellina canadensis*), Wood Thrush (*Hylocichla mustelina*), and Common Nighthawk (*Chordeiles minor*) – none of these species were documented during breeding bird surveys in May/June 2020 nor incidentally during the course of other site assessments.

3.3.3.1 Barn Swallow

Barn Swallow is designated Threatened in Ontario per O. Reg. 230/08 pursuant to the *Endangered Species Act* (ESA) and is federally designated Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC; and listed on Schedule 1 of SARA). Prior to European settlement Barn Swallow nested in or on natural features (e.g., caves, cliff faces, etc.); today most nesting is associated with built structures such as barns, bridge/culvert undersides, and awnings/overhangs on the sides of buildings (COSEWIC 2011). Foraging habitat includes a variety of open areas such as agricultural lands, old fields, and open water. Foraging distances from nest sites depend on habitat quality and social characteristics and have been found to extend greater than one kilometre (Brown and Brown 1999), though most forays may average only a few hundred metres from nests (Turner 1981).

Barn Swallow was documented at six (6) stations throughout the Study Area (BI-6, BI-7, BI-8, BI-12, BI-13, BI-14), mostly in proximity to the Welland Canal. Several Barn Swallow were documented flying into portions of the industrial buildings on the west side of the Welland Canal (i.e., former Robin Hood flour mill) and are presumed to be nesting at this location (see **Figure 3**). The industrial building was not accessed during field activities as part of this study.

3.3.3.2 Bank Swallow

Bank Swallow is designated Threatened in Ontario per O. Reg. 230/08 pursuant to the ESA and is federally designated Threatened by COSEWIC (and listed on Schedule 1 of SARA). This species frequently nests in vertical or near-vertical (i.e., above 75°) cliff faces, banks, and stockpiles that contain sandy overburden which allow for nesting out of reach from mammalian predators.

One (1) Bank Swallow was documented as a flyover at BI-9 during the second survey (15 June 2020); this individual may have been foraging over the Welland Canal or flying through the Study Area on transit. Based on the breeding bird surveys undertaken in May and June 2020, this species is not nesting within or adjacent to any of the proposed forcemain alignment options.

3.3.3.3 Eastern Wood-pewee

Eastern Wood-pewee is designated Special Concern in Ontario per O. Reg. 230/08 pursuant to the ESA and is federally designated Special Concern by COSEWIC (and listed on Schedule 1 of SARA). This species is most commonly associated with relatively open, deciduous and mixed forests of various sizes, as well as forest edges and other areas with relatively continuous (albeit open) canopy cover (e.g., parks, cemeteries, etc.). This species' preference for open forests and forest edges may be attributed to its aerial foraging behaviour (COSEWIC 2012). Territory sizes were shown to average approximately 1.75 ha (representing a circle with a radius of 75 m) in a study in southern Ontario (as cited in COSEWIC 2012).

This species was documented as a "probable" breeder at station BI-2 and a "possible" breeder at BI-9 (see **Figure 2**). Both possible/probable breeding locations are associated with forest/swamp communities.

4 SIGNIFICANCE ASSESSMENT

Based on the biophysical information collected during background information gathering (per **Table 1**) and the results of Terrastory's surveys and site assessments (per **Section 2.2** and **Section 3**), **Table 3** below provides a determination of whether or not each significant natural feature as defined herein occurs within the Study Area. The shaded rows highlight features which may be present (candidate) or are confirmed within the Study Area, with significant natural feature mapping provided in **Figure 3**.

Table 3. Summary of the Assessment of Significant Natural Features on the Study Area and Adjacent Lands.

Significant Natural Feature	Status within the Study Area
PPS Significant Natural Features	
Significant Wetlands	*Absent*. See **Section 4.1.**
Significant Woodlands	*Present*. See **Section 4.2.**
Significant Valleylands	*Absent*. See **Section 4.3.**
Significant Wildlife Habitat	*Candidate*. See **Section 4.4.**
Significant Areas of Natural and Scientific Interest	*Absent*.
Habitat of Endangered and Threatened Species (per ESA and SARA)	*Candidate*. See **Section 4.5.**
Fish Habitat (per *Fisheries Act*)	*Confirmed and Candidate*. See **Section 4.6.**
Regionally Significant Natural Features (i.e., not considered by the PPS)	
Evaluated Wetlands	*Absent*. See **Section 4.1.**
Regionally Significant Woodland	*Confirmed*. See **Section 4.2.**
Conservation Authority Regulated Features and Hazard Lands	

Significant Natural Feature	Status within the Study Area
Wetlands, watercourses, valleylands, meanderbelts, floodplains, steep slopes, and shorelines.	*Confirmed*. See below.

4.1 Wetlands

As described in **Section 3.3.1.1**, two (2) swamp communities/units and a meadow marsh dominated by Reed-canary Grass are present within the Study Area. All identified wetlands have been identified through fieldwork as part of this study and have not been evaluated based on the Ontario Wetland Evaluation System (OWES).

4.2 Significant Woodlands

A variety of treed vegetation communities (e.g., treed swamp, forest, woodland, regenerating thicket) are present within the Study Area. While existing provincial woodland mapping is provided in **Figure 3**, some of these mapped woodland features were deemed to be absent or shrub-dominated through fieldwork as part of this study.

The ROP provides criteria for establishing woodland significance through Policy 7.B.1.5, which is provided below:

a) Contain threatened or endangered species or species of concern;
b) In size, be equal to or greater than:
    i. 2hectares, if located within or overlapping Urban Area Boundaries;
    ii. 4 hectares, if located outside Urban Areas and north of the Niagara Escarpment;
    iii. 10 hectares, if located outside Urban Areas and south of the Escarpment;
c) Contain interior woodland habitat at least 100 metres in from the woodland boundaries;
d) Contain older growth forest and be 2 hectares or greater in area;
e) Overlap or contain one or more of the other significant natural heritage features listed in Policies 7.B.1.3 or 7.B.1.4; or
f) Abut or be crossed by a watercourse or water body and be 2 or more hectares in area.

The results of this study do not allow for a determination of whether or not each treed vegetation community mapped in **Figure 2** meets Regional woodland significance criteria. Notwithstanding this, at a minimum the forest/treed swamp near the northern boundary of the Study Area just west of the Welland Canal is part of a larger and contiguous woodland feature extending northward onto adjacent SLSMC lands. Based on size alone, this feature meets Regional criteria for establishing woodland significance. In respect of the woodland/swamp just east of the Seaway WWTP, it is difficult to determine if Regional woodland significance criteria is satisfied due to considerable dieback of Green Ash and succession to thicket-dominated (or abundant) vegetation communities. Use of plot-based canopy coverage estimates (and completion of additional survey work outlined in **Section 7**) would likely be necessary to further confirm the extent of Regionally Significant Woodlands within the Study Area.

4.3 Significant Valleylands

Although areas with distinctive valleyland morphology (which are drained by a surface water feature) are present in the western portion of the Study Area just east of the Seaway WWTP, this morphology appears to have been created by dredged fill materials (spoils) associated with

construction of the Welland Canal. As such, no valleylands (significant or otherwise) are present within the Study Area.

4.4 Significant Wildlife Habitat

Given the size of the Study Area and variable (though disturbed) habitats, several Significant Wildlife Habitat (SWH) types have the potential to occur. The potential presence of SWH features/areas has been considered in the context of the proposed alternatives considered through this Municipal Class EA. The following nine (9) SWH features/areas and species of concern have the greatest potential to be impacted by one (or more) of the forcemain alignment options considered herein:

- Seasonal Concentration Areas of Animals
    1. Raptor Wintering Area
    2. Bat Maternity Colonies
    3. Reptile Hibernaculum
    4. Deer Winter Congregation Areas
- Rare Vegetation Communities or Specialized Habitats for Wildlife
    5. Bald Eagle and Osprey Nesting, Foraging and Perching Habitat
    6. Woodland Raptor Nesting Areas
    7. Amphibian Breeding Habitat (Woodlands)
- Habitat of Species of Conservation Concern
    8. Special Concern and Rare Wildlife Species
        i. Eastern Wood-pewee (*Contopus virens*)
        ii. Monarch (*Danaus plexippus*)
        iii. Yellow-banded Bumblebee (*Bombus terricola*)
        iv. Snapping Turtle (*Chelydra serpentina*)
- Animal Movement Corridors
    9. Amphibian Movement Corridors

4.5 Habitat of Endangered and Threatened Species

The Study Area contains a mixture of federal (SLSMC) and provincial/private lands. As such, the requirements of the federal *Species at Risk Act* (SARA) and provincial *Endangered Species Act* (ESA) apply, depending on land ownership.

Based on the species-specific and habitat-based assessments undertaken, the following (4) Endangered/Threatened species have the greatest potential to be impacted by one (or more) of the forcemain alignment options considered herein:

1) Little Brown Myotis (*Myotis lucifugus*)
2) Northern Myotis (*Myotis septentrionalis*)
3) Tri-colored Bat (*Perimyotis subflavus*)
4) Barn Swallow (*Hirundo rustica*)

In addition to the species above, it is noted that potential habitat for several Endangered/Threatened bird species listed on Schedule 1 of SARA is present including Red-headed Woodpecker, Canada Warbler, Wood Thrush, and Common Nighthawk. Red-headed Woodpecker was also recently designated as Endangered by COSSARO. None of these bird species were documented during breeding bird surveys (or incidentally) in 2020; however, updated surveys may

be required should construction of the selected forcemain alignment not occur before ~2025 (see **Section 7**).

It is further noted that Black Ash (*Fraxinus nigra*) is considered Threatened by both COSEWIC and COSSARO but is not yet listed as such on Schedule 1 of SARA or O. Reg. 242/08 of the provincial ESA. This species was not documented anywhere within the Study Area; however, a targeted survey along the preferred forcemain alignment at detailed design may be advised (depending on this species' regulatory status at that time; see **Section 7**).

A general description of the four (4) Endangered/Threatened species listed above and their habitat is offered below.

4.5.1.1 Bats

Little Brown Myotis, Northern Myotis, and Tri-colored Bat have the potential to roost and forage within the Study Area. Little Brown Myotis and Northern Myotis form maternity colonies that roost in larger-diameter trees with cracks, crevices, and/or exfoliating bark; Little Brown Myotis will also frequently roost in buildings (e.g., attics, barns, etc.). Roosting sites for Tri-colored Bat maternity colonies are less understood but have been documented in dead or dying leaf clusters of oaks (*Quercus* spp.) and maples (*Acer* spp.), along with live foliage and buildings (Humphrey and Fotherby 2019). Individuals (i.e., non-reproductive females and males) of all three bat species may roost in smaller diameter trees and other spaces (e.g., beneath house siding, etc.) which are not occupied by maternity colonies. Overwintering habitat includes caves and mines that maintain temperatures above 0°C. White Nose Syndrome (a fungal disease caused by an introduced pathogen) has devastated populations of each species across their ranges. The fungus causes hibernating individuals to become dehydrated, leading to excessive arousal, depleted fat reserves, and ultimately emaciation and/or death.

This study did not employ the use of unattended, ultrasonic bat acoustic monitoring units to determine the prevailing bat community of the Study Area. Notwithstanding this, habitats which could support roosting by Little Brown Myotis, Northern Myotis, and Tri-colored Bat are present within portions of all three (3) alternative forcemain alignments.

4.5.1.2 Barn Swallow

As described in **Section 3.3.3.1**, Barn Swallow appears to be nesting in portions of the industrial buildings (i.e., former Robin Hood flour mill) on the western margin of the Welland Canal.

4.6 Fish Habitat

The Welland Canal is a significant surface water feature connecting Lake Ontario and Lake Erie. Fish records (available on iNaturalist) from anglers downstream of the Study Area (i.e., from downtown Port Colborne) include several large-bodied species including Smallmouth Bass (*Micropterus dolomieu*), Longnose Gar (*Lepisosteus osseus*), and Freshwater Drum (*Aplodinotus grunniens*), along with Round Goby (*Neogobius melanostomus*). These records are downstream of Lock 8 where the Canal is more hydrologically and ecologically connected to Lake Erie. Additional species documented within the Canal between St. Catharines and Port Colborne include Common Carp (*Cyprinus carpio*), Largemouth Bass (*Micropterus salmoides*), Northern Pike (*Esox lucius*), White Sucker (*Catostomus comersonii*), Brown Bullhead (*Ameiurus negulosus*), Channel Catfish (*Ictalurus punctatus*), Goldfish (*Carassius auratus*), and Shorthead Redhorse (*Moxostoma macrolepidotum*) (Kim and Mandrak 2016). Based on the results of a three-year telemetry study (Kim and Mandrak 2016), certain fish

species (particularly Common Carp and Freshwater Drum) have been shown to move between different locks within the Canal and between the Canal and Lake Erie.

Fish occupation within the watercourse just east of the Seaway WWTP and 138 Barrick Road (see **Figure 3**) is unknown. This feature has an intermittent hydrologic regime and no fish were documented incidentally during fieldwork in support of this study. Notwithstanding this, portions of the watercourse may contain water semi-permanently (particularly downstream of the culvert just east of 138 Barrick Road) and it is not known with certainty whether fish from other adjacent waterbodies have seasonal access to this feature.

The Central Park Drain (Municipal Drain) in the southern portion of the Study Area is Class F and therefore not considered direct fish habitat.

5 ALTERNATIVES EVALUATION

Provided below is a description of each proposed forcemain alignment alternative with emphasis on potential and anticipated natural heritage impacts stemming from each option.

The three (3) alternative alignments (i.e., Options #2A, #2B, and #3) each require tunnelling beneath the Welland Canal, including launch and exits shafts on the east and west sides. Based on information provided by the project Engineer (GM BluePlan Engineering Ltd.), the tunnel diameter would be approximately 2.24 metres with an overall length beneath the canal of over 200 m (depending on the alignment selected). Forcemain construction on the west side of the Canal would likely take place via open-cut trenching with an overall construction corridor anticipated to be approximately 6-8 metres wide.

5.1 Option #1/4: Do Nothing / Rehabilitation

The do nothing / rehabilitation option poses the least potential for natural heritage impacts and regulatory considerations. While specific construction measures associated with "rehabilitation" are unknown at this time, it is assumed that limited excavation within the forcemain alignment would be required. Should more substantial earthworks be necessary, these works would likely be predominantly restricted to the current forcemain easement which appears to be regularly mowed and is generally devoid of woody vegetation. Limited (if any) additional loss of wetland area and no new watercourse crossings would be anticipated.

5.2 Option #2A: Barrick Road Crossing – ROW

This option requires a single crossing of the Welland Canal north of "The Island" via tunnelling (i.e., directional drilling). West of the Canal this option would require open-cut trenching through a wetland (deciduous swamp) and Regionally Significant Woodland. Additional wetland impacts (both temporary and permanent) would be associated with the proposed lay-down and servicing features to support construction and long-term maintenance of the forcemain. The extent of wetland disturbance/loss (temporary or permanent) within the 6-8 metre wide construction corridor is expected to be around 700 m^2 (with additional wetland disturbance/loss associated with servicing). The entire swamp and contiguous Regionally Significant Woodland are considered Significant Deer Wintering habitat by MNRF and would also support raptor nesting. Eastern Wood-pewee (Special Concern species) was documented as a "possible" breeder within the vicinity of this alignment option along with candidate significant habitat for breeding Anurans (frogs/toads) within the swamp.

Further west, this alignment crosses potentially significant snake overwintering habitat (i.e., complex of large boulder/rubble piles) and potentially significant raptor wintering areas. Additional wetland disturbance may be expected due to the proximity of the forcemain alignment to Barrick Road, along with a crossing of the watercourse just east of 138 Barrick Road. It is understood that the watercourse crossing could be undertaken via tunnelling. The remainder of alignment would largely extend through residential areas in which some impact to landscaped trees and hedgerow vegetation is expected.

5.3 Option #2B: Barrick Road Crossing – SEAWAY

This alignment is similar to #2A and requires a single crossing of the Welland Canal north of "The Island" via tunnelling. The footprint of this alignment extends (partially) through the same wetland and Regionally Significant Woodland as #2A; however, this alignment also extends through a separate wetland community just east of the Seaway WWTP. The estimated extent of wetland loss/disturbance within the 6-8 m construction corridor is therefore greater and likely around 1,000 m^2 (plus additional loss/disturbance associated with servicing).

A more southerly crossing of the watercourse east of 138 Barrick Road will be required, and the alignment also crosses several candidate SWH types for overwintering snakes, wintering deer, nesting raptors, and breeding Anurans (frogs/toads).

5.4 Option #3 – North Island Crossing

This alignment may require two separate crossings of the Welland Canal, though it is understood that tunnelling the entire length of the Canal/Island (thereby requiring only a single tunnel) may be feasible. This alignment avoids impacts to the wetland and Regionally Significant Woodland necessitated by Options #2A/#2B but overlaps with a separate woodland community and wetland east of the Seaway WWTP. A small meadow marsh dominated by *Phragmites* is also present on the west side of the railway corridor and would be impacted, but this feature has low habitat value. Of the three (3) new alignment alternatives, this option would be associated with the least wetland loss/disturbance.

This alignment also requires a crossing of the watercourse east of 138 Barrick Road in the same general location as #2B, and open cut trenching through the same candidate SWH types.

6 REGULATORY AND REVIEW CONSIDERATIONS

Provided below in **Table 4** is a summary of natural heritage regulatory and review considerations for each alternative forcemain alignment option. As noted in **Section 2.5**, regulatory considerations for this municipal undertaking are somewhat unique in that portions of the proposed alignments extend through federal lands managed by SLSMC and are therefore subject to a different (federal) legislative context. Notwithstanding this, it is expected that Regional and NPCA environmental planning staff will (at a minimum) act as commenting agencies on the Municipal Class EA, and that relevant federal agencies responsible for protection of the natural environment will also be circulated.

Table 4. Natural Heritage Regulatory and Review considerations for the EA Alternatives.

Option	Natural Heritage Regulatory and Review Consideration (beyond Municipal Class EA requirements)
Option #1/4 – Do Nothing / Rehabilitation	Exact nature of works associated with "rehabilitation" unknown. Regulatory considerations may be limited but would include (at a minimum) consideration for the protection of nesting birds and bird nests under the federal *Migratory Birds Convention Act* and provincial *Fish and Wildlife Conservation Act*.
Option #2A – Barrick Road Crossing - ROW	• Federal ***Fisheries Act*** **(Welland Canal):** Although it is understood that the undertaking will not make direct contact with the bed of the Welland Canal, a Request for Project Review to Fisheries and Oceans Canada (i.e., "DFO") is recommended to ensure that the proposed project design and construction mitigation will not result in Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat. • Federal ***Fisheries Act*** **(Watercourse per Figure 3):** Confirmation of whether this surface water feature directly supports fish (via electrofishing) is recommended to clarify regulatory requirements per the *Fisheries Act*. If fish are documented within this watercourse (or the undertaking has a high potential to affect fish habitat in downstream or adjacent waterbodies), a Request for Project Review to Fisheries and Oceans Canada (i.e., "DFO") will be necessary along with mitigation measures (i.e., tunnelling rather than open-cut trenching) to avoid HADD. • Federal ***Migratory Birds Convention Act*****:** Section 6 of the Migratory Birds Regulations under the MBCA prohibits the disturbance or destruction of nests, eggs, or nest shelters of a migratory bird. The provincial ***Fish and Wildlife Conservation Act*** extends the protection of bird nests and eggs to certain species not listed under the Migratory Birds Regulations (e.g., certain Corvids, Strigids, Accipitrids, etc.) on provincial lands. As vegetation clearance is required in support of construction of all alignment alternatives, such activities will be subject to a timing restriction to protect nesting birds and bird nests which will likely extend from April 1 to August 31 (i.e., vegetation to be removed between September 1 and March 31). • Federal ***Species at Risk Act*****:** The results of this study documented potential habitat for three (3) Endangered bat species (Little Brown Myotis, Northern Myotis, Tri-colored Bat). Each of these species is listed as Endangered on Schedule 1 of SARA. Correspondence with Environment Canada is recommended to confirm study/regulatory requirements related to these bat species (and any other Endangered/Threatened species listed on Schedule 1 of SARA). Within private/provincial lands, the Ministry of the Environment, Conservation, and Parks (MECP) would typically recommend a timing restriction on tree clearing during the active bat season (i.e., all tree removal to occur between October 1 and April 30) along with other construction mitigation measures (i.e., avoidance of work at night if possible). It is expected that Environment Canada would recommend a similar approach (at a minimum) on federal lands managed by SLSMC in the context of SARA. Need for additional surveys for bats (i.e., acoustic monitoring, etc.) should be confirmed with Environment Canada (see **Section 7**). Note that while presumed Barn Swallow nesting habitat was identified through this study (in the old Robin Hood flour mill), this location will not be affected by the proposed forcemain alternatives evaluated herein. While habitats for several other federally Endangered/Threatened bird species listed on Schedule 1 of SARA (e.g., Red-headed Woodpecker, Canada Warbler, Wood Thrush, Common Nighthawk) are present, none of these species were documented during breeding bird surveys in May/June 2020. • **Federal Policy on Wetland Conservation (1996):** As some degree of wetland loss/disturbance on federal lands managed by SLSMC is expected with all three (3) new alignment options, this policy may be applicable to the undertaking and requires "no net loss" of wetland area. Wetland compensation may be requested by applicable federal agencies.

Option	Natural Heritage Regulatory and Review Consideration (beyond Municipal Class EA requirements)
	• ***NPCA Regulation*:** Although NPCA appears to lack direct regulatory authority on federal lands, it is likely that the Authority will (at a minimum) act as a commenting agency on the Municipal Class EA. Alternative trenching measures (i.e., tunnelling) to cross the watercourse east of 138 Barrick Road may be requested, along with measures to address wetland loss/disturbance. • Provincial ***Drainage Act*:** All three (3) proposed alignments extend northward along Welland Street from the Eastside SPS on Killaly Street. A Municipal Drain (Central Park Drain) is mapped along the east side of Welland Street. Existing mapping of this feature appears to be historical (i.e., outdated), and it is unknown whether *Drainage Act* requirements pertain to the Regional undertakings. Once a preferred alignment is selected, confirmation of any *Drainage Act* implications with the City's Drainage Superintendent is advised. • Provincial ***Endangered Species Act*:** See above discussion related to SARA requirements. The ESA only applies to provincial/private land (i.e., not lands managed by SLSMC). Further correspondence with MECP is advised to demonstrate that the project will not adversely affect the three (3) aforementioned Endangered bat species (Little Brown Myotis, Northern Myotis, Tri-colored Bat) or their habitat. • **Regional OP Policy 7.B.1.11 ("No Significant Negative Impacts"):** Significant Woodlands, Significant Wildlife Habitat, and Significant Habitat of Species of Concern are considered Environmental Conservation Areas pursuant to the ROP. Given that the Region is acting as proponent, it is unknown if Regional Environmental Planning staff will undertake a review of the proposed works for general conformance with ROP natural heritage policies. In particular, this includes the need to establish "no significant negative impacts" to the identified significant natural features. Recommendations for further study are offered in **Section 7** to assist with confirming the presence or absence of several "candidate" significant features identified herein during detailed design. • **Regional OP Policy 7.B.1.19 (Tree Saving Plan):** This ROP policy requires the completion of a Tree Saving Plan (TSP) where development is proposed within a Significant Woodland. Although this Policy may not strictly apply to the undertaking, the completion of a TSP is a typical requirement for undertakings which may impact Significant Woodlands in Niagara Region.
Option #2B – Barrick Road Crossing - SEAWAY	Regulatory considerations similar to #2A above. Slightly greater wetland impact is anticipated over Option #2A.
Option #3 – North Island Crossing	Regulatory considerations similar to #2A and #2B. Less wetland and (candidate) SWH impacts are anticipated over Options #2A and #2B. Based on existing information, this alignment is preferred from a natural heritage perspective.

7 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER STUDY

The preceding Natural Heritage Review provides an overall characterization of the natural environment occurring within and adjacent to a series of alternative forcemain alignment options considered via a Schedule B Municipal Class EA. Included herein is a comprehensive approach to identifying the presence or absence of several significant natural features afforded varying degrees of protection by applicable environmental policies. In some cases, potential or "candidate" significant

features or species have been identified based on existing information. Potential negative impacts to the identified significant natural features and regulatory considerations associated with each alignment option are provided above.

Based on the findings presented in this report, Terrastory has identified several natural features with policy significance including:

- **Identified wetlands**, primarily deciduous/thicket swamp along with a small meadow marsh.
- **Regionally Significant Woodland** and other identified forests/woodlands.
- **Confirmed Significant Wildlife Habitat** including deer wintering habitat (as determined by MNRF) and probable/possible breeding habitat for Eastern Wood-pewee.
- **Candidate Significant Wildlife Habitat** for bat maternity colonies, hibernating snakes, wintering raptors, nesting raptors, breeding amphibians, and species of conservation concern (Monarch, Yellow-banded Bumblebee, Snapping Turtle).
- **Confirmed nesting habitat for the provincially Threatened Barn Swallow** and **candidate roosting habitat for three (3) provincially and federally Endangered bats** (Little Brown Myotis, Northern Myotis, and Tri-colored Bats).
- **Confirmed fish habitat** in the Welland Canal and **potential (seasonal) fish habitat** in a watercourse flowing southward just east of 138 Barrick Road and the Seaway WWTP.

Selection of the preferred forcemain alignment will take into consideration the results of several technical studies and factors (e.g., natural heritage, hydrogeological considerations, archeology, cost, etc.). From a natural heritage perspective, all of the proposed alignments could be supported subject to appropriate mitigation (i.e., avoidance, minimization, and/or compensation if necessary) and regulatory clearance from relevant municipal, provincial, and federal agencies. The alignment option that appears to pose the least potential for natural heritage impact and regulatory considerations (other than Option #1/4 – do nothing/rehabilitation) is Option #3. This option would involve crossing the Welland Canal beneath the north island through Derek Point Memorial Park and would be associated with the least amount of wetland loss/disturbance.

It is emphasized that this study represents an overall review of natural heritage considerations in the context of the forcemain alignment options. Further study would be necessary to confirm regulatory requirements and support agency review processes at detailed design once a preferred alignment has been selected. Recommendations for further survey include:

- **Fish community survey of the watercourse:** It is unknown if the watercourse east of the Seaway WWTP (and 138 Barrick Road) contains direct (seasonal) fish habitat. All proposed alignment options (other than do nothing/rehabilitation) would require a crossing of this feature (likely through tunnelling). A fish community survey with a backpack electrofishing unit would confirm the presence/absence of fish, and by extension regulatory requirements associated with the *Fisheries Act*. The fisheries information may also support review by Regional and NPCA environmental planning staff. Fish community surveys in Ontario must be undertaken under the authority of a Licence to Collect Fish for Scientific Purposes secured from MNRF.
- **Snake emergence surveys:** All three (3) proposed alternative alignments overlap with areas identified as potentially significant snake hibernacula. These areas are dominated by large boulders and rocks which could provide snakes access below the frost line. Snake emergence

surveys undertaken in early spring (March/April/early May, weather dependent) would clarify whether the selected alignment is expected to adversely affect this SWH type. In the event that significant snake overwintering habitat is documented within the selected alignment, appropriate mitigation (e.g., seasonal restrictions on construction, feature replacement, etc.) should be considered and/or incorporated into detailed design.

- **Anuran (frog/toad) calling surveys:** All three (3) proposed alternative alignments will require some degree of wetland encroachment. While such wetlands appear to lack standing water by summer (at least within the proposed alignment locations), it is unknown if early season breeding anurans occupy such areas. Implementation of early (and mid) season anuran calling surveys would clarify whether or not this SWH type is present and may support agency review of detailed design.
- **Bat habitat assessment and (if necessary) acoustic monitoring:** Three (3) Endangered bat species (Little Brown Myotis, Northern Long-eared Myotis, Tri-colored Bat) may roost and forage within wooded portions of the Study Area. Following selection of the preferred forcemain alignment, an assessment of bat roosting habitat quality (i.e., density of snags/cavity trees) should occur through the construction corridor (and other treed areas to be disturbed). A survey to confirm the presence/absence of **raptor stick nests** (protected by the FWCA and considered SWH) can be undertaken concurrently. Further correspondence with Environmental Canada and MECP may be necessary to confirm requirements and suitability of mitigation recommendations. It is expected that a tree removal timing window would be established to avoid impacting roosting bat maternity colonies or individuals (i.e., tree removal to occur only between October 1 and April 30).
- **Tree Inventory:** ROP policies require the preparation of a Tree Saving Plan where development/disturbance is proposed within a Regionally Significant Woodland. If required, a tree inventory/health assessment could be undertaken within the selected alignment to determine the exact composition and extent of tree removals. All three (3) proposed alignments would likely be associated with removal of several hundred woodland trees along with additional woody vegetation (e.g., shrubs, seedlings/saplings) and trees outside of woodlands. If Option #2A is selected, confirmation of trees/woody vegetation removals within private properties along the south side of Barrick Road, and along the northern property boundary of the Seaway WWTP parcel, may also be beneficial.
- **Updated Surveys:** If construction of the new forcemain alignment does not occur before ~2025, updated breeding bird and vegetation surveys may be warranted to confirm presence/absence of significant species.
- **Targeted Black Ash Survey:** Black Ash is considered Threatened by both COSEWIC and COSSARO but is not yet listed as such on Schedule 1 of SARA or O. Reg. 242/08 of the provincial ESA. This species was not documented anywhere within the Study Area; however, a targeted survey along the preferred forcemain alignment at detailed design may be advised (depending on this species' regulatory status at that time).

While the recommended surveys/assessments described above are likely necessary to support a fulsome natural heritage impact assessment once a preferred alignment is selected, completion of other species-specific surveys/assessments may also be needed depending on detailed design of the selected alignment and correspondence with relevant review agencies. For example, all three (3) proposed alignment alternatives overlap with Significant Deer Wintering habitat designated by MNRF and candidate raptor wintering areas. Notwithstanding this, given that the future alignment easement will remain in natural cover (though likely mowed/maintained to eliminate woody

vegetation), potential long-term impacts to wintering deer or raptors may be negligible (the open alignment corridor may in fact assist deer movements through the Study Area under certain conditions). As such, surveys to confirm the presence/absence of significant congregations of wintering deer and raptors may not be necessary, but this should be determined during detailed design and through agency correspondence. Additional study requirements (if any) for species at risk should be confirmed with Environment Canada and MECP to address regulatory requirements under SARA and the ESA, respectively.

Once a preferred alignment has been selected and relevant review agencies have had an opportunity to comment on the undertaking, an Update/Addendum to the results of this study (i.e., through an Environmental Impact Study or equivalent) would be prudent to support detailed design. The Update/Addendum should incorporate the results of any necessary surveys/assessments (as detailed above) and be supported by a more fulsome impacts assessment incorporating mitigation to address policy and regulatory requirements.

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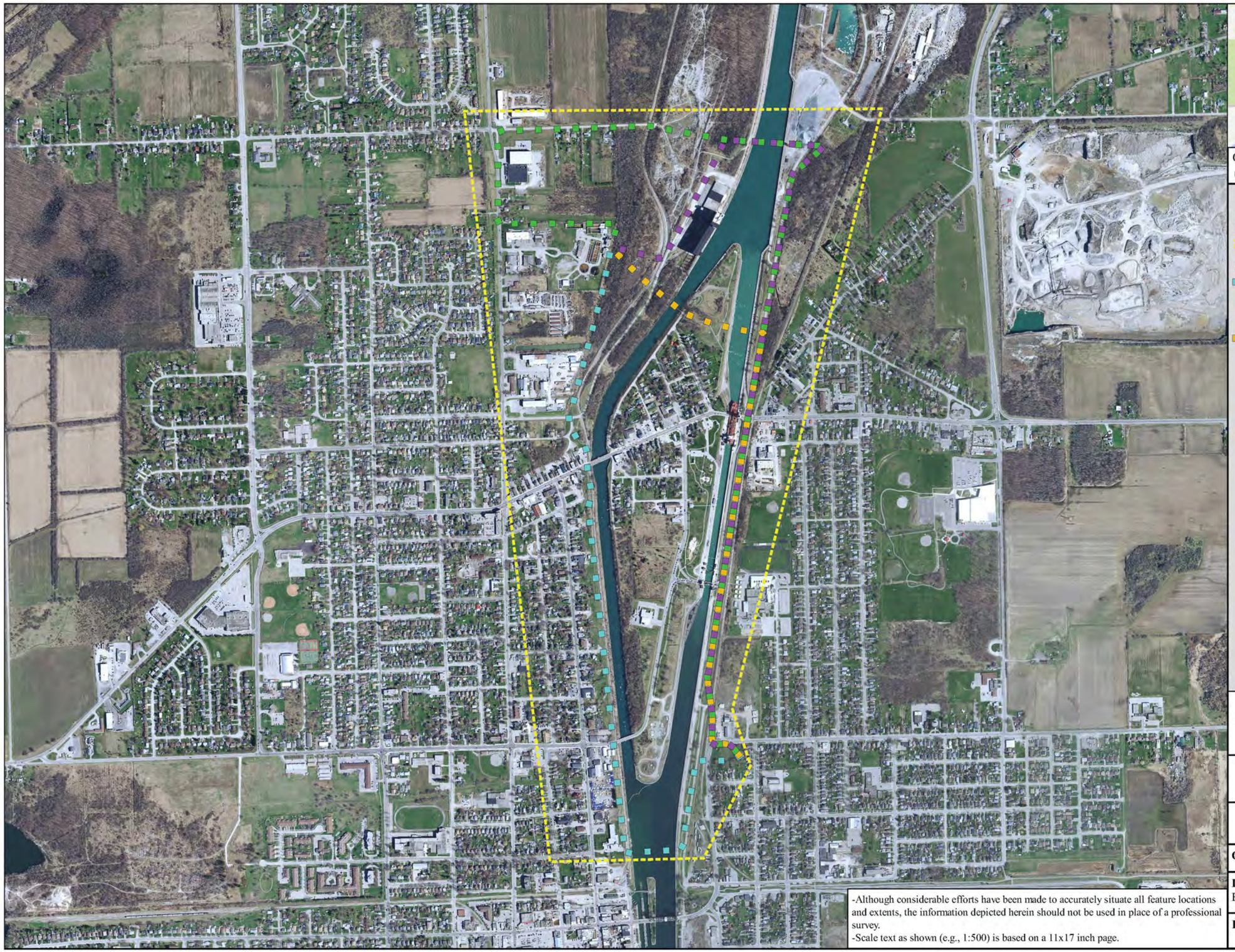
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Legend

Study Area

Primary Study Area

Forcemain Alignment Options

#1/4 - Do Nothing / Rehabilitation

#2A - Barrick Road Crossing - ROW

#2B - Barrick Road Crossing - SEAWAY

#3 - North Island Crossing

-Although considerable efforts have been made to accurately situate all feature locations and extents, the information depicted herein should not be used in place of a professional survey.
-Scale text as shown (e.g., 1:500) is based on a 11x17 inch page.

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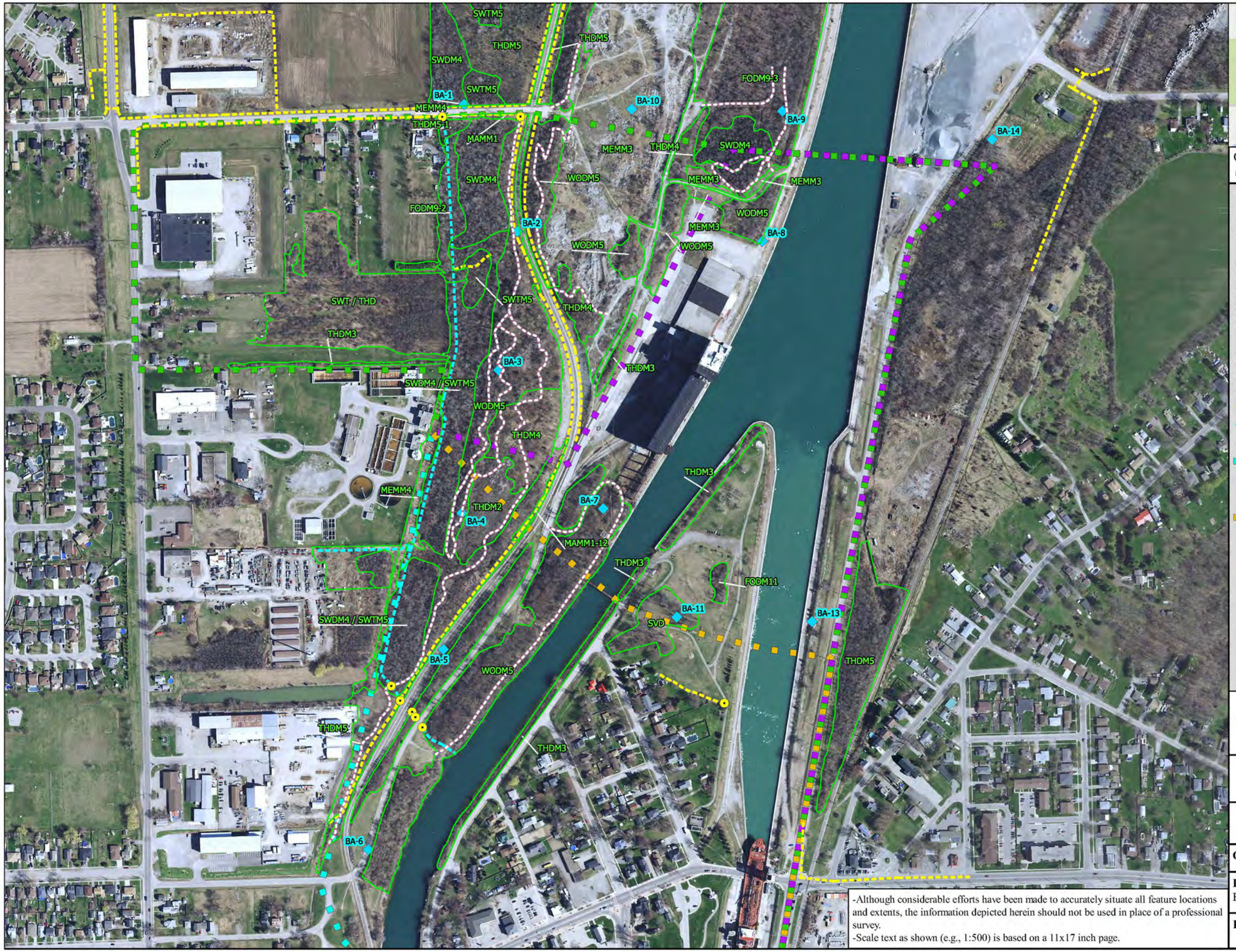
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Project No.:	By:	Date:
2007	TK	2021-07-22

Orthophotograph Date: 2015 (SWOOP).

Location: East Side SPS Forcemain Municipal Class EA, City of Port Colborne.

Figure 1. Location of the Study Area.





Legend

Built Structures and Infrastructure

- Culvert
- Nature Trail

Biophysical Conditions - Terrastory

- Vegetation Communities

Survey Stations

- Breeding Bird Survey Stations

Significant Natural Features - Agency Identified

Surface Water Drainage Features (Regional Mapping with minor updates)

- Drainage Ditch
- Watercourse

Forcemain Alignment Options

- #1/4 - Do Nothing / Rehabilitation
- #2A - Barrick Road Crossing - ROW
- #2B - Barrick Road Crossing - SEAWAY
- #3 - North Island Crossing

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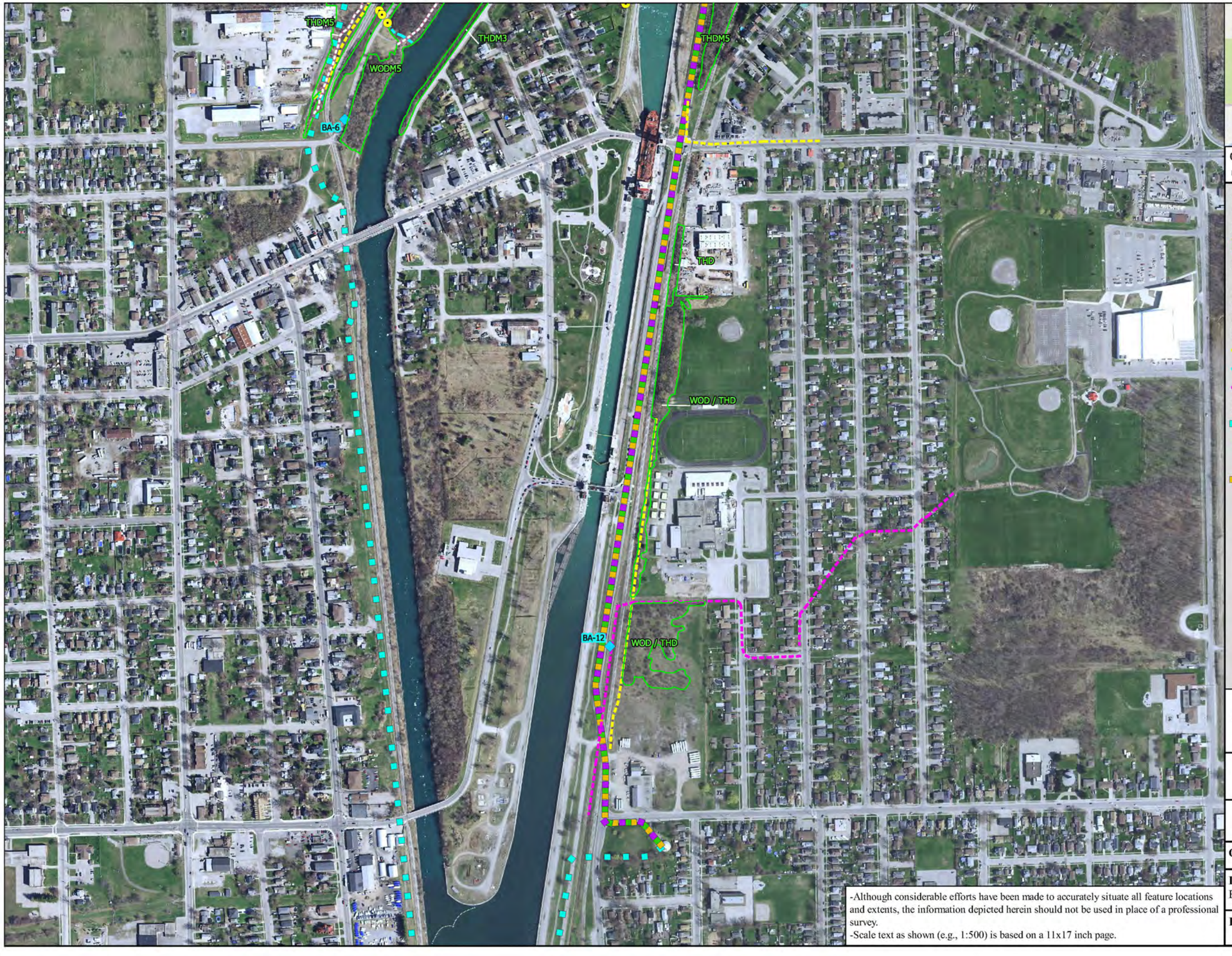
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Orthophotograph Date: 2015 (SWOOP).

Location: East Side SPS Forcemain Municipal Class EA, City of Port Colborne.

Figure 2a. Biophysical Features and Conditions.

-Although considerable efforts have been made to accurately situate all feature locations and extents, the information depicted herein should not be used in place of a professional survey.
-Scale text as shown (e.g., 1:500) is based on a 11x17 inch page.





Legend

Biophysical Conditions - Terrastory

- Vegetation Communities

Survey Stations

- Breeding Bird Survey Stations

Significant Natural Features - Agency Identified

Surface Water Drainage Features (Regional Mapping with minor updates)

- Drainage Ditch
- Watercourse
- Central Park Drain (Municipal Drain)

Forcemain Alignment Options

- #1/4 - Do Nothing / Rehabilitation
- #2A - Barrick Road Crossing - ROW
- #2B - Barrick Road Crossing - SEAWAY
- #3 - North Island Crossing

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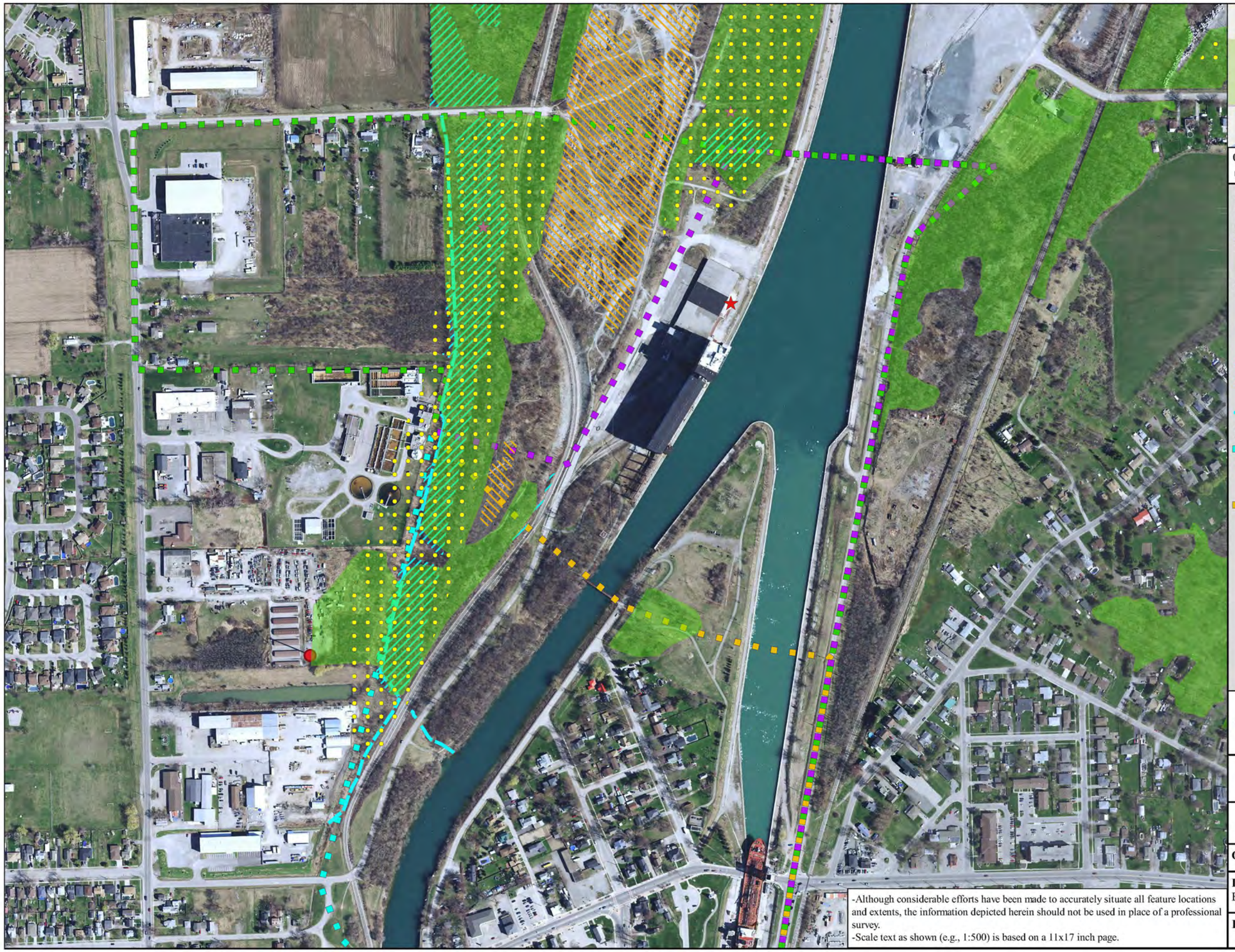
N	Project No.: 2007	By: TK	Date: 2021-07-22

Orthophotograph Date: 2015 (SWOOP).

Location: East Side SPS Forcemain Municipal Class EA, City of Port Colborne.

Figure 2b. Biophysical Features and Conditions.

-Although considerable efforts have been made to accurately situate all feature locations and extents, the information depicted herein should not be used in place of a professional survey.
-Scale text as shown (e.g., 1:500) is based on a 11x17 inch page.



Legend

Significant Natural Features - Agency Identified

- Deer Wintering Areas (Provincial Mapping)
- Woodlands (Provincial Mapping)

Significant Natural Features - Terrastory

- Presumed Barn Swallow Nesting Area
- Eastern Wood-pewee (Vocalizing Male)
- Osprey Nest (Telecommunications Tower)
- Wetland
- Higher Potential to support Significant Snake Hibernacula
- Potential Fish Habitat

Forcemain Alignment Options

- #1/4 - Do Nothing / Rehabilitation
- #2A - Barrick Road Crossing - ROW
- #2B - Barrick Road Crossing - SEAWAY
- #3 - North Island Crossing

TERRASTORY
environmental consulting inc.

1:4,750

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Project No.:	By:	Date:
2007	TK	2021-07-22

Orthophotograph Date: 2015 (SWOOP).

Location: East Side SPS Forcemain Municipal Class EA, City of Port Colborne.

Figure 3. Singnificant Natural Features.

-Although considerable efforts have been made to accurately situate all feature locations and extents, the information depicted herein should not be used in place of a professional survey.
-Scale text as shown (e.g., 1:500) is based on a 11x17 inch page.

Appendix 1. Representative Photographs



Photo 1. Seaway WWTP as seen from the existing forcemain easement looking north (15 June 2020).



Photo 2. Nature trail (13 July 2020).



Photo 3. Nature trail with scrubby regenerating vegetation (14 July 2020).



Photo 4. Canopy dieback in the deciduous swamp (27 May 2020).



Photo 5. Canopy dieback in the deciduous swamp (27 May 2020).



Photo 6. Canopy dieback in the deciduous swamp (15 June 2020).



Photo 7. Watercourse downstream of the culvert just east of 138 Barrick Road (27 May 2020).



Photo 8. Potential snake hibernaculum (27 May 2020).



Photo 9. Potential snake hibernaculum (27 May 2020).



Photo 10. Deciduous thicket (15 June 2020).



Photo 11. Probable Barn Swallow nesting location looking south (27 May 2020).



Photo 12. Northeast corner of the Study Area now used for storage by SLSMC (27 May 2020).

Appendix 2. Vascular Plant List

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Acer x freemanii	Freeman's Maple	Aceraceae	SNA	hyb	6	-5
Achillea millefolium	Common Yarrow	Asteraceae	SNA	IR	n/a	3
Aegopodium podagraria	Goutweed	Apiaceae	SNA	IR	n/a	0
Agrimonia gryposepala	Hooked Agrimony	Rosaceae	S5	C	2	3
Agrostis gigantea	Redtop	Poaceae	SNA	IR	n/a	-3
Agrostis stolonifera	Creeping Bentgrass	Poaceae	SNA	IR	n/a	-3
Ajuga reptans	Creeping Bugleweed	Lamiaceae	SNA	IR	n/a	5
Alisma triviale	Northern Water-plantain	Alismataceae	S5	X	1	-5
Alliaria petiolata	Garlic Mustard	Brassicaceae	SNA	IR	n/a	0
Allium sativum	Cultivated Garlic	Liliaceae	SNA	IR	n/a	5
Ambrosia artemisiifolia	Common Ragweed	Asteraceae	S5	C	n/a	3
Amelanchier laevis	Smooth Serviceberry	Rosaceae	S5	C	5	5
Apocynum cannabinum	Hemp Dogbane	Apocynaceae	S5	C	3	0
Arabidopsis thaliana	Mouse-ear Cress	Brassicaceae	SNA	IR	n/a	5
Arenaria serpyllifolia	Thyme-leaved Sandwort	Caryophyllaceae	SNA	IR	n/a	0
Arisaema triphyllum	Jack-in-the-pulpit	Araceae	S5	C	5	-3
Asclepias syriaca	Common Milkweed	Asclepiadaceae	S5	C	n/a	5
Avena sativa	Cultivated Oats	Poaceae	SNA	IR	n/a	5
Barbarea vulgaris	Bitter Wintercress	Brassicaceae	SNA	IR	n/a	0
Boehmeria cylindrica	False Nettle	Urticaceae	S5	C	4	-5
Bromus commutatus	Hairy Brome	Poaceae	SNA	IU	n/a	5
Bromus inermis	Smooth Brome	Poaceae	SNA	IR	n/a	5
Bromus japonicus	Japanese Brome	Poaceae	SNA	IR	n/a	3
Carex blanda	Woodland Sedge	Cyperaceae	S5	C	3	0
Carex cristatella	Crested Sedge	Cyperaceae	S5	C	3	-3
Carex gracillima	Graceful Sedge	Cyperaceae	S5	C	4	3
Carex granularis	Limestone Meadow Sedge	Cyperaceae	S5	C	3	-3
Carex hystericina	Porcupine Sedge	Cyperaceae	S5	C	5	-5
Carex tenera	Tender Sedge	Cyperaceae	S5	C	4	0
Carex tribuloides	Blunt Broom Sedge	Cyperaceae	S4	C	5	-3
Carex vulpinoidea	Fox Sedge	Cyperaceae	S5	C	3	-5
Carpinus caroliniana	Blue-beech	Betulaceae	S5	C	6	0
Catalpa speciosa	Northern Catalpa	Bignoniaceae	SNA	IR	n/a	3
Centaurea stoebe	Spotted Knapweed	Asteraceae	SNA	IR	n/a	5
Cerastium fontanum	Common Mouse-ear Chickweed	Caryophyllaceae	SNA	IR	n/a	3
Chaenorhinum minus	Dwarf Snapdragon	Scrophulariaceae	SNA	IU	n/a	5
Cicuta maculata	Spotted Water-hemlock	Apiaceae	S5	C	6	-5
Circaea canadensis	Broad-leaved Enchanter's Nightshade	Onagraceae	S5	C	2	3
Convolvulus arvensis	Field Bindweed	Convolvulaceae	SNA	IR	n/a	5
Cornus amomum	Alternate-leaved Dogwood	Cornaceae	S5	C	6	3
Cornus racemosa	Gray Dogwood	Cornaceae	S5	C	2	0
Cornus stolonifera	Red-osier Dogwood	Cornaceae	S5	C	2	-3

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Cotinus coggygria	European Smoketree	Anacardiaceae	SNA	n/a	n/a	5
Crataegus calpodendron	Pear Hawthorn	Rosaceae	S4	U	4	5
Crataegus coccinea var. *pringlei*	Pringle's Hawthorn	Rosaceae	S5	R	4	5
Crataegus crus-galli	Cockspur Hawthorn	Rosaceae	S4	C	4	0
Crataegus holmesiana	Holmes' Hawthorn	Rosaceae	S4S5	R	4	5
Dactylis glomerata	Orchard Grass	Poaceae	SNA	IR	n/a	3
Danthonia spicata	Poverty Oatgrass	Poaceae	S5	C	5	5
Daucus carota	Wild Carrot	Apiaceae	SNA	IR	n/a	5
Descurainia sophia	Flixweed	Brassicaceae	SNA	IR	n/a	5
Dianthus armeria	Deptford Pink	Caryophyllaceae	SNA	IR	n/a	5
Dipsacus fullonum	Common Teasel	Dipsacaceae	SNA	IR	n/a	3
Echium vulgare	Common Viper's Bugloss	Boraginaceae	SNA	IR	n/a	5
Elaeagnus angustifolia	Russian Olive	Elaeagnaceae	SNA	IR	n/a	3
Elaeagnus umbellata	Autumn Olive	Elaeagnaceae	SNA	IR	n/a	3
Eleocharis obtusa	Blunt Spikerush	Cyperaceae	S5	C	5	-5
Elymus repens	Creeping Wildrye	Poaceae	SNA	IR	n/a	3
Epilobium ciliatum	Northern Willowherb	Onagraceae	S5	C	3	-3
Epilobium coloratum	Purple-veined Willowherb	Onagraceae	S5	C	3	-5
Erigeron annuus	Annual Fleabane	Asteraceae	S5	C	n/a	3
Erigeron philadelphicus	Philadelphia Fleabane	Asteraceae	S5	C	1	-3
Erigeron strigosus	Rough Fleabane	Asteraceae	S5	R	4	3
Fragaria virginiana	Wild Strawberry	Rosaceae	S5	C	2	3
Fraxinus pennsylvanica	Green Ash	Oleaceae	S4	C	3	-3
Galium aparine	Cleavers	Rubiaceae	S5	C	4	3
Geum aleppicum	Yellow Avens	Rosaceae	S5	C	2	0
Geum canadense	White Avens	Rosaceae	S5	C	3	0
Geum laciniatum	Rough Avens	Rosaceae	S4	C	4	-3
Glechoma hederacea	Ground Ivy	Lamiaceae	SNA	IR	n/a	3
Glyceria striata	Fowl Mannagrass	Poaceae	S5	C	3	-5
Hemerocallis fulva	Orange Daylily	Liliaceae	SNA	IR	n/a	5
Hesperis matronalis	Dame's Rocket	Brassicaceae	SNA	IR	n/a	3
Hypericum perforatum	Common St. John's-wort	Clusiaceae	SNA	IR	n/a	5
Impatiens capensis	Spotted Jewelweed	Balsaminaceae	S5	C	4	-3
Iris pseudacorus	Yellow Iris	Iridaceae	SNA	IR	n/a	-5
Juglans nigra	Black Walnut	Juglandaceae	S4?	C	5	3
Juncus articulatus	Jointed Rush	Juncaceae	S5	U	5	-5
Juncus dudleyi	Dudley's Rush	Juncaceae	S5	C	1	-3
Juncus effusus	Soft Rush	Juncaceae	S5	C	4	-5
Juncus torreyi	Torrey's Rush	Juncaceae	S5	U	3	-3
Juniperus virginiana	Eastern Red Cedar	Cupressaceae	S5	C	4	3
Lamium purpureum	Purple Dead-nettle	Lamiaceae	SNA	IR	n/a	5
Leersia oryzoides	Rice Cutgrass	Poaceae	S5	C	3	-5

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Lepidium campestre	Field Peppergrass	Brassicaceae	SNA	IR	n/a	5
Leucanthemum vulgare	Oxeye Daisy	Asteraceae	SNA	IR	n/a	5
Ligustrum vulgare	European Privet	Oleaceae	SNA	IR	n/a	3
Linaria vulgaris	Butter-and-eggs	Scrophulariaceae	SNA	IR	n/a	5
Lithospermum officinale	European Gromwell	Boraginaceae	SNA	IR	n/a	5
Lolium pratense	Meadow Fescue	Poaceae	SNA	IR	n/a	3
Lonicera morrowii	Morrow's Honeysuckle	Caprifoliaceae	SNA	IR	n/a	3
Lonicera tatarica	Tartarian Honeysuckle	Caprifoliaceae	SNA	IR	n/a	3
Lotus corniculatus	Garden Bird's-foot Trefoil	Fabaceae	SNA	IR	n/a	3
Ludwigia palustris	Marsh Seedbox	Onagraceae	S5	C	5	-5
Lycopus americanus	American Water-horehound	Lamiaceae	S5	C	4	-5
Lysimachia ciliata	Fringed Loosestrife	Primulaceae	S5	C	4	-3
Lysimachia nummularia	Creeping Jennie	Primulaceae	SNA	IR	n/a	-3
Lysimachia punctata	Spotted Loosestrife	Primulaceae	SNA	IR	n/a	5
Medicago lupulina	Black Medic	Fabaceae	SNA	IR	n/a	3
Melilotus albus	White Sweet-clover	Fabaceae	SNA	IR	n/a	3
Melilotus officinalis	Yellow Sweet-clover	Fabaceae	SNA	IR	n/a	3
Morus alba	White Mulberry	Moraceae	SNA	IR	n/a	0
Myosotis scorpioides	True Forget-me-not	Boraginaceae	SNA	IR	n/a	-5
Oenothera biennis	Common Evening Primrose	Onagraceae	S5	C	n/a	3
Oxalis dillenii	Slender Yellow Wood-sorrel	Oxalidaceae	S5?	C	n/a	3
Parthenocissus vitacea	Thicket Creeper	Vitaceae	S5	C	4	3
Pastinaca sativa	Wild Parsnip	Apiaceae	SNA	IR	n/a	5
Persicaria virginiana	Virginia Smartweed	Polygonaceae	S4	C	6	0
Phalaris arundinacea	Reed Canary Grass	Poaceae	S5	C	n/a	-3
Phedimus kamtschaticus	Hybrid Stonecrop	Crassulaceae	SNA	n/a	n/a	0
Phragmites australis ssp. australis	European Reed	Poaceae	SNA	IR	n/a	-3
Picris hieracioides	Hawkweed Oxtongue	Asteraceae	SNA	IU	n/a	5
Plantago lanceolata	English Plantain	Plantaginaceae	SNA	IR	n/a	3
Plantago major	Common Plantain	Plantaginaceae	SNA	IR	n/a	3
Plantago rugelii	Rugel's Plantain	Plantaginaceae	S5	C	1	0
Poa palustris	Fowl Bluegrass	Poaceae	S5	C	5	-3
Poa pratensis subsp. pratensis	Kentucky Bluegrass	Poaceae	SNA	IR	n/a	3
Populus deltoides	Eastern Cottonwood	Salicaceae	S5	C	4	0
Populus tremuloides	Trembling Aspen	Salicaceae	S5	C	2	0
Potentilla norvegica	Norwegian Cinquefoil	Rosaceae	S5	C	n/a	0
Prunella vulgaris	Heal-all	Lamiaceae	S5	C	n/a	0
Prunus avium	Sweet Cherry	Rosaceae	SNA	IR	n/a	5
Prunus serotina	Black Cherry	Rosaceae	S5	C	3	3
Prunus virginiana	Choke Cherry	Rosaceae	S5	C	2	3
Pyrus communis	Common Pear	Rosaceae	SNA	IR	n/a	5
Quercus macrocarpa	Bur Oak	Fagaceae	S5	U	5	3

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Quercus palustris	Pin Oak	Fagaceae	S4	C	9	-3
Ranunculus acris	Tall Buttercup	Ranunculaceae	SNA	IR	n/a	0
Reynoutria japonica var. japonica	Japanese Knotweed	Polygonaceae	SNA	IU	n/a	3
Rhamnus cathartica	Common Buckthorn	Rhamnaceae	SNA	IR	n/a	0
Ribes americanum	Wild Black Currant	Grossulariaceae	S5	C	4	-3
Ribes cynosbati	Prickly Gooseberry	Grossulariaceae	S5	C	4	3
Rosa canina	Dog Rose	Rosaceae	SNA	IR	n/a	5
Rosa multiflora	Multiflora Rose	Rosaceae	SNA	IR	n/a	3
Rubus idaeus subsp. strigosus	Wild Red Raspberry	Rosaceae	S5	C	2	3
Rubus occidentalis	Black Raspberry	Rosaceae	S5	C	2	5
Rubus odoratus	Purple-flowering Raspberry	Rosaceae	S5	C	3	5
Rudbeckia laciniata	Cut-leaved Coneflower	Asteraceae	S5	C	7	-3
Rumex crispus	Curly Dock	Polygonaceae	SNA	IR	n/a	0
Sagittaria latifolia	Broad-leaved Arrowhead	Alismataceae	S5	C	4	-5
Salix atrocinerea	Rusty Willow	Salicaceae	SNA	IR	n/a	-3
Scirpus atrovirens	Dark-green Bulrush	Cyperaceae	S5	C	3	-5
Scirpus cyperinus	Cottongrass Bulrush	Cyperaceae	S5	C	4	-5
Sisyrinchium montanum	Strict Blue-eyed-grass	Iridaceae	S5	C	4	0
Solidago juncea	Early Goldenrod	Asteraceae	S5	C	3	5
Solidago nemoralis subsp. nemoralis	Gray-stemmed Goldenrod	Asteraceae	S5	C	2	5
Sonchus arvensis subsp. arvensis	Smooth Sow-thistle	Asteraceae	SNA	IR	n/a	3
Sphenopholis intermedia	Slender Wedge Grass	Poaceae	S4S5	C	6	0
Symphyotrichum lanceolatum	Panicled Aster	Asteraceae	S5	C	3	-3
Symphyotrichum novae-angliae	New England Aster	Asteraceae	S5	C	2	-3
Syringa vulgaris	Common Lilac	Oleaceae	SNA	IR	n/a	5
Taraxacum officinale	Common Dandelion	Asteraceae	SNA	IR	n/a	3
Tilia cordata	Little-leaf Linden	Tiliaceae	SNA	IR	n/a	5
Toxicodendron radicans	Poison Ivy	Anacardiaceae	S5	C	2	0
Trifolium hybridum	Alsike Clover	Fabaceae	SNA	IR	n/a	3
Trifolium pratense	Red Clover	Fabaceae	SNA	IR	n/a	3
Trifolium repens	White Clover	Fabaceae	SNA	IR	n/a	3
Typha angustifolia	Narrow-leaved Cattail	Typhaceae	SNA	IR	n/a	-5
Ulmus americana	American Elm	Ulmaceae	S5	C	3	-3
Ulmus pumila	Siberian Elm	Ulmaceae	SNA	IR	n/a	3
Verbascum blattaria	Moth Mullein	Scrophulariaceae	SNA	IU	n/a	3
Verbascum thapsus	Common Mullein	Scrophulariaceae	SNA	IR	n/a	5
Verbena hastata	Blue Vervain	Verbenaceae	S5	C	4	-3
Veronica arvensis	Corn Speedwell	Scrophulariaceae	SNA	IR	n/a	5
Veronica officinalis	Common Speedwell	Scrophulariaceae	SNA	IR	n/a	5
Veronica serpyllifolia subsp. serpyllifolia	Thyme-leaved Speedwell	Scrophulariaceae	SNA	IR	n/a	0
Viburnum lantana	Wayfaring-tree	Caprifoliaceae	SNA	IR	n/a	5
Viburnum opulus ssp. trilobum	Highbush Cranberry	Caprifoliaceae	S5	C	5	-3

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Vicia cracca	Tufted Vetch	Fabaceae	SNA	IR	n/a	5
Viola sororia	Woolly Blue Violet	Violaceae	S5	C	4	0
Vitis riparia	Riverbank Grape	Vitaceae	S5	C	n/a	0
Yucca flaccida	Weak-leaved Yucca	Agavaceae	SNA	IR	n/a	5
Zanthoxylum americanum	Common Prickly-ash	Rutaceae	S5	C	3	3

Appendix 3. Breeding Bird Surveys

1 BREEDING BIRD SURVEY METHODOLOGY

Two (2) rounds of breeding bird surveys were conducted in accordance with the Ontario Breeding Bird Atlas (OBBA) protocol (Bird Studies Canada et al. 2001). Surveys occurred within the appropriate season (May 24–July 10), time of day (between dawn and 5 hours after dawn), and weather conditions (no rain, wind speed ≤3 on the Beaufort Wind Scale). The two (2) rounds of surveys occurred at least (10) days apart to augment the determination of breeding status. Each station was surveyed for a minimum duration of ten (10) minutes.

A total of fourteen (14) survey stations were established and situated systematically to cover the variety of bird habitats on-site, particularly habitats with a high potential to support significant bird species and those that occur within or adjacent to potential areas of disturbance. The stations were generally situated at a distance that minimized the potential for double counting individuals (i.e., ~300 metres), but were established somewhat closer where warranted (i.e., to ensure a particular habitat was sufficiently surveyed, where noise pollution predominates, etc.). Birds were also recorded on transit between stations and incidentally outside of the main breeding bird survey period. The locations of all point count stations and significant bird species were recorded in the field with a high-accuracy GPS (Mesa II).

Signs of breeding activity accompanied each bird record (e.g., singing male, probable pair, agitation, carrying nest material, etc.). The OBBA provides four (4) breeding categories to accompany each observation:

Observed: Species observed during its breeding season (no evidence of breeding).

Possible Breeding: Includes any of the following observation types: 1) species observed in its breeding season in suitable nesting habitat, and 2) singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat.

Probable Breeding: Includes any of the following observation types: 1) pair observed in their breeding season in suitable nesting habitat, 2) permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart, at the same place, 3) courtship or display between a male and a female or 2 males, including courtship feeding or copulation, 4) visiting probable nest site, 5) agitated behaviour or anxiety calls of an adult, 6) brood patch on adult female or cloacal protuberance on adult male, and 7) nest-building or excavation of nest hole.

Confirmed Breeding: Includes any of the following observation types: 1) distraction display or injury feigning, 2) used nest or egg shell found (occupied or laid within the period of the study), 3) recently fledged young or downy young, including young incapable of sustained flight, 4) adults leaving or entering nest site in circumstances indicating occupied nest, 5) adult carrying fecal sac, 6) adult carrying food for young, 7) nest containing eggs, and 8) nest with young seen or heard.

2 RESULTS

Table 1 . Results of Breeding Bird Surveys.

Common Name	Scientific Name	Breeding Bird Stations[1] and Breeding Status[2]													
		BI-1	BI-2	BI-3	BI-4	BI-5	BI-6	BI-7	BI-8	BI-9	BI-10	BI-11	BI-12	BI-13	BI-14
American Crow	*Corvus brachyrhynchos*			Po		Po				Po					
American Goldfinch	*Spinus tristis*	Pr	Po	Pr	Po	Pr	Pr	Po	Pr	Po	Pr	Po	Po	Po	Po
American Kestrel	*Falco sparverius*			Po					Po						
American Robin	*Turdus migratorius*	Po		Pr	Pr	Pr	Pr	Pr		Pr	Po	Co	Po	Pr	Po
Baltimore Oriole	*Icterus galbula*					Po		Po				Pr	Po	Po	Po
Bank Swallow	***Riparia riparia***									**O**					
Barn Swallow	***Hirundo rustica***						**Po**	**Po**	**Co**				**Po**	**Po**	**Po**
Black-capped Chickadee	*Poecile atricapillus*		Po	Po			Po	Pr	Po	Po					
Blue Jay	*Cyanocitta cristata*	Po	Po			Po	Po	Po		Po		Po			
Brown-headed Cowbird	*Molothrus ater*	Pr	Pr	Po		Pr	Po		Po					Po	Po
Canada Goose	*Branta canadensis*							Po							
Carolina Wren	*Thryothorus ludovicianus*	Po	Pr	Pr	Po	Po	Po								Po
Cedar Waxwing	*Bombycilla cedrorum*	Po		Po				Pr			Po	Po			
Chipping Sparrow	*Spizella passerina*	Po									Po	Po			
Cliff Swallow	*Petrochelidon pyrrhonota*								Co						
Common Grackle	*Quiscalus quiscula*	Po			Po			Po					Pr		
Common Raven	*Corvus corax*							Co							
Common Yellowthroat	*Geothlypis trichas*			Pr	Po										
Double-crested Cormorant	*Phalacrocorax auritus*	O							O			O		O	O
Downy Woodpecker	*Dryobates pubescens*	Po									Po				
Eastern Phoebe	*Sayornis phoebe*		Po									Po			
Eastern Wood-pewee	***Contopus virens***		**Pr**							**Po**					
European Starling	*Sturnus vulgaris*	Pr		Po				Po	Pr		Po	Pr	Po	Pr	
Field Sparrow	*Spizella pusilla*			Pr	Po						Pr				
Gray Catbird	*Dumetella carolinensis*	Pr	Po	Pr	Pr	Pr	Po	Pr	Po	Po		Pr	Po		
Great Blue Heron	*Ardea herodias*								O						
Great Crested Flycatcher	*Myrarchus crinitus*	Po	Pr								Po				
Herring Gull	*Larus argentatus*								O					O	
House Finch	*Haemorhous mexicanus*													Po	
House Sparrow	*Passer domesticus*								Po			Po			
House Wren	*Troglodytes aedon*	Po		Po	Po	Pr	Pr	Pr	Po			Po		Po	Po
Indigo Bunting	*Passerina cyanea*			Pr	Po					Po	Po				

Common Name	Scientific Name	Breeding Bird Stations[1] and Breeding Status[2]													
		BI-1	BI-2	BI-3	BI-4	BI-5	BI-6	BI-7	BI-8	BI-9	BI-10	BI-11	BI-12	BI-13	BI-14
Killdeer	*Charadrius vociferus*					Po									
Mourning Dove	*Zenaida macroura*							Po							
Northern Cardinal	*Cardinalis cardinalis*	Po	Po	Pr		Po	Po			Po	Pr	Po	Pr	Pr	Pr
Northern Flicker	*Colaptes auratus*	Pr			Po									Po	
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*			Po				Po				Po	Po		Po
Osprey	*Pandion haliaetus*				Co		O							O	
Red-bellied Woodpecker	*Melanerpes carolinus*			Po											
Red-eyed Vireo	*Vireo olivaceus*	Po	Pr					Po		Pr					
Red-winged Blackbird	*Agelaius phoeniceus*	Pr	Po	Pr	Po	Po	Po		Po		Po	Po	Pr	Pr	Pr
Ring-billed Gull	*Larus delawarensis*	O	O		O	O		O	O			O	O	O	O
Rock Pigeon	*Columba livia*								Po						
Song Sparrow	*Melospiza melodia*	Pr	Po			Po	Pr	Pr	Po		Po	Po	Po	Po	Pr
Turkey Vulture	*Cathartes aura*														O
Warbling Vireo	*Vireo gilvus*						Po	Pr				Pr	Pr	Po	
White-breasted Nuthatch	*Sitta carolinensis*		Po												
Yellow Warbler	*Setophaga petechia*			Pr	Po	Po					Po	Po	Pr	Pr	Po

[1] Locations of breeding bird survey stations are indicated on **Figure 2**.

[2] **Co** = Confirmed Breeder; **Pr** = Probable Breeder; **Po** = Possible Breeder; **O** = Observed (no evidence of breeding). Breeding status determined based on the results of the formal breeding bird surveys.

APPENDIX C: STAGE 1 AND STAGE 2 ARCHAEOLOGICAL REPORTS (PREPARED BY GOLDER ASSOCIATES)

ORIGINAL REPORT

Stage 1 Archaeological Assessment

Eastside Sewage Pumping Station Forcemain Replacement, Various Lots and Concessions, Geographic Township of Humberstone, former County of Welland, City of Port Colborne, Regional Municipality of Niagara, Ontario

Submitted to:

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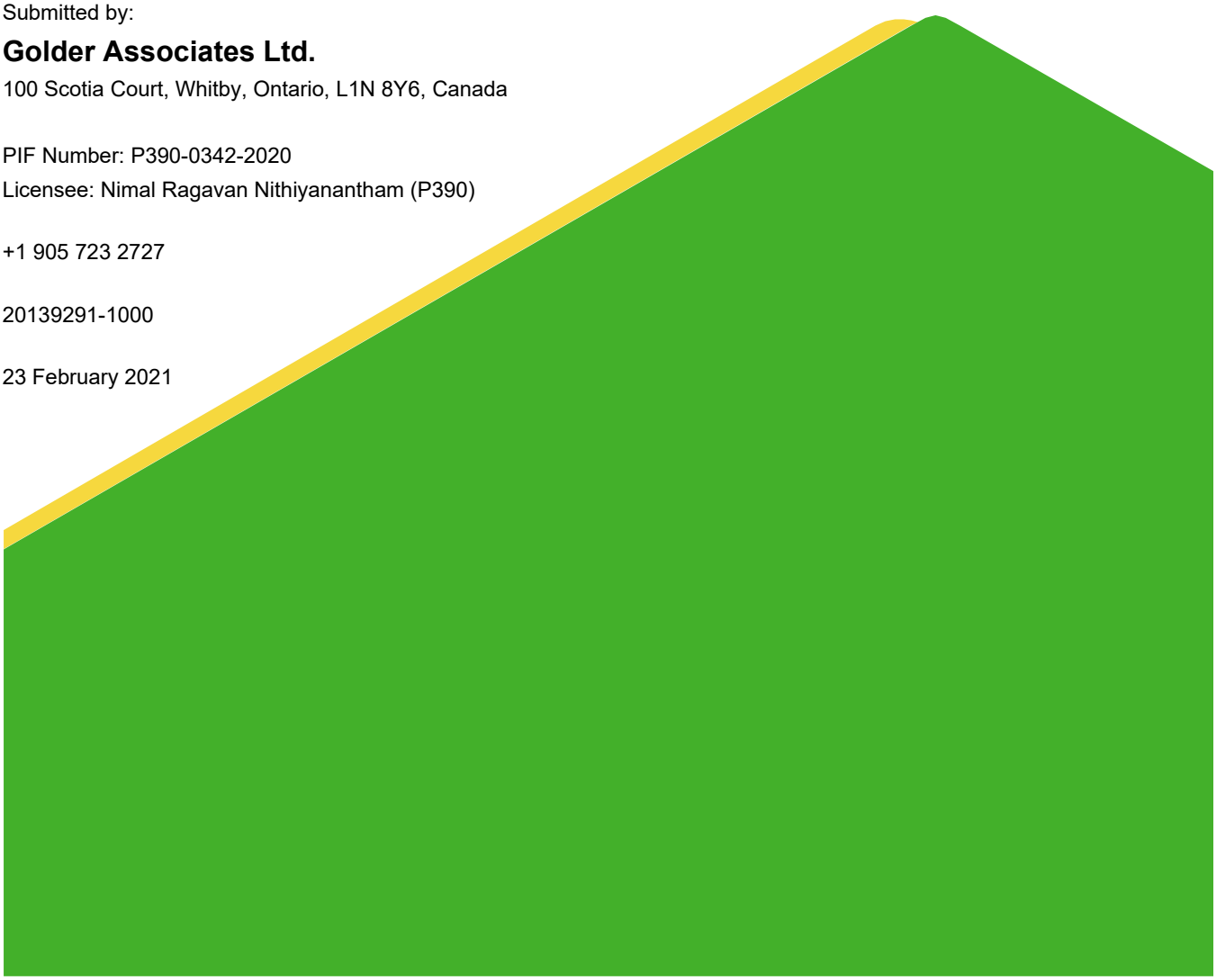
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23 February 2021



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Executive Summary

The Executive Summary highlights key points from the report only, for complete information and findings as well as limitations, the reader should examine the complete report.

Golder Associates Ltd. (Golder) was retained by Niagara Region to conduct a Stage 1 archaeological assessment in support the Municipal Class Environmental Assessment (MCEA) Study to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain in the City of Port Colborne (the Study). The Study will evaluate four alternative routes generally bound by Barrick Road on the north, Highway 140/Elizabeth Street on the east, Lakeshore Road East and Kent Street on the south, and Fielden Avenue on the west.

The four alternative route options are:

- **Alternative Route 1 (Do Northing**) **/ Alternative Route 4 (Rehabilitation**): both routes are aligned with the existing forcemain route extending west from the Eastside SPS (53 Killaly Street East) to Fraser Street, south along Fraser Street, crossing the Welland Canal north of Clarence Street. The forcemain extends north along the west side of the canal to the Seaway Wastewater Treatment Plant, located at 30 Prosperity Avenue.
- **Alternative Route 2A (Barrick Road Crossing – ROW):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the canal north of The Island to Barrick Road, east to Elm Street, south to 975 Elm Street and 59 Prosperity Avenue, and east to the Seaway Wastewater Treatment Plant.
- **Alternative Route 2B (Barrick Road Crossing – SEAWAY):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the canal north of The Island to Barrick Road, southwest through 2 Sherwood Forest Lane, and west to the Seaway Wastewater Treatment Plant.
- **Alternative Route 3 (North Island Crossing):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the northern tip of The Island north of Main Street East/West, and northwest to the Seaway Wastewater Treatment Plant.

For the purposes of this Stage 1 archaeological assessment, a 30 m wide buffer will be assessed for each alternative route. Collectively, the alternative routes will be referred to as the “project area”. The project area is located within Lots 27 and 28, Concession 1; Lots 26 to 28, Concession 2; and Lots 27 and 28, Concession 3, in the Geographic Township of Humberstone, former County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

Background research determined the project area to have the archaeological potential for the recovery of both pre-contact and post-contact archaeological resources. This determination was based on the proximity of previously registered archaeological sites, historical settlements, historical transportation routes, designated and listed cultural heritage properties, as well as soil texture.

A review of previous archaeological investigations of the project area determined that between 2013 and 2016 several archaeological assessments have been undertaken adjacent to and within the project area. All these

assessments have resulted in their respective areas being cleared by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) of further archaeological concern.

A negative indicator of archaeological potential is extensive below-grade land disturbance. This includes widespread earth movement activities that would have removed or relocated any archaeological resources to such a degree that their information potential and cultural heritage value or interest has been lost. Based on 20th century mapping and property inspection, much of the project area exhibits evidence of extensive below-grade land disturbances as a results of infrastructure development, underground utilities, and grading activities; these areas can be described as having no archaeological potential

Based on the findings presented in this report, the following recommendations are presented:

1. If Alternative Route 1 (Do Nothing) is selected as the preferred route:
    a. No further archaeological investigations are warranted as this route option will not involve any impacts.
2. If Alternative Routes 2A, 2B, 3 or 4 are selected as the preferred route:
    a. Parts of the route that are described as retaining archaeological potential, as shown in Map 8, are recommended to be subjected to a Stage 2 archaeological assessment. It is recommended these areas be subjected to test pit survey at 5 m intervals per Section 2.1.2 of the MHSTCI (2011).
    b. Parts of the route that are described as having no archaeological potential, as shown in Map 8, are recommended to be considered free from further archaeological investigations per Section 2.1, Standard 2.b. of the MHSTCI (2011).
    c. Parts of the route that are described as previously assessed and recommend no further archaeological assessment, as shown in Map 8, are recommended to be considered free from further archaeological investigations.

The MHSTCI is requested to review, and provide a letter indicating their satisfaction with the results and recommendations presented herein, with regard to the 2011 *Standards and Guidelines for Consultant Archaeologists* and the terms and conditions for archaeological licences, and to enter this report into the Ontario Public Register of Archaeological Reports.

Study Limitations

Golder has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the archaeological profession currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty expressed or implied is made.

This report has been prepared for the specific site, design objective, developments, and purpose described to Golder by Niagara Region (the Client). The factual data, interpretations, and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location.

The information, recommendations, and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the Client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings, and other documents as well as electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

Unless otherwise stated, the suggestions, recommendations, and opinions given in this report are intended only for the guidance of the Client in the design of the specific project.

Special risks occur whenever archaeological investigations are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain archaeological resources. The sampling strategies incorporated in this study, if any, comply with those identified in the Ministry of Tourism, Culture and Sport's 2011 *Standards and Guidelines for Consultant Archaeologists*.

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Acknowledgements

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APPENDICES

APPENDIX A
Cultural Heritage Resources

1.0 PROJECT CONTEXT

1.1 Development Context

Golder Associates Ltd. (Golder) was retained by Niagara Region to conduct a Stage 1 archaeological assessment in support the Municipal Class Environmental Assessment (MCEA) Study to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain in the City of Port Colborne (the Study). The Study will evaluate four alternative routes generally bound Barrick Road on the north, Highway 140/Elizabeth Street on the east, Lakeshore Road East and Kent Street on the south and Fielden Avenue on the west (Map 1).

The four alternative route options are:

- **Alternative Route 1 (Do Northing) / Alternative Route 4 (Rehabilitation)**: both routes are aligned with the existing forcemain route extending west from the Eastside SPS (53 Killaly Street East) to Fraser Street, south along Fraser Street, crossing the Welland Canal north of Clarence Street. The forcemain extends north along the west side of the canal to the Seaway Wastewater Treatment Plant, located at 30 Prosperity Avenue.
- **Alternative Route 2A (Barrick Road Crossing – ROW):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the canal north of The Island to Barrick Road, east to Elm Street, south to 975 Elm Street and 59 Prosperity Avenue, and east to the Seaway Wastewater Treatment Plant.
- **Alternative Route 2B (Barrick Road Crossing – SEAWAY):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the canal north of The Island to Barrick Road, southwest through 2 Sherwood Forest Lane, and west to the Seaway Wastewater Treatment Plant.
- **Alternative Route 3 (North Island Crossing):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the northern tip of The Island north of Main Street East/West, and northwest to the Seaway Wastewater Treatment Plant.

For the purposes of this Stage 1 archaeological assessment, a 30 m wide buffer will be assessed for each alternative route. Collectively, the alternative routes will be referred to as the “project area”. The project area is located within Lots 27 and 28, Concession 1; Lots 26 to 28, Concession 2; and Lots 27 and 28, Concession 3, in the Geographic Township of Humberstone, former County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

The Stage 1 archaeological assessment was conducted under professional archaeological consultant licensee, Nimal Ragavan Nithiyanantham (P390). Permission to investigation the project area was provided by Niagara Region.

1.2 Objectives

The objectives of a Stage 1 archaeological assessment, as outlined by the 2011 *Standards and Guidelines for Consultant Archaeologists* published by the *Ministry of Heritage, Sport, Tourism and Cultural Industries* (MHSTC1) (2011), are as follows:

- To provide information about the project area’s geography, geology, history, previous archaeological fieldwork and current land condition.

- To evaluate in detail the project area's archaeological potential, which will support recommendations for Stage 2 survey for all or parts of the project area.
- To recommend appropriate strategies for Stage 2 archaeological survey.

1.3 Historical Context

1.3.1 Pre-Contact Indigenous Period

The general culture and tool tradition history of the Indigenous pre-contact period of southern Ontario is summarised briefly in Table 1 and is based largely on Ellis and Ferris (1990).

Table 1: Overview of Pre-Contact Cultural Chronology of Southern Ontario

Period		Time Period	Characteristics
Paleo	Early	10,950 – 10,350 BP	Gainey, Barnes and Crowfield traditions; small bands; mobile hunters and gatherers; utilization of seasonal resources and large territories; fluted projectiles
	Late	10,350 – 9,950 BP	Holcombe, Hi-Lo and Lanceolate biface traditions; continuing mobility; campsite/way-station sites; smaller territories are utilized; non-fluted projectiles
Archaic	Early	9,950 – 7,950 BP	Side-notched, Corner-notched (Nettling, Thebes) and Bifurcate Base traditions; growing diversity of stone tool types; heavy woodworking tools appear (e.g., ground stone axes and chisels)
	Middle	7,950 – 4,450 BP	Stemmed (Kirk, Stanly/Neville), Brewerton side- and corner-notched traditions; reliance on local resources; populations increasing; more ritual activities; fully ground and polished tools; net-sinkers common; earliest copper tools
	Late	4,450 – 2,900 BP	Narrow Point (Lamoka), Broad Point (Genesee) and Small Point (Crawford Knoll) traditions; less mobility; use of fish-weirs; formal cemeteries appear; stone pipes emerge; long-distance trade (marine shells and galena)
Woodland	Early	2,900 – 2,350 BP	Meadowood tradition; cord-roughened ceramics emerge; Meadowood cache blades

Period		Time Period	Characteristics
			and side-notched points; bands of up to 35 people
	Middle	2,350 – 1,400 BP	Saugeen tradition; stamped ceramics appear; Saugeen projectile points; cobble spall scrapers; Seasonal settlements and resource utilization; post holes, hearths, middens, cemeteries and rectangular structures identified
	Transitional	1,400 – 1,050 BP	Princess Point tradition; cord roughening, impressed lines, and punctate designs on pottery; adoption of maize horticulture at the western end of Lake Ontario; oval houses and 'incipient' longhouses; first palisades; villages with up to 75 people
	Late	1,050 – 650 BP	Early – Glen Meyer tradition; settled village-life based on agriculture; small villages (0.4 ha) with 75–200 people and 4–5 longhouses; semi-permanent settlements
		650 – 550 BP	Middle – Uren and Middleport traditions; classic longhouses emerge; larger villages (1.2 ha) with up to 600 people; more permanent settlements (30 years)
		550 – 350 BP	Late – Larger villages (1.7 ha); examples up to 5 ha with 2,500 people; extensive croplands; also hamlets, cabins, camps and cemeteries; potential tribal units; fur trade begins ca. 1580; European trade goods appear

1.3.1.1 Paleo Period

Occupation of southern Ontario became possible just after the end of the Wisconsin Glacial Period. Although there were a complex series of ice retreats and advances which played a large role in shaping the local topography, south-central Ontario was finally ice free by 12,500 years ago. The first human settlement can be traced back 11,000 years, when this area was settled by Indigenous groups that had been living south of the Great Lakes. The period of these early Indigenous inhabitants is known as the Paleo Period (Ellis and Deller 1990). The Paleo period marks the beginning of human settlement in southern Ontario. It is characterized by small bands of nomadic hunter-gatherers who largely depended on the communal hunting of big game such as

caribou, and possible mammoth and/or mastodon. This early period of occupation is divided into early and late phases, which span from ca. 10,950 – 9,950 BP (Ellis and Deller 1990) and from ca. 10,350 -9,950 BP (Jackson 2004), respectively.

Our current understanding of settlement patterns of Early Paleo peoples suggests that small bands, consisting of probably no more than 25 to 35 individuals, followed a pattern of seasonal mobility extending over large territories (Ellis and Deller 1990). Early Paleo sites tend to be located in elevated locations on well-drained loamy soils. Many of the known sites were located on former beach ridges associated with glacial lakes. There are a few extremely large Early Paleo sites, such as one located close to Parkhill, Ontario, which covered as much as six hectares. It appears that these sites were formed when the same general locations were occupied for short periods of time over the course of many years. Given their placement in locations conducive to the interception of migratory mammals such as caribou, it has been suggested that they may represent communal hunting camps. There are also smaller Early Paleo camps scattered throughout the interior of southwestern and south-central Ontario, usually situated adjacent to wetlands.

The most recent research suggests that population densities were very low during the Early Paleo Period (Ellis and Deller 1990:54). Archaeological examples of Early Paleo sites are rare.

The Late Paleo Period (10,350 – 9,950 BP) has been less researched and is consequently more poorly understood. By this time, the environment of south-central Ontario was coming to be dominated by closed coniferous forests with some minor deciduous elements. It seems that many of the large game species that had been hunted in the early part of the Paleo Period had either moved further north, or as in the case of the mastodons and mammoths, become extinct.

Like the early Paleo peoples, late Paleo-peoples covered large territories as they moved about in response to seasonal resource fluctuations. On a province-wide basis, Late Paleo projectile points are far more common than Early Paleo materials, suggesting a relative increase in population.

The end of the Late Paleo Period was heralded by numerous technological and cultural innovations that appeared throughout the Archaic Period. These innovations may be best explained in relation to the dynamic nature of the post-glacial environment and region-wide population increases.

1.3.1.2 Archaic Period

During the Early Archaic Period (9, 950 – 7,950 BP) (8000 – 6000 B.C.), the jack and red pine forests that characterized the Late Paleo environment were replaced by forests dominated by white pine with some associated deciduous trees (Ellis et al. 1990:68-69). One of the more notable changes in the Early Archaic Period is the appearance of side and corner-notched projectile points. Other significant innovations include the introduction of ground stone tools such as celts and axes, suggesting the beginnings of a simple woodworking industry. The presence of these often large and not easily portable tools suggests there may have been some reduction in the degree of seasonal movement, although it is still suspected that population densities were quite low, and band territories large.

During the Middle Archaic Period (7,950 – 4,450 BP) (6000 – 2500 B.C.) the trend to more diverse toolkits continued, as the presence of netsinkers suggest that fishing was becoming an important aspect of the subsistence economy. It was also at this time that "bannerstones" were first manufactured.

Bannerstones are carefully crafted ground stone devices that served as a counterbalance for atlatls or spear throwers. Another characteristic of the Middle Archaic Period is an increased reliance on local, often poorer

quality, chert resources for the manufacturing of projectile points and other stone tools. It seems that during earlier periods, when groups occupied large territories, it was possible for them to visit a primary outcrop of high-quality chert at least once during their seasonal round. However, during the Middle Archaic Period, groups inhabited smaller territories that often did not encompass a source of high-quality raw material. In these instances, lower quality materials which had been deposited by the glaciers in the local till and river gravels were utilized.

This reduction in territory size was probably the result of gradual region-wide population growth which led to the infilling of the landscape. This process forced a reorganization of Indigenous subsistence practices, as more people had to be supported from the resources of a smaller area. During the latter part of the Middle Archaic Period, technological innovations such as fish weirs have been documented as well as stone tools especially designed for the preparation of wild plant foods.

It is also during the latter part of the Middle Archaic Period that long distance trade routes began to develop, spanning the northeastern part of the continent. In particular, native copper tools manufactured from a source located northwest of Lake Superior were being widely traded (Ellis et al. 1990:66). By 3500 B.C. the local environment had stabilized and began to reflect the more modern landscape (Ellis et al. 1990:69).

During the Late Archaic Period (4,450 – 2,900 BP) (2500 – 950 B.C.) the trend towards decreased territory size and a broadening subsistence strategy continued. Late Archaic sites are far more numerous than either Early or Middle Archaic sites, and it seems that the local population had expanded. It is during the Late Archaic Period that more formal cemeteries appear. Before this time individuals were interred close to the location where they died. During the Late Archaic Period, if an individual died while his or her group happened to be at some distance from their group cemetery, the bones would be kept until they could be placed in the cemetery. Consequently, it is not unusual to find disarticulated skeletons, or even skeletons lacking minor elements such as fingers, toes, or ribs, in Late Archaic burial pits.

The appearance of cemeteries during the Late Archaic Period has been interpreted as a response to increased population densities and competition between local groups for access to resources. It is argued that cemeteries would have provided strong symbolic claims over a local territory and its resources. These cemeteries are often located on heights of well-drained sandy/gravel soils adjacent to major watercourses.

This suggestion of increased territoriality is also consistent with the regionalized variation present in Late Archaic Period projectile point styles. It was during the Late Archaic Period that distinct local styles of projectile points appear. Also, it was during the Late Archaic Period that trade networks which had been established during the Middle Archaic Period continued to flourish. Native copper from northern Ontario and marine shell artifacts from as far away as the Mid-Atlantic coast are frequently encountered as grave goods at Southern Ontario sites. Other artifacts such as polished stone pipes and banded slate gorgets also appear on Late Archaic sites in Southern Ontario. One of the more unusual and interesting of the Late Archaic Period artifacts is the birdstone, which are small, bird-like effigies usually manufactured from green banded slate.

1.3.1.3 Woodland Period

The Early Woodland Period (2,900 – 2,350 BP) (950 – 400 B.C.) is distinguished from the Late Archaic Period primarily by the addition of ceramic technology. While the introduction of pottery provides a useful demarcation point for archaeologists, it may have made less difference in the lives of the Early Woodland peoples. The first pots were thick walled and are often friable when found archaeologically. It has been suggested that they were used in the processing of nut oils by boiling crushed nut fragments in water and skimming off the oil. These

vessels were not easily portable, and individual pots likely did not have a long use life. There have also been numerous Early Woodland sites located at which no pottery was found, suggesting that these poorly constructed undecorated vessels had yet to assume a central position in the day-to-day lives of Early Woodland peoples.

Other than the introduction of this limited ceramic technology, the life-ways of Early Woodland peoples show a great deal of continuity with the preceding Late Archaic Period. For instance, birdstones continue to be manufactured, although the Early Woodland varieties have "pop-eyes" which protrude from the sides of their heads.

Likewise, the thin, well-made projectile points which were produced during the terminal part of the Archaic Period continue in use. However, the Early Woodland Period variants were side-notched rather than corner-notched, giving them a slightly altered and distinctive appearance.

The trade networks which were established in the Middle and Late Archaic Periods also continued to function, although there does not appear to have been as much trade in marine shell during the Early Woodland Period. During the last 200 years of the Early Woodland Period, projectile points manufactured from high quality raw materials from the American Midwest begin to appear on sites in southwestern Ontario.

In terms of settlement and subsistence patterns, the Middle Woodland Period (2,350 – 1,400 BP) (400 B.C. – 500 A.D.) provides a major point of departure from the Archaic and Early Woodland Periods. While Middle Woodland peoples still relied on hunting and gathering to meet their subsistence requirements, fish were becoming an even more important part of the diet.

In addition, Middle Woodland peoples relied much more extensively on ceramic technology. Middle Woodland vessels are often heavily decorated with hastily impressed designs covering the entire exterior surface and upper portion of the vessel interior. Consequently, even very small fragments of Middle Woodland vessels are easily identifiable.

It is also at the beginning of the Middle Woodland Period that rich, densely occupied sites appear along the margins of major rivers and lakes. While these areas had been utilized by earlier peoples, Middle Woodland sites are significantly different in that the same location was occupied off and on for as long as several hundred years and large deposits of artifacts often accumulated. Unlike earlier seasonally utilized locations, these Middle Woodland sites appear to have functioned as base camps, occupied off and on over the course of the year. There are also numerous small upland Middle Woodland sites, many of which can be interpreted as special purpose camps from which localized resource patches were exploited. This shift towards a greater degree of sedentism continues the trend witnessed from at least Middle Archaic times and provides a prelude to the developments that follow during the Late Woodland Period.

The Late Woodland began with a shift in settlement and subsistence patterns involving an increasing reliance on corn horticulture (Fox 1990:185; Smith 1990; Williamson 1990:312). Corn may have been introduced into southwestern Ontario from the American Midwest as early as 600 A.D. or a few centuries before. Corn did not become a dietary staple, however, until at least three to four hundred years later, when the cultivation of corn gradually spread into south-central and southeastern Ontario.

During the Transitional Woodland Period, particularly within the Princess Point Complex (circa 1,450 -900 BP) (*circa* AD 500-1050), a number of archaeological material changes have been noted including the appearance of triangular projectile point styles, first seen during this period beginning with the Levanna form; cord-wrapped stick decorated ceramics using the paddle and anvil forming technique evolving from the mainly coil-manufactured and

dentate stamped and pseudo-scallop shell impressed ceramics; and if not appearance, increasing use of maize (*Zea mays*) as a food source (e.g., Bursey 1995; Crawford et al. 1997; Ferris and Spence 1995:103; Martin 2004 [2007]; Ritchie 1971:31-32; Spence et al. 1990; Williamson 1990:299).

The Late Woodland Period is widely accepted as the beginning of agricultural life ways in southern Ontario. Researchers have suggested that a warming trend during this time may have encouraged the spread of maize into southern Ontario, providing a greater number of frost-free days (Stothers and Yarnell 1977). Further, shifts in the location of sites have also been identified with an emphasis on riverine, lacustrine and wetland occupations set against a more diffuse use of the landscape during the Middle Woodland (Dieterman 2001).

One such site, located on the Grand River near Cayuga, Ontario is the Grand Banks site (AfGx-3). As of 1997, 40 maize kernels and 29 cupules had been recovered at this site (Crawford et al. 1997). The earliest AMS radiocarbon assay run on maize from paleosol II produced a date of approximately AD 500 (Crawford et al. 1997:116). This site is interpreted as a long-term basecamp that may have been used year-round or nearly year-round (Crawford and Smith 1996:785). This growing sedentism is seen as a departure from Middle Woodland hunting and gathering and may reflect growing investment in the care of garden plots of maize (Smith 1997:15). The riverine location of Grand Banks (AfGx-3) may have also provided light, nutrient-rich soil for agriculture (Crawford et al. 1997). While Levanna projectile points are formal tools, Princess Point Complex toolkits are predominantly characterized by informal or expedient flake tools and ground stone and bone artifacts are rare (Ferris and Spence 1995:103; Shen 2000). At Grand Banks, experimental archaeology suggests that chert flakes were put to a variety of useful tasks, from butchering to bone-working to wood-working to plant-working. Formal bifaces and projectile points had less evidence of use-wear (Shen 2000). Local cherts appear to have been used, although Onondaga, albeit also a local resource, was preferred at Grand Banks (AfGx-3) (Shen 1997).

The first agricultural villages in southern Ontario date to the 10th century A.D. Unlike the riverine base camps of the Middle Woodland Period, these sites are located in the uplands, on well-drained sandy soils.

Village sites dating between 1,050 – 650 BP (900 and 1300 AD). share many attributes with the historically reported early Late Woodland sites, including the presence of longhouses and sometimes palisades. However, these early longhouses were actually not all that large, averaging only 12.4 metres in length (Dodd et al. 1990:349; Williamson 1990:304-305). It is also quite common to find the outlines of overlapping house structures, suggesting that these villages were occupied long enough to necessitate re-building.

The Jesuits reported that the Huron moved their villages once every 10 – 15 years, when the nearby soils had been depleted by farming and conveniently collected firewood grew scarce (Pearce 2010). It seems likely that early Late Woodland people occupied their villages for considerably longer, as they relied less heavily on corn than did later groups, and their villages were much smaller, placing less demand on nearby resources.

Judging by the presence of carbonized corn kernels and cob fragments recovered from sub-floor storage pits, agriculture was becoming a vital part of the early Late Woodland economy. However, it had not reached the level of importance it would in the middle and late Woodland Periods. There is ample evidence to suggest that more traditional resources continued to be exploited and comprised a large part of the subsistence economy. Seasonally occupied special purpose sites relating to deer procurement, nut collection, and fishing activities, have all been identified. While beans are known to have been cultivated later in the Late Woodland Period, they have yet to be identified on early Late Woodland Period sites.

The middle Late Woodland Period (650 – 550 BP) witnessed several interesting developments in terms of settlement patterns and artifact assemblages. Changes in ceramic styles have been carefully documented, allowing the placement of sites in the first or second half of this 100-year period. Moreover, villages, which averaged approximately 0.6 hectares in extent during the early Late Woodland Period, now consistently range between one and two hectares in size.

House lengths also change dramatically, more than doubling to an average of 30 metres, while houses of up to 45 metres (m) have been documented. This increase in longhouse length has been variously interpreted. The simplest possibility is that increased house length is the result of a gradual, natural increase in population (Dodd et al. 1990:323, 350, 357; Smith 1990). However, this does not account for the sudden shift in longhouse lengths around 1300 A.D. Other possible explanations involve changes in economic and socio-political organization (Dodd et al. 1990:357). One suggestion is that during the middle Late Woodland Period small villages were amalgamating to form larger communities for mutual defence (Dodd et al. 1990:357). If this was the case, the more successful military leaders may have been able to absorb some of the smaller family groups into their households, thereby requiring longer structures. This hypothesis draws support from the fact that some sites had up to seven rows of palisades, indicating at least an occasional need for strong defensive measures. There are, however, other middle Late Woodland villages which had no palisades present (Dodd et al. 1990). More research is required to evaluate these competing interpretations.

The lay-out of houses within villages also changes dramatically by 650 BP. During the early Late Woodland Period villages were haphazardly planned, with houses oriented in various directions. During the middle Late Woodland Period villages are organized into two or more discrete groups of tightly spaced, parallel aligned, longhouses. It has been suggested that this change in village organization may indicate the initial development of the clans which were a characteristic of the historically known Late Woodland peoples (Dodd et al. 1990:358).

During the late Late Woodland period, the Iroquoian-speaking linguistic and cultural groups developed. Prior to European Contact, neighbouring Iroquois-speaking communities united to form several confederacies known as the Huron (Huron-Wendat), Neutral (called Attiewandaron by the Wendat), Petun (Tionnontaté or Khionontateronon) in Ontario, and the Five Nations (later Six Nations) of the Iroquois (Haudenosaunee) of upper New York State (Birch 2010:31; Warrick 2013:71). These groups are located primarily in south and central Ontario. Each group was distinct but shared a similar pattern of life already established by the 16th century (Trigger 1994:42).

Prior to European contact, the geographic distribution of pre-contact Late Woodland sites describes two major groups east and west of the Niagara Escarpment: the ancestral Attiewandaron to the west, and the ancestral Huron-Wendat to the east (Warrick 2000:446). Ancestral Huron-Wendat villages have been located as far east as the Trent River watershed, where “concentrations of sites occur in the areas of the Humber River valley, the Rouge and Duffin Creek valleys, the lower Trent valley, Lake Scugog, the upper Trent River and Simcoe County” (Ramsden 1990:363). These concentrations are distributed in a triangular area along the north shore of Lake Ontario and northward bounded by the Trent River system and the Niagara Escarpment (Ramsden 1990:363).

Settlement types included longhouses, house sizes depended on the size of the extended family that inhabited it; however, archaeological evidence suggests that the average longhouse was 25 feet by 100 feet, with heights about the same as widths (Heidenreich 1978:366). Village size gradually enlarged as horticulture began to take on a more central importance in subsistence patterns, particularly the farming of maize, squash, and beans, supplemented by fishing, hunting, and gathering.

Sites were chosen for their proximity to sources of “water, arable soils, available firewood, [and] a young secondary forest, [as well as] a defendable position” (Heidenreich 1978:375). Later villages consisted of up to 100 longhouses clustered closely together, and only the largest villages on the frontier were fortified (Heidenreich 1978:377).

Subsistence patterns reflect a horticultural diet that was supplemented with fish rather than red meat (Heidenreich 1978:377). ‘Slash-and-burn’ farming was used to quickly and efficiently clear trees and brushwood for flour and flint corn fields (Heidenreich 1978:380). These were consistently cultivated until no longer productive, at which point the village was abandoned, an event that took place about every 8 to 12 years (Heidenreich 1978:381). Consequently, as horticulture became the primary mode of subsistence, pre-contact Indigenous groups gradually relocated from the northern shores of Lake Ontario to further inland, likely as a result of depleting resources and growing tension between Indigenous communities.

1.3.2 Contact Period

The Huron-Wendat and Haudenosaunee called those within the territory of the Niagara Peninsula the “Attiewandaron” (also spelled Attiwondaronks and Atiquandaronk) (Brown 2009: 26). According to Samuel de Champlain, who first referred to the Attiewandaron as *la Nation neutre,* the Attiewandaron inhabited forty villages and could field 4,000 warriors (Jury 1974: 4; White 1978: 410; Warrick 2008: 80). It is speculated that prior to the great epidemics of the 1630s, the Attiewandaron Confederacy numbered approximately 35,000 to 40,000 individuals (White 1978: 409; Warrick 2008: 86).

Their territory at the western end of Lake Ontario and along the north shore of Lake Erie was favourably located for easy trade with the Erie, Haudenosaunee, Tionnontaté, and Huron-Wendat (Trigger 1994: 47). The interior lands occupied by the Attiewandaron contained rapidly running streams, large rivers, and portage routes. A significant trail beginning at Lake Simcoe, following the Nottawasaga River to the Pine River to the source of the Irvine River and into the Grand River and banks of Lake Erie, formed an Indigenous portage route favoured for travel and trade between Huron-Wendat and Attiewandaron territorial lands (Bricker 1934: 58).

From 1649 to 1650, the Haudenosaunee engaged in warfare with the Huron-Wendat Confederacy, destroying several Huron-Wendat villages throughout Southern Ontario (Trigger 1994: 53). The small groups that remained of the Huron-Wendat Confederacy became widely dispersed throughout the Great Lakes region, ultimately resettling in Quebec (Schmalz 1991: 17). Many Huron-Wendat groups sought refuge and protection within the Attiewandaron, until the Haudenosaunee attacked in the 1650s (Trigger 1994: 56; Warrick 2008: 208). Many were captured and incorporated into the Haudenosaunee or sought refuge within other tribes (Lennox and Fitzgerald 1990: 410; Trigger 1994: 57). The last mention of the Attiewandaron in French writing was in 1671 (Noble 2012).

After the 1660s, the Haudenosaunee controlled most of Southern Ontario. Although their homeland was located south of the lower Great Lakes, they occupied at “least half a dozen villages along the north shore of Lake Ontario and into the interior” (Schmalz 1991: 17; Williamson 2013: 60). The Haudenosaunee established “settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. Their settlements were on canoe-and-portage routes that linked Lake Ontario to Georgian Bay and the upper Great Lakes” (Williamson 2013: 60). The Haudenosaunee had established a village at the Rouge River, the Humber River, and at the Niagara River (Robinson 1965: 15-16; Schmalz 1991: 29).

At this time, several Algonquin-speaking linguistic and cultural groups within the Anishinaabeg (or Anishinaabe) began to challenge the Haudenosaunee dominance in the region (Johnston 2004: 9-10; Gibson 2006: 36). Before contact with the Europeans, the Anishinaabeg were primarily in Northern Ontario, with the Ojibwa territorial

homeland inland from the north shore of Lake Huron (MNCFN [date unknown]: 3). The English referred to those Algonquin-speaking linguistic and cultural groups that settled in the area bounded by Lakes Ontario, Erie, and Huron as Chippewas or Ojibwas (Smith 2002: 107). In 1640, the Jesuit fathers had recorded the name "*oumisagai*, or Mississaugas, as the name of an Algonquin group near the Mississagi River on the northwestern shore of Lake Huron. The French, and later the English applied this same designation to all Algonquian [-speaking groups] settling on the north shore of Lake Ontario" (Smith 2002: 107; Smith 2013: 19-20). "The term 'Mississauga' perplexed the Algonquins, or Ojibwas, on the north shore of Lake Ontario, who knew themselves as the Anishinaabeg" (Smith 2013: 20).

Following a major smallpox epidemic, combined with the capture of New Netherland by the English, access to guns and powder became increasingly restricted for the Haudenosaunee. After a series of successful attacks against the Haudenosaunee by groups within the Anishinaabeg, the Haudenosaunee dominance in the region began to fail. By the 1690s, Haudenosaunee settlements along the northern shores of Lake Ontario were abandoned, and in 1701, the Haudenosaunee were defeated. After these battles, the Anishinaabeg replaced the Haudenosaunee in Southern Ontario (Coyne 1895: 28; Schmalz 1991: 20, 27, 29; Gibson 2006: 37; Warrick 2008: 242; Williamson 2013: 60).

1.3.3 Post-Contact Period

Although their territory was located south of the lower Great Lakes, the Haudenosaunee controlled most of southern Ontario after the 1660s, occupying at "least half a dozen villages along the north shore of Lake Ontario and into the interior" (Schmalz 1991:17; Williamson 2013:60). The Haudenosaunee established "settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. Their settlements were on canoe-and-portage routes that linked Lake Ontario to Georgian Bay and the upper Great Lakes" (Williamson 2013:60). The Haudenosaunee had established a village named Ganatsekwyagon at the mouth of the Rouge River, and Teiaiagon at a bend near the mouth of the Humber River to exploit both branches of the Toronto Carrying Place Trail (Robinson 1965:15-16; Schmalz 1991:29). Because of the French being allies of the Huron-Wendat, the Haudenosaunee prevented French explorers and missionaries from utilizing the St. Lawrence River and traveling within their territory north of Lake Ontario (Lajeunesse 1960:xxix).

At this time, several Algonquin-speaking linguistic and cultural groups within the Anishinaabeg (or Anishinaabe) began to challenge the Haudenosaunee dominance in the region (Johnston 2004:9-10; Gibson 2006:36). The Anishinaabeg were originally located primarily in northern Ontario. Before contact with the Europeans, the Ojibwa territorial homeland was situated inland from the north shore of Lake Huron (MNCFN nd:3). The English referred to those Algonquin-speaking linguistic and cultural groups that settled in the area bounded by Lakes Ontario, Erie, and Huron as Chippewas or Ojibwas (Smith 2002:107). In 1640, the Jesuit fathers had recorded the name "oumisagai, or Mississaugas, as the name of an Algonquin group near the Mississagi River on the northwestern shore of Lake Huron. The French, and later English applied this same designation to all Algonquian [-speaking groups] settling on the north shore of Lake Ontario" (Smith 2002:107; Smith 2013:19-20). "The term 'Mississauga' perplexed the Algonquins, or Ojibwas, on the north shore of Lake Ontario, who knew themselves as the Anishinaabeg" (Smith 2013:20).

After a major smallpox epidemic and combined with the capture of New Netherland by the British, access to guns and powder became increasingly restricted for the Haudenosaunee. After a series of successful attacks against the Haudenosaunee by groups within the Anishinaabeg from 1653 to 1662, the Haudenosaunee dominance in the region began to fail (Warrick 2008:242; Schmalz 1991:20). Prior to 1680, groups within the Anishinaabeg had begun to settle just north of the evacuated Huron-Wendat territory and with the British entering the fur-trading

market, began to expand further into southern Ontario (Gibson 2006:36; Schmalz 1991:18). By the 1690s, Haudenosaunee settlements along the northern shores of Lake Ontario were abandoned (Williamson 2013:60). By 1701, after a series of battles throughout Ontario, the Anishinaabeg replaced the Haudenosaunee in southern Ontario (Gibson 2006:37; Schmalz 1991:27-29; Coyne 1895:28).

In 1701, representatives of several groups within the Anishinaabeg and the Haudenosaunee, collectively known as the First Nations, assembled in Montreal to participate in Great Peace negotiations, sponsored by the French (Johnston 2004:10; Trigger 2004:58). The Mississaugas secured sole possession of the territory along and extending northward of Lake Ontario and Lake Erie (Hathaway 1930:433).

From 1701 to the fall of New France in 1759, the fur trade continued in Ontario with both the Ojibwa and Mississauga and various other groups within the Anishinaabeg trading with both the English and the French. Subsistence patterns include a primary focus on hunting, fishing, and gathering with little focus on agriculture (McMillian and Yellowhorn 2004:110). Groups within the Anishinaabeg, such as the Ojibwa and Mississauga, utilized housing known as a wigwam, a temporary and moveable structure that was easy to construct and disassemble, allowing them to travel swiftly throughout their territory (McMillian and Yellowhorn 2004:111).

The Seven Years War brought warfare between the French and British in North America. In 1763, the Royal Proclamation declared the Seven Years War over, giving the British control of New France. The British did not earn the respect of the Anishinaabeg, as the British did not honour fair trade nor the Anishinaabeg occupancy of the land as the French had. Consequently, the Pontiac Uprising, also known as the Beaver Wars, began that same year (Schmalz 1991:70; Johnston 2004:13-14). This uprising involved both groups within the Haudenosaunee and groups within the Anishinaabeg. After numerous attacks on the British, the Pontiac Uprising was over by 1766 when a peace agreement was concluded with Sir William Johnson, the Superintendent of Indian Affairs (Schmalz 1991:81). The fur-trade continued throughout southern Ontario until the beginning of British colonization.

The project area is located within Between the Lakes Treaty No. 3. On May 22, 1784, for the sum of £1180 worth of trade goods, the Mississaugas of the Credit ceded to the Crown approximately 3,000,000 acres of land located between Lakes Huron, Ontario, and Erie.

This purchase was to procure a permanent abode for that part of the Six Nations coming into Canada. As written in the below passage, the Between the Lakes Treaty No. 3 includes (Government of Canada 2016):

> All that parcel or tract of land lying and being between the Lakes Ontario and Erie, beginning at Lake Ontario, four miles south' westerly from the point opposite to Niagara Fort, known by the name of Mississaugue Point, and running from thence along the said lake to the creek that falls from a small lake, known by the name of Washquarter into the said Lake Ontario, and from thence north forty-five degree west, fifty miles; thence south forty-five degrees west, twenty miles; and thence south until it strikes the River La Tranche; then down the stream of the said river to that part or place where a due south course will lead to the mouth of Catfish Creek emptying into Lake Erie, and from the above mentioned part or place of the aforesaid River La Tranche, following the south course to the mouth of the said Catfish Creek; thence down Lake Erie to the lands heretofore purchased from the Nation of Mississague Indians; and from thence along the said purchase at Lake Ontario at the place of beginning as above mentioned together with all the woods, ways, paths, waters, watercourses and appurtenances thereunto belonging.

1.3.4 Euro-Canadian Settlement Period (Late AD 1700s to 1900)

1.3.4.1 Township of Humberstone, Welland County

During the American War of Independence, in the late 1700s, a large number of United Empire Loyalists, who were granted land for staying loyal to the British crown, began to move into the Niagara Peninsula, putting greater demand on the quantity of available lands for settlement within what would become Welland County (Brown 2009:33). These land grants were very liberal, where “field officers being allowed to select 5,000 acres, captains 3,000 acres, subalterns 2,000 acres and privates 200 acres” (Murphy 1887:87-88; Michael 1967:11). By 1784, about 40 families had settled on the territory now comprising the County of Welland (Murphy 1887:88).

In 1784, the Mississauga at the western end of Lake Ontario ceded a large tract of land that “included the Niagara Peninsula, lands close to the head of Lake Ontario, and the north shore of Lake Erie as far west as Cat Fish Creek” (Surtees 1994:103). The British purchased this land for £1,180 worth of trade goods, and it became known as the Between the Lakes Purchase (Surtees 1994:103). The tract included over one million hectares of land, and a tract of land nearly ten kilometres deep on either side of the Grand River was awarded to the Six Nations (Surtees 1994:103-104). In 1792, a land sale document was produced to confirm the actual limits of this purchase, which includes the Township of Humberstone (Surtees 1994:104).

The Township of Humberstone was first surveyed by Deputy Surveyor Thomas Welsh in 1794 and was bounded by the Township of Crowland to the north, the Township of Bertie on the east, the Township of Wainfleet to the west, and Lake Erie to the south (Ott 1970:11; Murphy 1887:275). Humberstone was surveyed with concession roads running east and west, and side roads running north-south (Ott 1970:11-12). The township contains about 32,000 acres of fertile soil “which is more or less alluvial and varies in quality from black muck to clay loam, [ranking] the township amongst the best agricultural districts in Ontario” (Murphy 1887:275; Page 1876:11). A ridge of high land runs on the southern side of the township parallel to Lake Erie and the land slopes to the lake consists of well-timbered hills of “oak, ash, hemlock, cedar, linden, butternut, walnut, beech, and whole groves of sugar maple” (Murphy 1887:275). The north-western portion of the township lower and contains extensive marshes (Murphy 1887:276).

During the War of 1812, the Niagara Peninsula was heavily bombarded by both American and British artillery and much of the countryside was destroyed during the invasion and defence of Upper Canada. In 1814, an American force led by General Duncan McArthur traveled from Detroit along the shore of the lake, burning nearly everything in their path from the Detroit River to the Grand River (Brown 2009:36). The distinctively shaped lake-side hill named Sugarloaf Hill, which was located along the southern half of the Township of Humberstone and reminded “early settlers of a tasty loaf eaten by former immigrants from Pennsylvania”, was used as a “signal beacon to warn of impending American attacks” (City of Port Colborne 2013).

1.3.4.2 Welland Canal

Credit for building the first Welland Canal is attributed to William Hamilton Merritt. In 1818, Merritt, a farmer and the owner of a mill on the bank of Twelve Mile Creek, petitioned the Legislature of Upper Canada to construct a canal to divert water from the Welland River due to the seasonal variations of the water supply available from Twelve Mile Creek (Westwater 2010). However, it was discovered that an extensive ridge ran between the two waterways and the idea was given up (Westwater 2010). A month later that Merritt proposed building a canal that would allow boats to travel between Lake Ontario and Lake Erie (Westwater 2010).

After several surveys and much debate over route, a path was decided on that would utilize natural waterways as much as possible. Wooden locks would be used to lift and lower the boats to the heights required between the two lakes.

Starting from Lake Ontario, Twelve Mile Creek would be taken as far south as the town of St. Catharines. Here, Dick's Creek, a tributary of Twelve Mile Creek was followed briefly north and then south again starting a slow climb upward which eventually culminated in a rapid succession of locks that took the canal up the escarpment (Old Welland Canals Field Guide nd). From here it continued south where it eventually met up with another tributary of Twelve Mile Creek and eventually the same ridge that had prevented Merritt's original idea of a water diversion ditch. While a tunnel through the ridge was originally conceived of, the final plan called for a channel or "Deep Cut" to continue south a distance of two miles to the Welland River (Old Welland Canals Field Guide nd). Welland River would then be followed to the Niagara River (above Niagara Falls), allowing access to Lake Erie. The Welland Canal Company was formed in January 1824 to build and manage the canal with construction starting on November 30, 1824 (Old Welland Canals Field Guide nd).

In 1828, after several years of construction an unexpected problem arose at the Deep Cut. To resolve these problems, as well as time constraints, a decision was made to dig a shallower channel and to use locks to transfer ships down to the Welland River. However, due to difference in elevation, a new source of water at a higher elevation was needed to fill the canal. Therefore, a new channel, a "Feeder Canal" was commission to divert water from the Grand River to the Welland Canal. After it was completed in 1829 the canal operated this way until 1832.

In 1833, the route along the Welland River was considered too time consuming, and a new route was dug that incorporated part of the Feeder Canal and continued south through the project area and all the way to Lake Erie. The canal was run this way for 11 years from 1833 to 1844.

The Second Welland Canal was designed to follow the route of the First Welland Canal with a few small modifications. Stone was also used instead of wood. The canal was rebuilt 1842-45. The Feeder Canal was also enlarged during this time to allow ship traffic. In 1851 the Feeder Canal was also extended to Lake Erie and provided an alternative route for ships.

The Third Welland Canal was designed to provide a new and straighter route that would allow bigger ships and shorter transit times. The canal was built 1872-81, while modifications continued until 1887. The Second Welland Canal remained a distinct canal north of Allanburg and operated until 1915. The Feeder Canal was no longer the source of water for the canal but handled boat traffic until the 1920's.

The Fourth Welland Canal was constructed between the years of 1913 and 1932. The canal now runs perpendicular to the Niagara Escarpment and is the most direct route of all three previous canals. The canal starts at the man-made Port Weller piers on Lake Ontario and continues south as straight as possible to Port Colborne.

1.3.4.3 City of Port Colborne

The community of Port Colborne grew significantly after the construction of the Welland Canal was complete in 1832 (Mika and Mika 1983:231; Brown 2009:71). Prior to that, a small village had begun to develop around Sugarloaf Hill after the area’s first settler, Christian Zavitz, built a gristmill (Brown 2009:71). Permanent settlement occurred by 1832 along the lakeshore at Gravelly Bay, and was named after the Lieutenant Governor, Sir John Colborne (Mika and Mika 1983:213). In 1834, a new village site was laid out further inland, whose early economy relied almost entirely on the operation of the canal (Mika and Mika 1983:231). By 1850, Port Colborne became a

major wheat-shipping and industrial hub where the Buffalo and Lake Huron Railway, the Welland Railway, and the horse-drawn streetcar line, known as the Toronto and St. Catherine's Railway, intersected (Mika and Mika 1983:232; Brown 2009:71).

In 1866, Irish nationalists from America, wanting to separate Ireland from the British Empire known as Fenians, attacked several locations along the Canadian board, including Port Colborne (Masters, 1948). In May of 1866, a small Canadian force, the Welland Canal Field Battery, was stationed to protect Port Colborne, but failed to do so (Mika and Mika, 1983, p.232). Other Canadian troops arrived, forcing the Fenians to withdraw to the United States where they were promptly arrested (Grodzinski, 2015). By 1890, Port Colborne was incorporated as a village that contained, "four churches, a public school, separate school, grist mill, sawmill, three planning mills, a sash and door factory, a branch of the Imperial Bank, offices of the Montreal and Dominion Telegraph and a grain elevator" (Mika and Mika, 1983, p.232). Towards the end of the 19th Century, commercial and manufacturing works began to be displaced by larger industrial conglomerates supported by improvements to the canal and harbour (City of Port Colborne, 2013), and as the 20th Century progressed, Port Colborne became one of the world's largest centres of the flour milling industry (*ibid*).

Port Colborne was officially declared a town in 1918, with a recorded population of 2,837 (City of Port Colborne, 2013), and continued growth and spread, eventually encompassing the Village of Humberstone, which was officially amalgamated in 1952.

1.3.4.4 Project Area

The project area is located within parts of Lots 27 and 28, Concession 1; Lots 26 to 28, Concession 2; and Lots 27 and 28, Concession 3, in the Geographic Township of Humberstone, County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

To understand the 19th century land use history of the project area, the 1862 *Tremaine's Map of the Counties of Lincoln and Welland, Canada West* and 1876 *Illustrated Historical Atlas of the Counties of Lincoln and Welland, Ontario* were examined (Map 2). A review of these resources reveals the project area to cross several properties owned by various individuals in the 19th century. Also, the project area either crosses and is in proximity to a number of historical features, including, historical villages and transportation routes (i.e., railways, roads, and the Welland Canal).

Topographic maps and aerials from the 1900s were reviewed to understand the 20th century land use of the project area and surroundings (Map 3 to Map 7). In the early 1900s, settlement continued to flourish out from the villages of Humberstone and Port Colborne, whereas north Humberstone village and east of the Welland Canal remained under agricultural use. By 1929, the Fourth Canal is visible on topographic maps within Port Colborne, and settlement east of the canal begins to slowly fill. By the middle of the 20th century, the City of Port Colborne had expanded to encompass much of the areas encompassing the project area.

1.4 Archaeological Context

1.4.1 Existing Conditions

The project area is situated in the central portion of City of Port Colborne and crosses the Welland Canal and island. Urban residential is the primary land use, encompassing the central portion of the project area. Industrial/ employment area, downtown commercial, and parks and open space make up the remainder of the land use. Overall, the area is generally extensively disturbed, primarily as a result of previous road construction, utilities installation, infrastructure development and dispersed building footprints.

1.4.2 Physiography

The project area is in the Haldimand Clay Plain physiographic region of southern Ontario. The Haldimand Clay Plain is a series of parallel belts, which lie between the Niagara Escarpment and Lake Erie, and occupies all of the Niagara Peninsula except for the fruit belt below the escarpment. Although it was once completely submerged in Lake Warren, the till is not all buried by stratified clay and generally comes to the surface on the low morainic ridges in the north.

Soil texture can be an important determinant of past settlement, usually in combination with other factors, such as topography. The project area consists primarily of loam (Farmington loam), as well as clay (Jeddo Clay) and miscellaneous (Dump). Characteristics of these soils are provided within Table 2. The topography of the project area and surrounding area slopes north to south and undulates east to west. The northern portion of the project area is at an elevation of approximately 184 m asl and the southern portion is at approximately 175 m asl.

Table 2: Soil types within the project area

Soil Types	Name of Soil	Description of Surface and Subsoil	Topography and Drainage	Past Land Use
Loam	Farmington Loam	Shallow light brown stony loam over limestone bedrock.	Smooth. Fair to good drainage.	Pasture and woodlots
Clay	Jeddo Clay	Dark grey clay and clay loam over compact grey clay subsoil; few stone.	Nearly flay. Very poor natural drainage.	General farming and dairying with pasture, hay, wheat, oats, barley, corn and buckwheat being the main crops grown.
Miscellaneous	Dump	Very young soils on canal dumps, in excavations and along rocky ledges.	Topography and drainage variable.	Pasture and woodlots. Also some corn, roots and hay.

Potable water is an important resource necessary for any extended human occupation or settlement. As water sources have remained relatively stable in Ontario since post-glacial times, proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Hydrological features such as primary water sources (i.e., lakes, rivers, creeks, streams) and secondary water sources (i.e., intermittent streams and creeks, springs, marshes, swamps) would have helped supply plant and food resources to the surrounding area. Per MHSTCI (2011), lands within 300 m of a water source are deemed to have archaeological potential. The project area is located 1.5 km north of Lake Erie (Map 1).

1.4.3 Registered Archaeological Sites

Per MHSTCI (2011), to compile an inventory of archaeological resources, the registered archaeological site records maintained by the MHSTCI in the Ontario Archaeological Site Database (OASD) were consulted. Table 3 provides a list of registered archaeological sites within 1 km of the project area.

A total of 20 archaeological sites are registered within 1 km of the project area. There are no registered archaeological sites within 300 m of Alternative Routes 1, 3, and 4. There are three registered sites within 300 m of Alternative Route 2A (AfGt-196, AfGt-197, and AfGt-201), and two registered sites are within 300 m of Alternative Route 2B (AfGt-196 and AfGt-197).

Table 3: Registered archaeological sites within 1 km of the project area.

Borden Number	Site Name	Time Period	Affinity	Site Type	Current Development Review Status
Registered archaeological Sites within 300 m of the project area					
AfGt-196	Chppawa1	Pre-Contact	Indigenous	-	Further CHVI
AfGt-197	Chippawa 2	Pre-Contact	Indigenous	-	Further CHVI
AfGt-201	Port Colborne P1	Pre-Contact	Indigenous	Camp / campsite	No Further CHVI
Registered archaeological sites > 300 m and within 1 km of the project area					
AfGt-26	Kikkert-Murray	Pre-Contact	Indigenous	-	Further CHVI
AfGt-35	Snider 1	Pre-Contact	Indigenous	-	Further CHVI
AfGt-36	Snider 2	Pre-Contact	Indigenous	-	Further CHVI
AfGt-37	Snider 3	Pre-Contact	Indigenous	Campsite/ workshop	Further CHVI
AfGt-38	Kikkert 1	Pre-Contact	Indigenous	-	Further CHVI
AfGt-39	Kikkert 2	Pre-Contact	Indigenous	-	Further CHVI
AfGt-41	Augustine 1	Pre-Contact	Indigenous	-	Further CHVI
AfGt-42	Augustine 2	Pre-Contact	Indigenous	-	Further CHVI
AfGt-43	Augustine 3	Pre-Contact	Indigenous	-	Further CHVI
AfGt-54	Ott 1	Pre-Contact	Indigenous	-	Further CHVI
AfGt-55	Ott 2	Pre-Contact	Indigenous	-	Further CHVI
AfGt-56	Ott 3	Pre-Contact	Indigenous	-	Further CHVI
AfGt-57	Ott 4	Pre-Contact	Indigenous	-	Further CHVI
AfGt-59	Ott 5	Pre-Contact	Indigenous	Quarry	Further CHVI
AfGt-82	Wildwood	Post-Contact, Pre-Contact	Indigenous, Euro-Canadian	-	Further CHVI
AfGt-101	Sugarloaf	Pre-Contact	Indigenous	Camp/ campsite/ workshop	Further CHVI
AfGt-233	Barrick Road Site	Pre-Contact	Indigenous	Camp/ campsite	Further CHVI

'-' *denotes information was not available on the OASD*

CHVI, cultural heritage value or interest

1.4.4 Previous Archaeological Assessments

Per *Section 1.1., Standard 1* of the MHSTCI (2011), a review of previous archaeological assessments undertaken within the limits of the project area or within 50 m the project area was completed. Five previous archaeological assessments were identified.

In 2013, Archeoworks Inc. undertook a Stage 1 archaeological assessment for a proposed elevated storage tank as part of the Port Colborne water and wastewater servicing within part of Lot 28, Concession 3, in the City of Port Colborne (Archeoworks Inc. 2013). The assessment determined the investigation area to have archaeological potential, and a Stage 2 assessment was recommended. In 2014, Archeoworks undertook the Stage 2 assessment and identified a pre-contact Indigenous site, Port Colborne P1 Site (AfGt-201) (Archeoworks Inc. 2014). The site was determined to have further CHVI, and a Stage 3 assessment was recommended. The Stage 3 assessment was completed in 2014 and resulted in the recovery of 266 pre-contact Indigenous lithic artifacts; therefore, Stage 4 mitigation through excavation was recommended (Archeoworks Inc. 2015). The Stage 4 excavation was subsequently completed in 2015, wherein the site was fully excavated (Archeoworks Inc. 2015).

In 2016, Archeoworks Inc. completed a Stage 1-2 archaeological assessment for the proposed upgrades to the East Side SPS, within part of Lot 27, Concession 1, in the City of Port Colborne (Archeoworks Inc. 2016). The Stage 1 assessment determined the property to have archaeological potential and a Stage 2 test pit survey was completed. No archaeological resources were encountered, and the property was recommended to be of no further archaeological concern.

1.4.5 Cultural Heritage Resources

Per Section 1.3 and 1.4 of the MHSTCI (2011), property listed on a municipal register or designated under the *Ontario Heritage Act* or that is a federal, provincial or municipal historic landmark or site is indicative of archaeological potential. According to the City of Port Colborne's *Heritage Property Registry* (Revised as of 17 June 2008), there is listed cultural heritage resource within the project area at 110 St. Arnaud Street, and eight designated and 130 listed cultural heritage resources within 300 m of the project area (City of Port Colborne 2008) (APPENDIX A). Additionally, there are eight known historic landmarks related to the early construction of the Welland Canal located within 300 m of the project area (Appendix A).

1.4.6 Historic Plaques

At the corner of Clarence Street and King Street, south of the project area, is a historical plaque, which reads (Ontario Plaques 2019):

> In 1831 the Welland Canal Company selected Gravelly Bay as the southern terminus of their waterway connecting Lakes Ontario and Erie, and in 1833 as the permission of Lieutenant-Governor Sir John Colborne to name the site "Port Colborne". The Hon. William H[amilton] Merritt, president of the Canal Company, has streets laid out on both sides of the canal in 1834 and, with several partners, built a grist-mill by 1835. Initially the community's economy depended largely on the canal, but from the 1850's Port Colborne developed as a wheat-shipping point, railway junction and industrial centre. It was incorporated as a village in 1869 and council first met on January 17, 1870.

1.4.7 Cemeteries

Per Section 1.3 of the MHSTCI (2011), early cemeteries are considered features that indicate archaeological potential. The Stage 1 assessment did not identify any 19th century cemeteries either within 300 m or within the project area.

2.0 FIELD METHODS

The Stage 1 property inspection of the project area was conducted on 19 August 2020 in compliance with Section 1.2 of the MHSTCI (2011). The weather during the Stage 1 property inspection was sunny with temperatures reaching a high of 22°C. The lighting conditions during the inspection permitted good visibility of all parts of the project area and were conducive to identifying features and assessing the archaeological potential.

The property inspection was carried out systematically every 20 to 30 m, reviewing the entire extent of the project area to identify the presence or absence of archaeological potential. Photographic images of the project area are presented within Section 8.0. Location and orientation information associated with all photographs taken in the field is provided on Map 8.

Features of archaeological potential were confirmed to be present, including, historical transportation routes, historical settlements, and a property listed on a municipal register.

3.0 ANALYSIS AND CONCLUSION

Archaeological potential is established by determining whether features or characteristics indicating potential are located on or in the vicinity of a project area. Features and characteristics that indicate a higher potential for archaeological resources are defined within Section 1.3.1 of the *Standards and Guidelines for Consultant Archaeologists* (MHSTI 2011:17-18) and include:

- Previously identified archaeological sites.
- Water sources:
  - Primary water sources (e.g., lakes, rivers, streams, creeks).
  - Secondary water sources (e.g., intermittent streams and creeks; springs; marshes; swamps).
  - Features indicating past water sources (e.g., glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels, shorelines of drained lakes or marshes, and cobble beaches).
  - Accessible or inaccessible shoreline (e.g., high bluffs, swamps or marsh fields by the edge of a lake, sandbars stretching into marsh).
- Elevated topography (eskers, drumlins, large knolls, plateaux).
- Pockets of well drained sandy soil, especially near areas of heavy soil or rocky ground.
- Distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases.
- Resource areas including:
  - Food or medicinal plants.
  - Scarce raw minerals (e.g., quartz, copper, ochre or outcrops of chert).
  - Early Euro-Canadian industry (fur trade, logging, prospecting, mining).
- Areas of early Euro-Canadian settlement including:
  - Early military or pioneer settlement (e.g., pioneer homesteads, isolated cabins, farmstead complexes).
  - Early wharf or dock complexes, pioneer churches and early cemeteries.
- Early historical transportation routes (e.g., trails, passes, roads, railways, portage routes).
- Property listed on a municipal register or designated under the *Ontario Heritage Act* or that is a federal, provincial or municipal historic landmark or site.
- Property that local histories or informants have identified with possible archaeological sites, historical events, activities or occupations.

Many of the above features of archaeological potential have a buffer assigned to them, extending the zone of archaeological potential beyond the physical feature. The following buffers are commonly accepted by the

MHSTCI and specifically indicated in Section 1.4 of the *Standards and Guidelines for Consultant Archaeologists* (MHSTCI 2011:20-21).

- 300 m buffer: previously identified archaeological site; water sources; areas of early Euro-Canadian settlement; or locations identified through local knowledge or informants.
- 100 m buffer: early historical transportation route.

In the event no buffer is inherently present, potential is restricted to the physical limits or the feature: elevated topography, pockets of well-drained sandy soil, distinctive land formations, resources areas, listed or designated properties and landmark properties.

3.1 Potential for Pre-Contact Archaeological Resources

Potential for pre-contact archaeological sites is established by determining the likelihood that archaeological resources may be present. Archaeological potential criteria commonly used by the MHSTCI (2011) were applied to determine areas of archaeological potential. These variables include distance to previously identified archaeological sites, distance to various types of water sources, drainage, soil type, glacial geomorphology, and the general topographic variability of the area.

Distance to water sources is an important determinant of past human settlement patterns and may result in a determination of archaeological potential. However, any combination of two or more other criteria, such as well-drained soils, or topographic variability, may also indicate archaeological potential.

In archaeological potential modelling, a distance to water criterion of 300 m is generally employed for water sources, including lakeshores, rivers, creeks, and swamps. The closest natural water sources are a couple unnamed secondary features and Lake Erie located approximately 1.0 km and 1.5 km, respectively.

Soil texture can be an important determinant of past settlement, usually in combination with other factors, such as topography. The project area consists of soils (Farmington Loam and Jeddo Clay), which are characterized as having been suitable for pre-contact Indigenous settlement.

Furthermore, the MHSTCI stipulates that areas within 300 m of previously identified archaeological sites have archaeological potential. A review of the OASD maintained by the MHSTCI identifies three pre-contact archaeological sites within 300 m of the project area.

3.2 Potential for Post-Contact Archaeological Resources

The criteria used by the MHSTCI to determine the potential for post-contact archaeological sites include the presence of 1) particular, resource-specific features that would have attracted past subsistence or extractive uses; 2) areas of initial, non-Indigenous settlement; 3) early historic transportation routes; 4) previously identified archaeological sites; and, 5) properties listed or designated under the Ontario Heritage Act.

As stated in Section 3.1, there are no natural water sources within 300 m of the project area. Areas of early Euro-Canadian settlements (e.g., pioneer homesteads, isolated cabins, farmstead complexes, early wharf or dock complexes, pioneer churches, and early cemeteries), early historical transportation routes (e.g., trails, passes, roads, railways, portage routes), and properties that local histories or informants have identified with possible archaeological sites, historical events, activities, or occupations, are considered features of archaeological potential. A review of 19th century mapping illustrates the project area to be located within proximity to a number

of historical settlements (i.e., Humberstone [formerly Petersburgh village] and Port Colborne village) and historical transportation routes (i.e., railways, roads, and the Welland Canal).

A review of the City of Port Colborne's *Heritage Property Registry* determined that there are 131 listed properties, eight designated properties, eight historical landmarks, and one historical plaque within 300 m the project area. A review of the OASD maintained by the MHSTCI did not identify any Euro-Canadian sites registered within 300 m of the project area.

3.3 Previous Archaeological Assessments

As noted in Section 1.4.4, several archaeological assessments have been completed adjacent to and within the project area. All these assessments have resulted in their respective areas being cleared by the MHSTCI of further archaeological concern (Map 8).

3.4 Archaeological Integrity

A negative indicator of archaeological potential is extensive below-grade land disturbance. This includes widespread earth movement activities that would have removed or relocated any archaeological resources to such a degree that their information potential and CHVI has been lost.

Activities that are recognized to cause sufficient disturbance to remove archaeological potential include: quarrying, major landscaping involving grading below topsoil, building footprints, and infrastructure development. Activities including agricultural cultivation, gardening, minor grading, and landscaping do not necessarily remove archaeological potential (MHSTCI 2011:18). Based on 20th century mapping and property inspection, much of the project area exhibits evidence of extensive below-grade land disturbances as a results of infrastructure development, underground utilities, and grading activities (Map 4 to Map 7); these areas can be described as having no archaeological potential (Map 8) (Image 1 to Image 8).

3.5 Conclusions

When the above data of archaeological potential, archaeological integrity and previous archaeological assessments is collectively applied to the project area and the alternative routes, it can be concluded that much of the project area and alternative routes have no archaeological potential for both pre-contact and post-contact archaeological resources. However, despite, the majority of the project area being extensively disturbed, areas possibly retaining archaeological potential were identified (Map 8) (Image 1 to Image 8). This corresponds to the grassed margins west of the existing East Side SPS at 53 Killaly Street East; the woodlot and areas of overgrown vegetation at the northeast portion of the project area, the woodlot at the north end of the project area, the grassed margins and overgrown vegetation along Barrick Road and Elm Street, the overgrown lands flanking the west side of the Welland Canal and the woodlot, overgrown vegetation and grassed margins east and north of the Seaway Water Pollution Control Plant (Map 8) (Image 1, Image 3, Image 4, and Image 9 to Image 12).

4.0 RECOMMENDATIONS

Based on the findings presented in the preceding sections of this report, the following recommendations are provided for each alternative route:

Alternative Route 1 – Do Nothing

1) If selected as the preferred alternative route (Map 8):

    a. No further archaeological investigations are warranted given this route will not involve any impacts.

Alternative Route 2A – Barrick Road Crossing - ROW

2) If selected as the preferred alternative route (Map 8):

    a. Parts of this route that are described as retaining archaeological potential are recommended to be subjected to a Stage 2 archaeological assessment. It is recommended these areas be subjected to test pit survey at 5 m intervals per Section 2.1.2 of the MHSTCI (2011).

    b. Parts of this route that are described as having no archaeological potential are recommended to be considered free from further archaeological investigations per Section 2.1, Standard 2.b. of the MHSTCI (2011).

    c. Parts of this route that are described as previously assessed and recommend no further archaeological assessment are recommended to be considered free from further archaeological investigations.

Alternative Route 2B – Barrick Road Crossing - Seaway

3) If selected as the preferred alternative route (Map 8):

    a. Parts of this route that are described as retaining archaeological potential are recommended to be subjected to a Stage 2 archaeological assessment. It is recommended these areas be subjected to test pit survey at 5 m intervals per Section 2.1.2 of the MHSTCI (2011).

    b. Parts of this route that are described as having no archaeological potential are recommended to be considered free from further archaeological investigations per Section 2.1, Standard 2.b. of the MHSTCI (2011).

    c. Parts of this route that are described as previously assessed and recommend no further archaeological assessment are recommended to be considered free from further archaeological investigations.

Alternative Route 3 – North Island Crossing

4) If selected as the preferred alternative route (Map 8):

    a. Parts of this route that are described as retaining archaeological potential are recommended to be subjected to a Stage 2 archaeological assessment. It is recommended these areas be subjected to test pit survey at 5 m intervals per Section 2.1.2 of the MHSTCI (2011).

b. Parts of this route that are described as having no archaeological potential are recommended to be considered free from further archaeological investigations per Section 2.1, Standard 2.b. of the MHSTCI (2011).

c. Parts of this route that are described as previously assessed and recommend no further archaeological assessment are recommended to be considered free from further archaeological investigations.

Alternative Route 4 – Rehab

5) If selected as the preferred alternative route:

a. Parts of this route that are described as retaining archaeological potential are recommended to be subjected to a Stage 2 archaeological assessment. It is recommended these areas be subjected to test pit survey at 5 m intervals per Section 2.1.2 of the MHSTCI (2011).

b. Parts of this route that are described as having no archaeological potential are recommended to be considered free from further archaeological investigations per Section 2.1, Standard 2.b. of the MHSTCI (2011).

c. Parts of this route that are described as previously assessed and recommend no further archaeological assessment are recommended to be considered free from further archaeological investigations.

The MHSTCI is requested to review, and provide a letter indicating their satisfaction with the results and recommendations presented herein, with regard to the 2011 *Standards and Guidelines for Consultant Archaeologists* and the terms and conditions for archaeological licences, and to enter this report into the Ontario Public Register of Archaeological Reports.

5.0 ADVICE ON COMPLIANCE WITH LEGISLATION

This report is submitted to the Minister of Heritage, Sport, Tourism, and Culture Industries 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 it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ontario Ministry of Tourism, 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 Sections 48 and 69 of *the Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such 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 undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of *the Ontario Heritage Act*.

The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33, requires that any person discovering or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the Registrar of Cemeteries at the Ontario Ministry of Consumer Services is also immediately notified.

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 licence.

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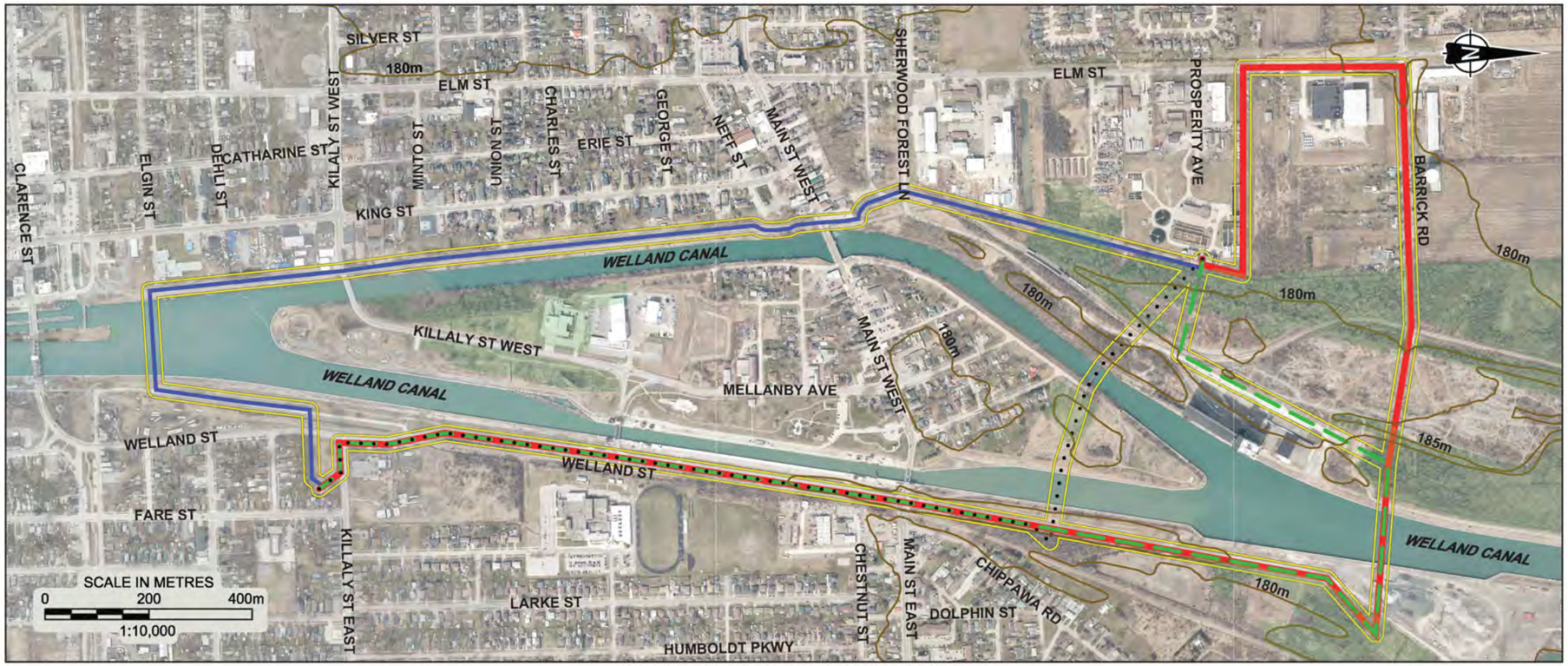
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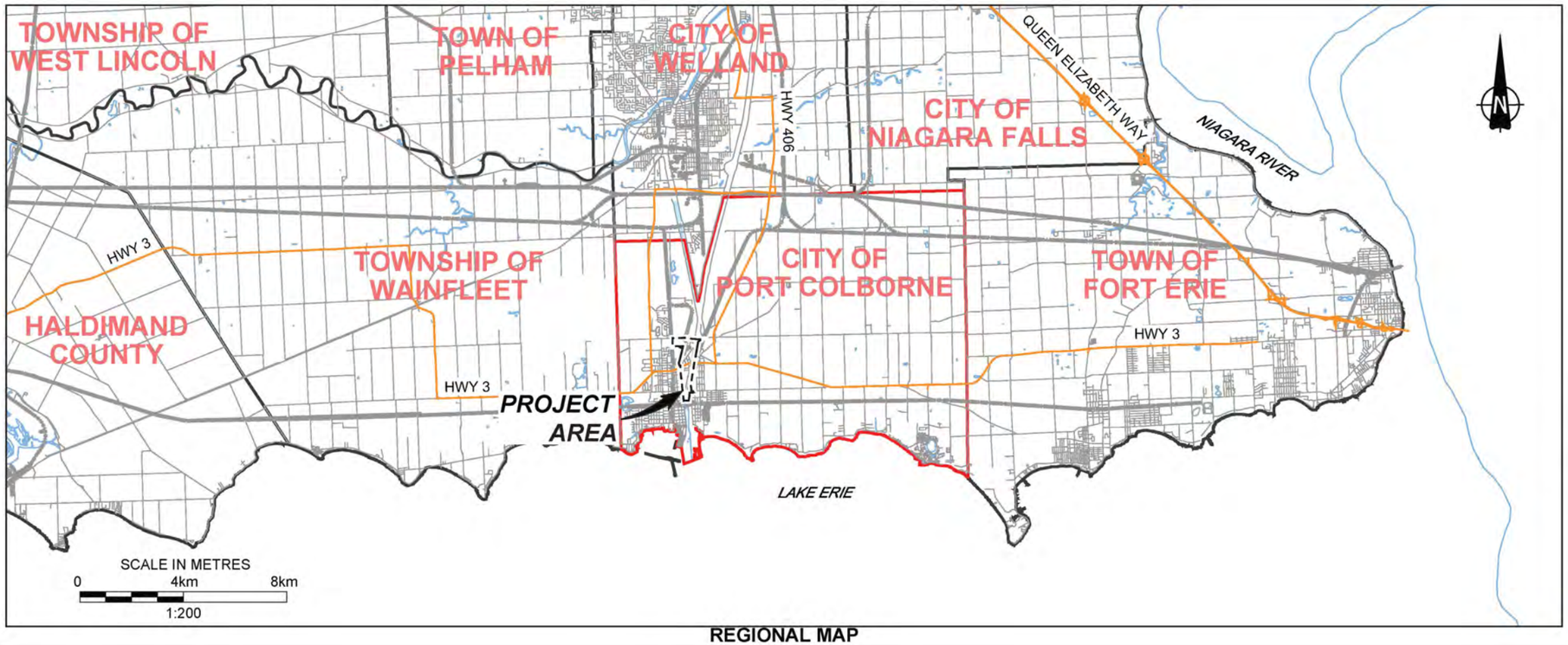
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7.0 MAPS

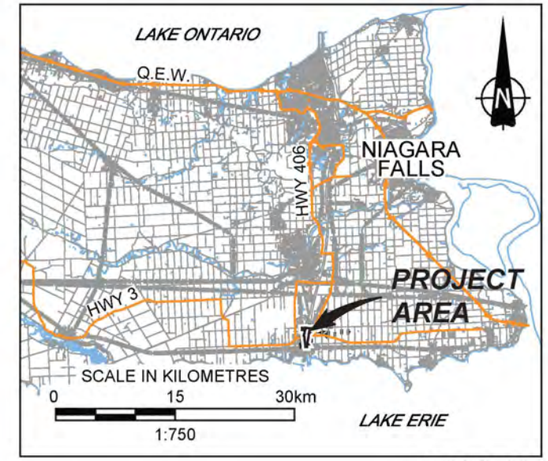
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AERIAL IMAGERY and OBM MAPPING



REGIONAL MAP



KEY PLAN

LEGEND

- 15m BUFFER FROM ALTERNATIVES (APPROXIMATE PROJECT AREA)

ROUTE ALTERNATIVES
- 1 - DO NOTHING / 4 - REHAB
- 2A - BARRICK ROAD CROSSING - ROW
- 2B - BARRICK ROAD CROSSING - SEAWAY
- 3 - NORTH ISLAND CROSSING

REGIONAL MAP
- APPROXIMATE PROJECT AREA
- CITY OF PORT COLBORNE BOUNDARY
- TOWNSHIP/MUNICIPALITY BOUNDARY
- WELLAND — TOWNSHIP/MUNICIPALITY

REFERENCE

DRAWING BASED ON MNR LIO, OBTAINED 2020, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020; AERIAL IMAGERY AND PARCEL DATA PROVIDED BY THE REGION OF NIAGARA; AND ROUTE ALTERNATIVES PROVIDED BY GM BLUEPLAN, SEPTEMBER 29 - 2020.

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

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EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE

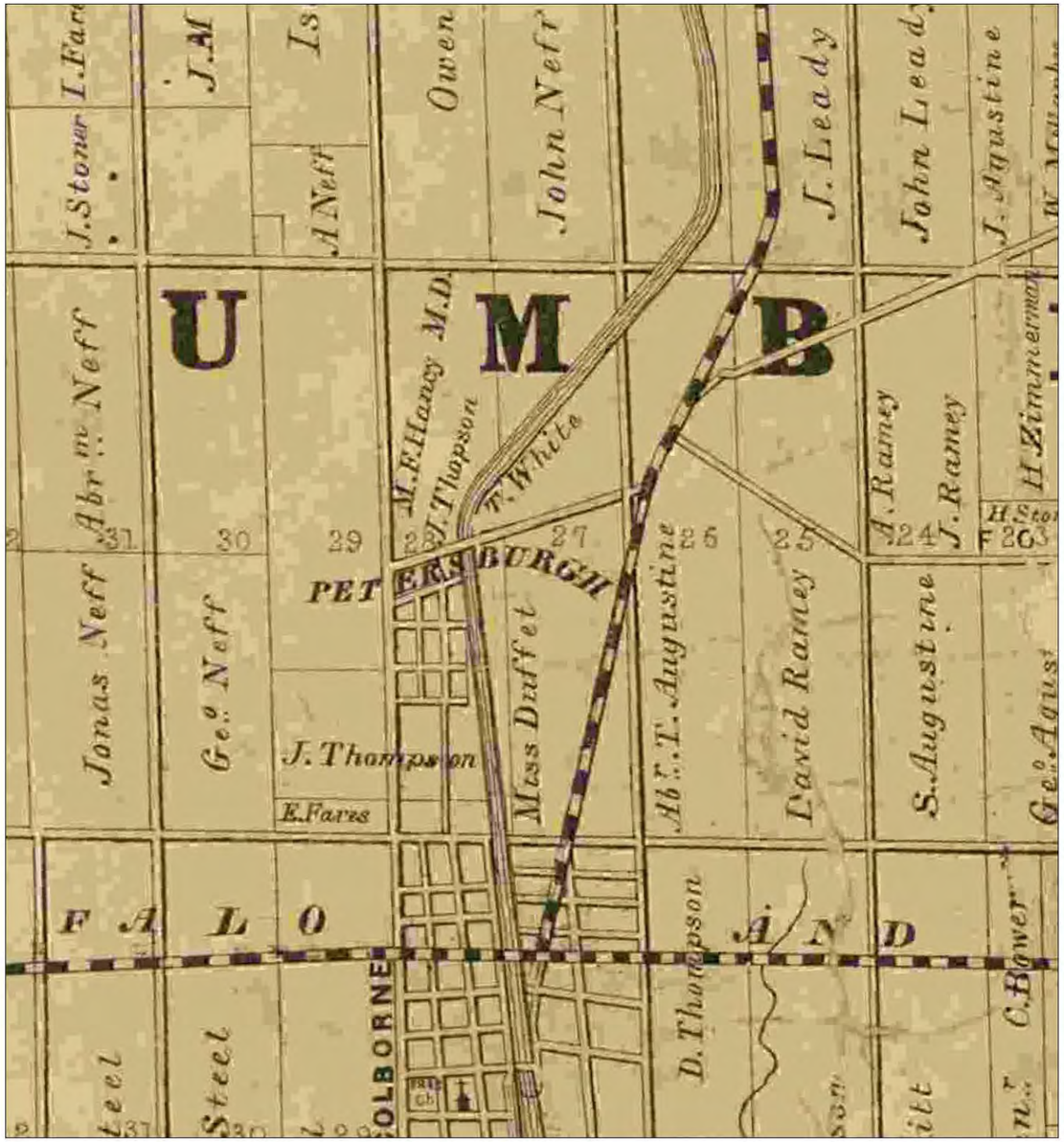
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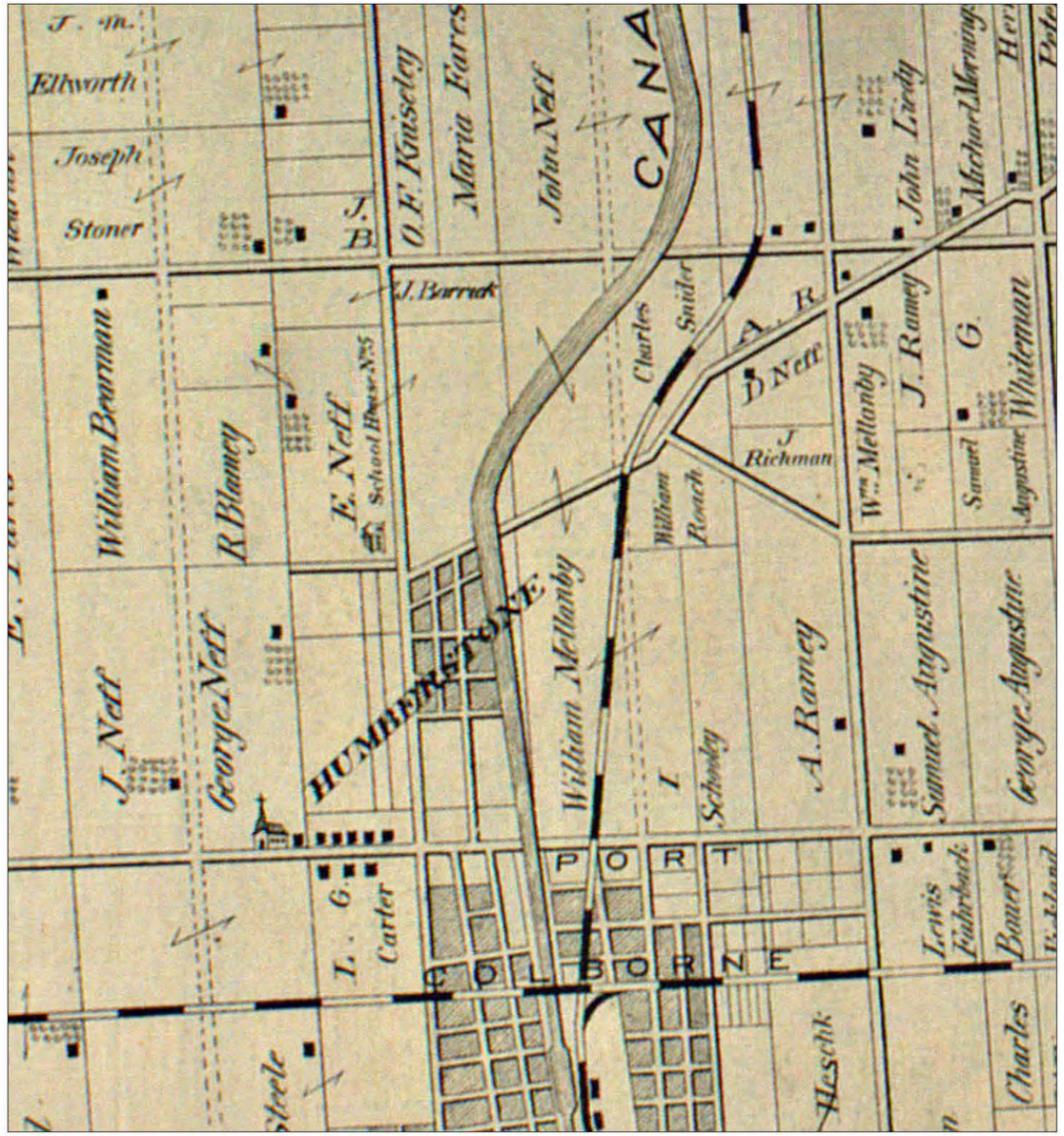
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1862



1876



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

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1876 ILLUSTRATED HISTORICAL ATLAS OF THE COUNTIES OF LINCOLN AND WELLAND, ONTARIO, COMPILED, DRAWN, AND PUBLISHED FROM PERSONAL EXAMINATIONS AND SURVEYS BY H.R. PAGE, TORONTO.

NOTES

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PROJECT

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EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE

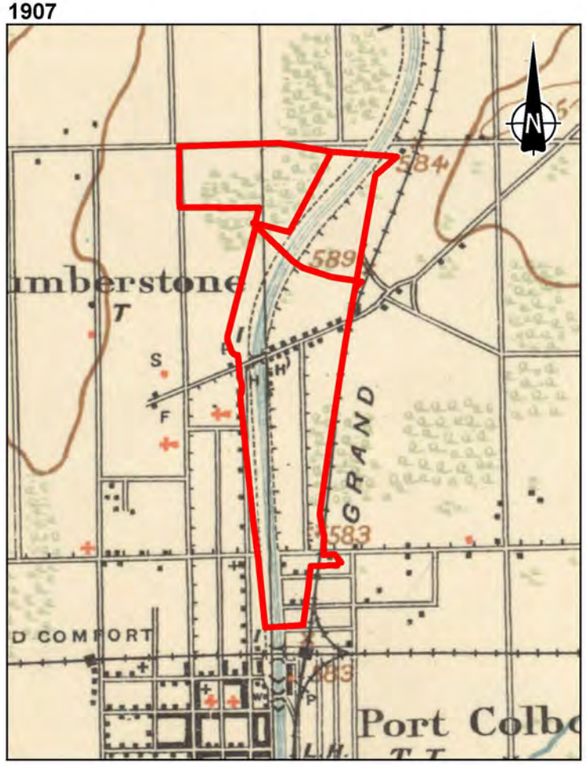
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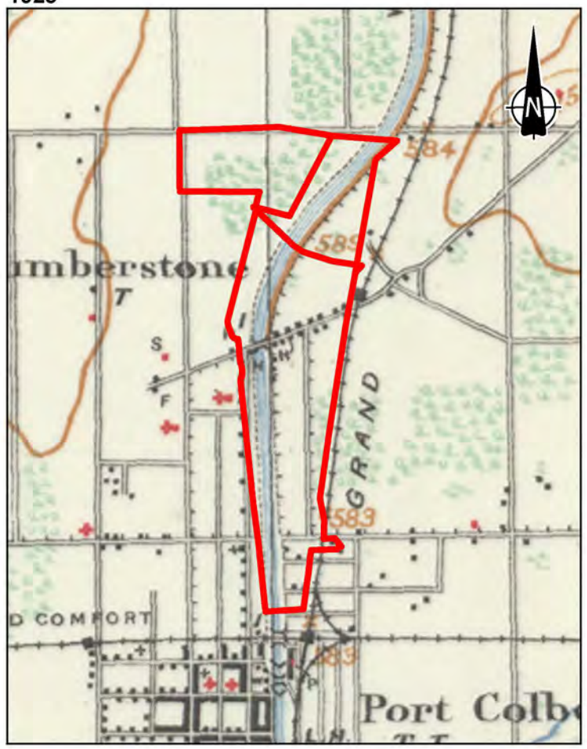
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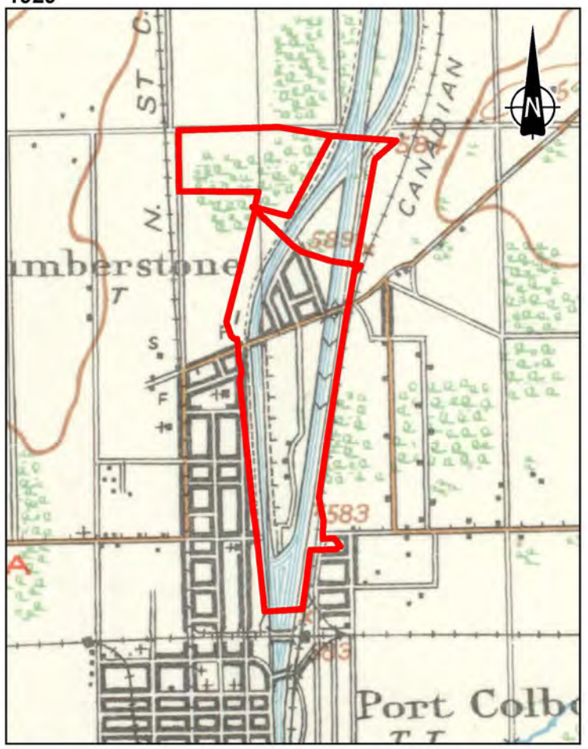
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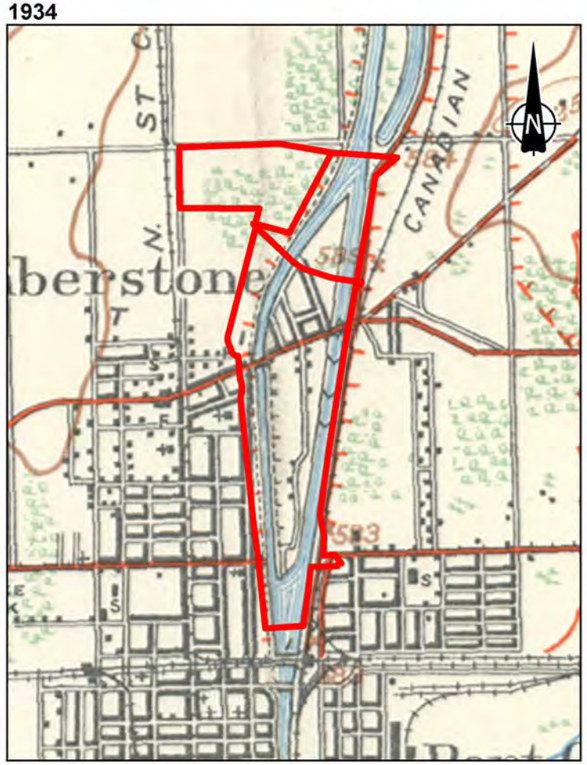
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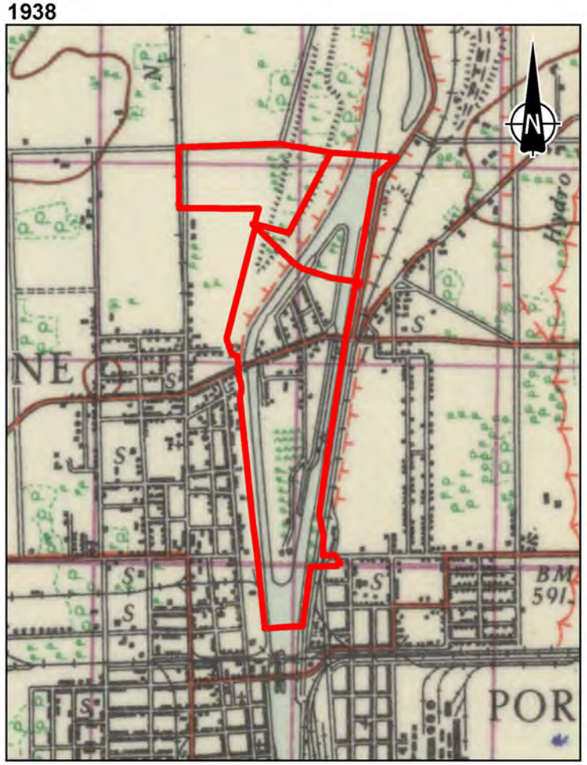
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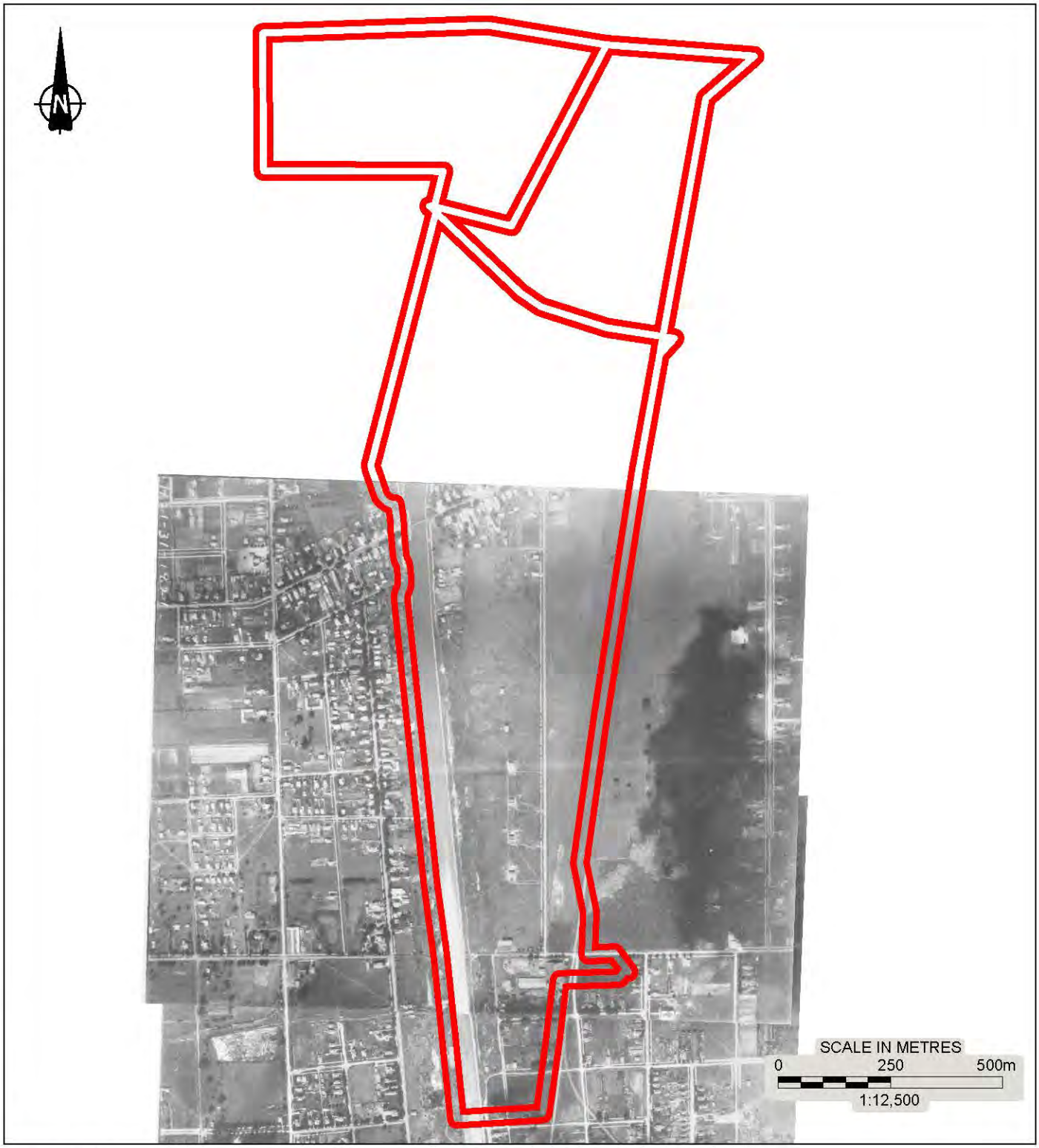
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EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE
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PROJECT

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EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE

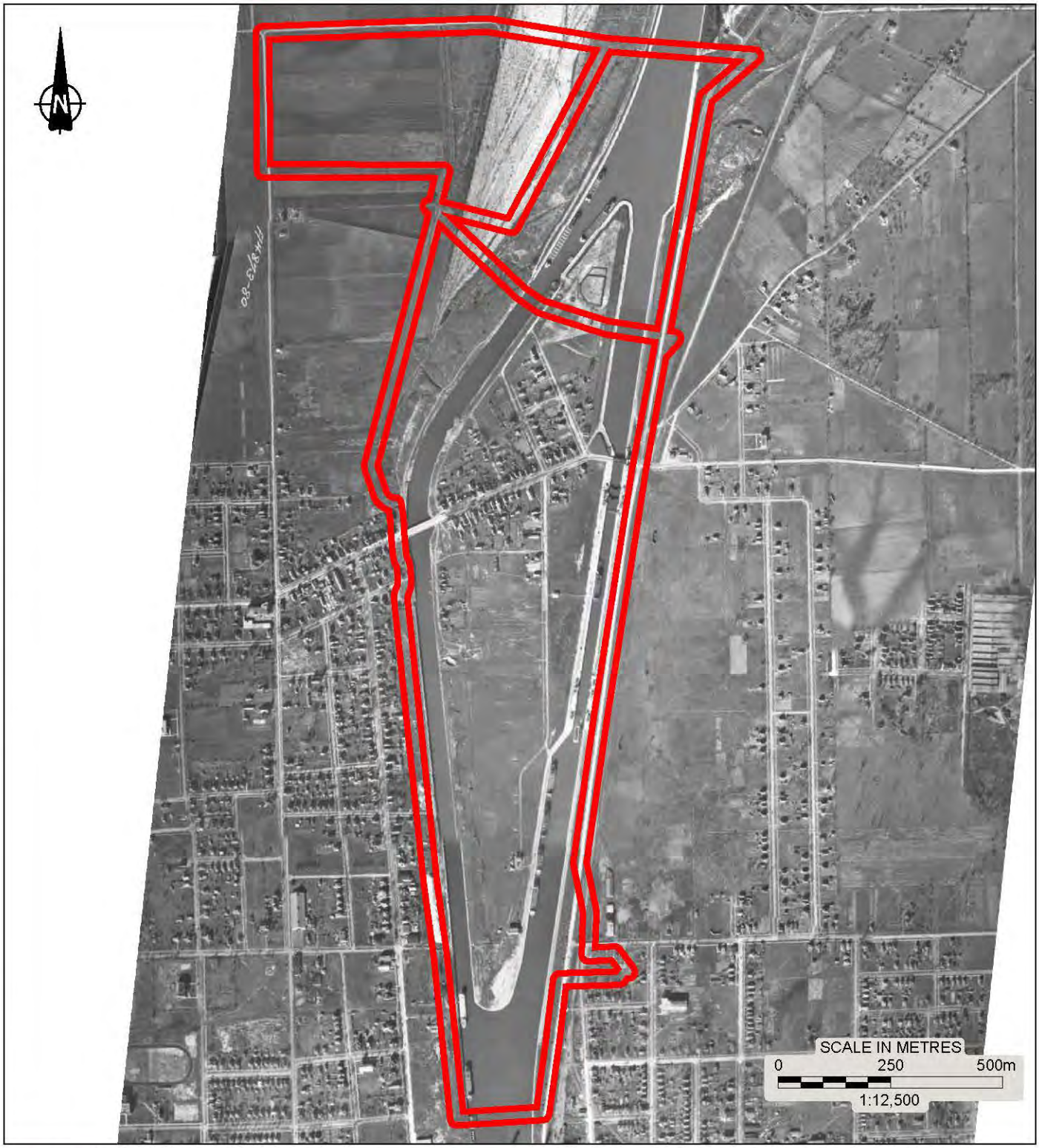
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MAP 4

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EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

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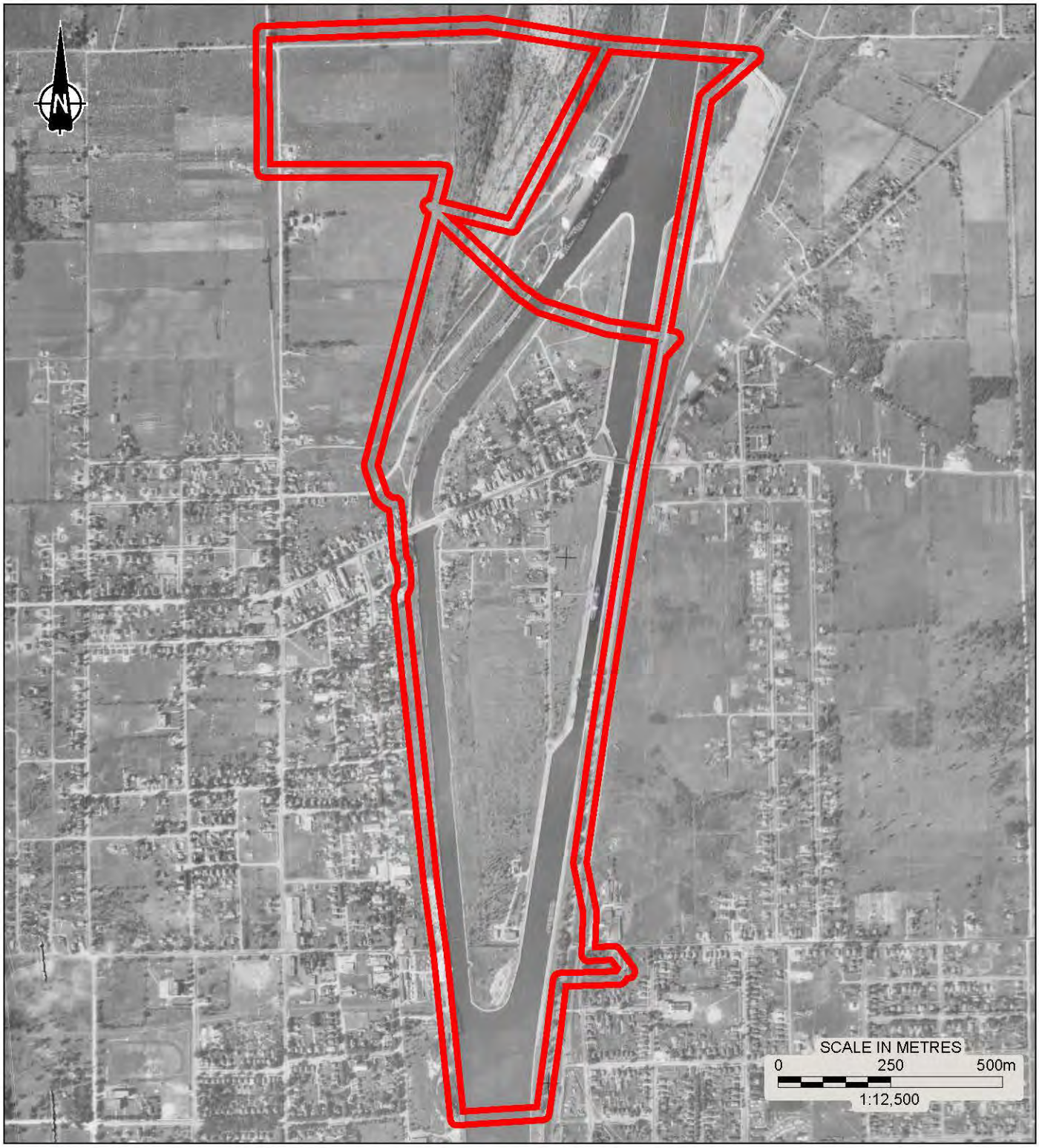
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MAP 5

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PORT COLBORNE, ONTARIO

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Drawing file: 20139291-1000-R01004.dwg



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

[NIAGARA AIR PHOTO DIGITAL IMAGES, 1968 SERIES]. [20444-35]. ST. CATHARINES, ON: BROCK UNIVERSITY MAPS, DATA & GIS, 2016. AVAILABLE: HTTPS://WWW.ARCGIS.COM/APPS/WEBAPPVIEWER/INDEX (ACCESSED 15/JAN/2021).

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

STAGE 1 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE

PROJECT AREA OVERLAID ON 1968 AERIAL PHOTOGRAPH

GOLDER

PROJECT No.		20139291	FILE No. 20139291-1000-R01004	
DESIGN			SCALE -S SHOWN	REV.
C-DD	-MS	Jan. 22/21		
CHECK			MAP 7	
REVIEW				

Client: Regional Municipality of Niagara
Original Format is Letter 279mm x 216mm
25mm
0
Jan 22, 2021 - 2:25pm
Drawing file: 20139291-1000-R01004.dwg

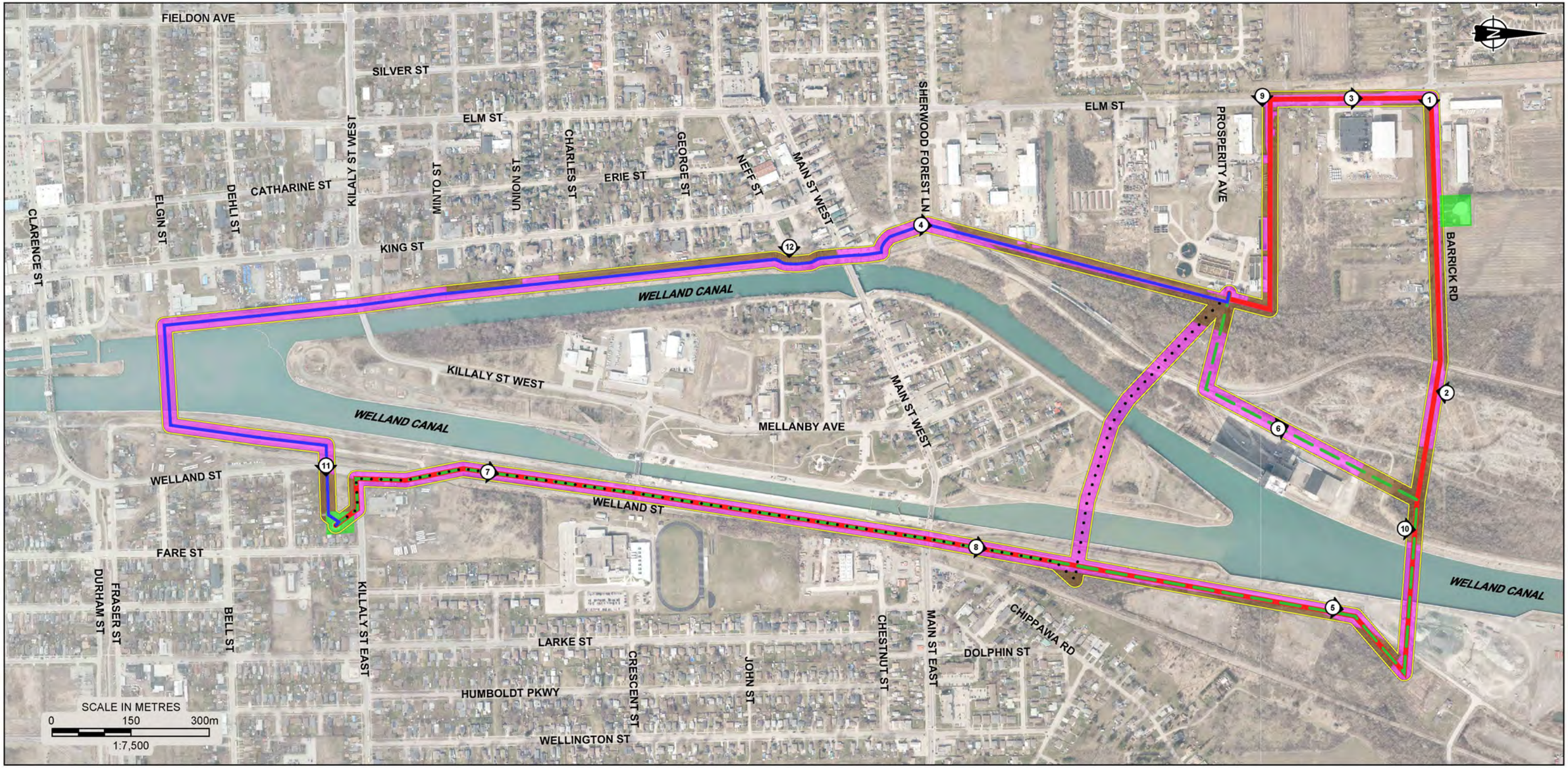
Client: Regional Municipality of Niagara

Original Format is Tabloid 279mm x 432mm

25mm 0

Feb 23, 2021 – 9:33am

Drawing file: 20139291-1000-R01008.dwg



LEGEND

15m BUFFER FROM ALTERNATIVES (APPROXIMATE PROJECT AREA)

ROUTE ALTERNATIVES
- 1 - DO NOTHING / 4 - REHAB
- 2A - BARRICK ROAD CROSSING - ROW
- 2B - BARRICK ROAD CROSSING - SEAWAY
- 3 - NORTH ISLAND CROSSING

STAGE 1 METHODS AND RESULTS:
- DISTURBED; NO FURTHER ARCHAEOLOGICAL CONCERN
- STAGE 2 TEST PIT SURVEY AT 5m INTERVALS RECOMMENDED
- PREVIOUSLY ASSESSED; NO FURTHER ARCHAEOLOGICAL CONCERN
- PHOTOGRAPH LOCATION, VIEWING DIRECTION, AND PLATE NUMBER

REFERENCE

DRAWING BASED ON AERIAL IMAGERY AND PARCEL DATA PROVIDED BY THE REGION OF NIAGARA; ROUTE ALTERNATIVES PROVIDED BY GM BLUEPLAN, SEPTEMBER 29 - 2020;

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
PORT COLBORNE QUARRY EXPANSION
CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

TITLE
STAGE 1 ARCHAEOLOGICAL ASSESSMENT RESULTS

GOLDER

PROJECT No. 20139291			FILE No.20139291-1000-R01008	
			SCALE AS SHOWN	REV.
CADD	AMS/DCH	Feb 24/21	MAP 8	
CHECK				

8.0 IMAGES



Image 1 View of disturbances associated with existing infrastructure (Barrick Road) and grassed margin identify as having - potential. Facing east.



Image 2 View of disturbances from grading and filling activities. Facing south.



Image 3 View of disturbances associated with existing infrastructure (Elm Street and utilities) and grassed margin to the left with archaeological potential. Facing north.



Image 4 View of disturbances associated with existing infrastructure (Sherwood Forest Lane and rail line) and areas of overgrown vegetation with archaeological potential. Facing slightly northeast.



Image 5 View of disturbances associated with existing infrastructure (Barber Drive and utilities). Facing slightly northeast.



Image 6 View of disturbances associated with grading and filling activities. Facing north.



Image 7 View of disturbances associated with existing infrastructure (Welland Street, rail line paved pathway, and Welland Canal). Facing slightly northeast.



Image 8 View of disturbances associated with existing infrastructure (Welland Street, rail line, paved pathway, and Welland Canal). Facing slightly northeast.



Image 9 View of grassed margin at 58 Prosperity Avenue identified as having archaeological potential. Facing east.



Image 10 View of overgrown/ treed areas identified as having archaeological potential. Facing north.



Image 11 View of grassed margin east of the existing East Side SPS pumping station identified as having archaeological potential. Facing east.



Image 12 View of grassed margin at the east end of Neff Street identified as having archaeological potential. Facing east.

Signature Page

Golder Associates Ltd.





Ragavan Nithiyanantham, MA, CAHP
Archaeologist/ Cultural Heritage Specialist

Michael Teal, MA
Associate, Senior Archaeologist

SN/RN/MT/ly

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https://golderassociates.sharepoint.com/sites/123072/project files/6 deliverables/01 stage 1 archaeological assessment/report/p390-0342-2020_23feb2021_re_st1_portcolborneeastsidesps.docx

APPENDIX A

Cultural Heritage Resources within 300 m of the project area

Table 4: Designated and listed cultural heritage resources within 300 m of the project area

Civic Address or Location	Description	Cultural Heritage Status
264 Barrick Road	Brick building, constructed in 1876	Heritage property listed (not designated) on the City *Heritage Registry*
315 Barrick Road	Regency architectural style, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
1 Borden Street	Regency architectural style, constructed in 1863	Heritage property listed (not designated) on the City *Heritage Registry*
25 Canal Bank Road	Stone-rock faced with brick construction, constructed in 1880	Heritage property listed (not designated) on the City *Heritage Registry*
35 Canal Bank Road	Plaster/stucco, constructed in 1910	Heritage property listed (not designated) on the City *Heritage Registry*
37 Canal Bank Road	Plaster/stucco, constructed in 1877	Heritage property listed (not designated) on the City *Heritage Registry*
45 Canal Bank Road	Regency architectural style, wood frame, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
304 Catherine Street	Regency architectural style, stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
310 Catherine Street	Asbestos cement sheet, wood frame, constructed in 1876	Heritage property listed (not designated) on the City *Heritage Registry*
326 Catherine Street	High Victorian architectural style, brick upper, stucco lower, constructed in 1910	Heritage property listed (not designated) on the City *Heritage Registry*
346 Catherine Street	St. James Rectory, brick stretcher bond, constructed in 1874	Protected heritage property designated under Part IV of the *OHA,* designated in 1988 (By-law 446-93)
358 Catherine Street	Stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
42 Charles Street	Clapboard with wood frame, constructed in 1900	Heritage property listed (not designated) on the City *Heritage Registry*
44 Charles Street	Stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
66 Charles Street	Regency architectural style, constructed in 1895	Heritage property listed (not designated) on the City *Heritage Registry*
153 Chippawa Road	Stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
24 Church Street	Regency architectural style, constructed in 1899	Heritage property listed (not designated) on the City *Heritage Registry*
28 Church Street	Regency architectural style, constructed 1910	Heritage property listed (not designated) on the City *Heritage Registry*
1 Clarence Street	Stucco, constructed in 1928	Heritage property listed (not designated) on the City *Heritage Registry*
67 Clarence Street	Brick, constructed in 1923	Heritage property listed (not designated) on the City *Heritage Registry*
795 Elm Street	Classic Revival architectural style, constructed in 1800	Heritage property listed (not designated) on the City *Heritage Registry*
803 Elm Street	Classic Revival architectural style, constructed 1870	Heritage property listed (not designated) on the City *Heritage Registry*
825 Elm Street	Shingle, sheathed, wood frame, constructed 1885	Heritage property listed (not designated) on the City *Heritage Registry*
344 Fares Street	Regency architectural style, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
349 Fares Street	Aluminum siding, sheathed, nailed frame, constructed in 1850	Heritage property listed (not designated) on the City *Heritage Registry*
367 Fares Street	Horizontal plank wood, constructed 1904	Heritage property listed (not designated) on the City *Heritage Registry*
379 Fares Street	Plaster/stucco, constructed in 1875	Heritage property listed (not designated) on the City *Heritage Registry*
443 Fares Street	DeWitt Carter Public School, brick sheathed, constructed in 1912	Heritage property listed (not designated) on the City *Heritage Registry*
447 Fare Street	Brick, unknown construction date	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
76/80 Fraser Street	Classic Revival architecture style, plaster/stucco, constructed 1879	Heritage property listed (not designated) on the City *Heritage Registry*
33 George Street	Plaster/stucco, constructed in 1902	Heritage property listed (not designated) on the City *Heritage Registry*
34 George Street	Classic Revival architecture style, tile, sheathed, foundation is squared rubble, constructed in1896	Heritage property listed (not designated) on the City *Heritage Registry*
41 George Street	Plaster/stucco, constructed in 1900	Heritage property listed (not designated) on the City *Heritage Registry*
62 George Street	Classic Revival architecture style, clapboard, not sheathed, foundation is squared rubble, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
135 Killaly Street West	Brick, constructed in 1865	Heritage property listed (not designated) on the City *Heritage Registry*
239 King Street	Brick, constructed in 1925	Heritage property listed (not designated) on the City *Heritage Registry*
265 King Street	Brick, constructed in 1925	Heritage property listed (not designated) on the City *Heritage Registry*
280 King Street	PC Historical & Marine Museum, Georgian architectural style, clapboard with glued/laminated frame, constructed in 1896	Heritage property listed (not designated) on the City *Heritage Registry*
293 King Street	Chickluna Garagae, California Mission architectural style, stucco, built in 1925	Protected heritage property designated under Part IV of the *OHA,* federally designated (By-law 446-93)
322 King Street	Ingleside, unknown date of construction	Protected heritage property designated under Part IV of the *OHA,* designated in 1987 (By-law 446-93)
354 King Street	Beaux Arts architectural style, brick, constructed in 1917	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
368 King Street	Stretcher bond brick, constructed in 1873	Heritage property listed (not designated) on the City *Heritage Registry*
380 King Street	Thomas E Reeb, Romanesque Revival architectural style, brick, constructed in 1909	Protected heritage property designated under Part IV of the *OHA,* designated in 1994 (By-law 446-93)
422 King Street	McNabb Lodge, Classic Revival architectural style, constructed in 1926	Heritage property listed (not designated) on the City *Heritage Registry*
518 King Street	The Ott House, brick, squared rubble foundation, constructed in 1863	Protected heritage property designated under Part IV of the *OHA,* designated in 1983 (By-law 446-93)
521 King Street	Stucco, constructed in 1905	Heritage property listed (not designated) on the City *Heritage Registry*
524 King Street	Brick, constructed in 1908	Heritage property listed (not designated) on the City *Heritage Registry*
530 King Street	Aluminum siding, constructed 1910	Heritage property listed (not designated) on the City *Heritage Registry*
537 King Street	Regency architectural style, stucco, constructed in 1895	Heritage property listed (not designated) on the City *Heritage Registry*
547 King Street	Stucco, constructed 1905	Heritage property listed (not designated) on the City *Heritage Registry*
548/550 King Street	Plaster/stucco, constructed in 1905	Heritage property listed (not designated) on the City *Heritage Registry*
561 King Street	Boomtown, stretcher bond, constructed 1900	Heritage property listed (not designated) on the City *Heritage Registry*
593 King Street (also known as 589 King Street)	Brick-stretcher bond, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
599 King Street	Classic Revival and Regency architectural styles, shingle exterior, constructed in 1880	Heritage property listed (not designated) on the City *Heritage Registry*
602 King Street	Brick, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
605/607 King Street	Plaster/stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
613 King Street	Classic Revival architectural style, clapboard, constructed in 1919	Heritage property listed (not designated) on the City *Heritage Registry*
620 King Street	Stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
625 King Street	Stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
626 King Street	Classic Revival architectural style, aluminum siding, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
632 King Street	Classic Revival architectural style, clapboard, constructed in 1875	Heritage property listed (not designated) on the City *Heritage Registry*
640 King Street	Queen Anne Revival architectural style, clapboard, constructed in 1875	Heritage property listed (not designated) on the City *Heritage Registry*
646 King Street	Classic Revival architectural style, plaster/stucco, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
664 King Street	Classic Revival architectural style, aluminum siding, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
665 King Street	Classic Revival variation architectural style, plaster/stucco, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
675 King Street	Classic Revival architectural style, aluminum siding, flint and cobble foundation, constructed 1890	Heritage property listed (not designated) on the City *Heritage Registry*
681 King Street	Classic Revival architectural style, stretcher bond brick,	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
	rubble foundation, constructed in 1890	
688 King Street	Classic Revival architectural style, plaster/stucco, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
693 King Street	Clapboard, squared rubble foundation, constructed in 1900	Heritage property listed (not designated) on the City *Heritage Registry*
698 King Street	Classic Revival architectural style, plaster/stucco, constructed in 1885	Heritage property listed (not designated) on the City *Heritage Registry*
707 King Street	No details available for style of construction, constructed in 1877	Heritage property listed (not designated) on the City *Heritage Registry*
720 King Street	Plaster/stucco, constructed 1880	Heritage property listed (not designated) on the City *Heritage Registry*
725 King Street	Plaster/stucco, constructed 1902	Heritage property listed (not designated) on the City *Heritage Registry*
740 King Street	No details available for style of construction, constructed in 1862	Heritage property listed (not designated) on the City *Heritage Registry*
747 King Street	Classic Revival architectural style, clapboard, constructed in 1902	Heritage property listed (not designated) on the City *Heritage Registry*
748 King Street	Plaster/stucco, squared limestone rubble foundation, constructed in 1885	Heritage property listed (not designated) on the City *Heritage Registry*
755 King Street	Clapboard, constructed 1900	Heritage property listed (not designated) on the City *Heritage Registry*
761 King Street	Classic Revival architectural style, stretcher bond brick, constructed in 1900	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
765 King Street	Classic Revival architectural style, plaster/stucco, constructed in 1900	Heritage property listed (not designated) on the City *Heritage Registry*
771 King Street	Clapboard, random rubble foundation, constructed in 1871	Heritage property listed (not designated) on the City *Heritage Registry*
774 King Street	Plaster/stucco, constructed in 1894	Heritage property listed (not designated) on the City *Heritage Registry*
782 King Street	Classic Revival architectural style, aluminum siding, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
783 King Street	Classic Revival architectural style, aluminum siding, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
786 King Street	Classic Revival architectural style, clapboard, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
791 King Street	Classic Revival architectural style, clapboard, constructed in 1855	Heritage property listed (not designated) on the City *Heritage Registry*
803 King Street	Brick, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
821 King Street	Classic Revival architectural style, plaster/stucco, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
27 Main Street West	Clapboard, constructed in 1902	Heritage property listed (not designated) on the City *Heritage Registry*
37 Main Street West	Classic Revival architectural style, aluminum siding, constructed in 1902	Heritage property listed (not designated) on the City *Heritage Registry*
45 Main Street West	Stucco, constructed in 1912	Heritage property listed (not designated) on the City *Heritage Registry*
53 Main Street West	Shingle, constructed in 1910	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
56 Main Street West	Classic Revival architectural style, siding, constructed in 1912	Heritage property listed (not designated) on the City *Heritage Registry*
76 Main Street West	Humberstone Hall, Classic Revival architectural style, squared rubble foundation, constructed in 1852	Protected heritage property designated under Part IV of the *OHA,* designated in 1982 (By-law 446-93)
85 Main Street West	Composition shingle or sheet, constructed in 1902	Heritage property listed (not designated) on the City *Heritage Registry*
91 Main Street West	Common brick bond, constructed in 1874	Heritage property listed (not designated) on the City *Heritage Registry*
100 Main Street West	Stretcher bond brick, constructed in 1875	Heritage property listed (not designated) on the City *Heritage Registry*
105 Main Street West	Stretcher bond brick, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
106 Main Street West	Classic Revival architectural style, stretcher bond brick, constructed in 1875	Heritage property listed (not designated) on the City *Heritage Registry*
114 Main Street West	Flint/cobble foundation, visible wood beams, stretcher bond brick, constructed in 1874	Heritage property listed (not designated) on the City *Heritage Registry*
115 Main Street West	Italianate architectural style, stucco and brick on sides, constructed in 1875	Heritage property listed (not designated) on the City *Heritage Registry*
120 Main Street West	Random rubble foundation, stretcher bond brick, constructed in 1870	Heritage property listed (not designated) on the City *Heritage Registry*
124 Main Street West	Squared rubble foundation, clapboard, constructed in 1896	Heritage property listed (not designated) on the City *Heritage Registry*
129 Main Street West	No details provided, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
130 Main Street West	Classic Revival architectural style, brick, random rubble foundation, constructed in 1862	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
142 Main Street West	Appleyard House, plaster/stucco, nailed pine board frame, constructed in 1885	Heritage property listed (not designated) on the City *Heritage Registry*
145 Main Street West	Elias Augustine House, Classic Revival variation, common bond brick, constructed in 1872	Protected heritage property designated under Part IV of the *OHA,* designated in 1986 (By-law 446-93)
155 Main Street West	The Century House, Classic Revival architectural style, plaster/stucco, constructed in 1896	Protected heritage property designated under Part IV of the *OHA,* designated in 2006 (By-law 446-93)
185 Main Street West	Boomtown architectural style, aluminum siding, constructed in 1880	Heritage property listed (not designated) on the City *Heritage Registry*
189 Main Street West	Panel/plywood, constructed in 1877	Heritage property listed (not designated) on the City *Heritage Registry*
196 Main Street West	Classic Revival architectural style, constructed in 1880	Heritage property listed (not designated) on the City *Heritage Registry*
201 Main Street West	Boomtown architectural style, stretcher bond brick, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
202 Main Street West	No details provided, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
207 Main Street West	Classic Revival architectural style, stretcher bond brick, constructed in 1870 (with modern addition)	Heritage property listed (not designated) on the City *Heritage Registry*
220 Main Street West	Regency Commercial building, stretcher bond brick, plaster/stucco, constructed in 1909	Heritage property listed (not designated) on the City *Heritage Registry*
223 Main Street West	Classic Revival (behind), Boomtown (front) architectural styles, stretcher bond brick, constructed in 1887	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
229 Main Street West	Plaster/stucco, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
237 Main Street West	Classic Revival architectural style, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
247 Main Street West	Natural stone, original house is brick, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
255 Main Street West	Brick, upper half siding, constructed in 1913	Heritage property listed (not designated) on the City *Heritage Registry*
256 Main Street West	Classic Revival, stretcher bond brick, constructed in 1870	Heritage property listed (not designated) on the City *Heritage Registry*
280 Main Street West	Classic Revival (on ½ of building), composition shingle or sheet, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
296 Main Street West	Regency variation, plaster/stucco, constructed in 1880	Heritage property listed (not designated) on the City *Heritage Registry*
9 Neff Road	Classic Revival variation architectural style, plaster/stucco, constructed in 1900	Heritage property listed (not designated) on the City *Heritage Registry*
27 Neff Road	Plaster/stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
50 Neff Road	Georgian Tradition architectural style, stretcher bond brick, wall construction is stone, constructed in 1848	Heritage property listed (not designated) on the City *Heritage Registry*
58 Neff Road	Brick, constructed in 1910	Heritage property listed (not designated) on the City *Heritage Registry*
86/88 Neff Road	Clapboard, constructed in 1860	Heritage property listed (not designated) on the City *Heritage Registry*
146 Neff Road	Clapboard, constructed in 1902	Heritage property listed (not designated) on the City *Heritage Registry*

Civic Address or Location	Description	Cultural Heritage Status
79 St. Arnaud Street	Stucco, unknown date of construction	Heritage property listed (not designated) on the City *Heritage Registry*
110 St. Arnaud Street	Classic Revival architectural style, stucco, constructed in 1880	Heritage property listed (not designated) on the City *Heritage Registry*
43 Union Street	Aluminum siding, constructed in 1900	Heritage property listed (not designated) on the City *Heritage Registry*
247 Welland Street	Brick, stucco, aluminum siding, constructed in 1900	Heritage property listed (not designated) on the City *Heritage Registry*
281 Welland Street	Classic Revival variation architectural style, aluminum siding, constructed in1900	Heritage property listed (not designated) on the City *Heritage Registry*
289 Welland Street	Classic Revival, plaster/stucco, constructed in 1875	Heritage property listed (not designated) on the City *Heritage Registry*
293 Welland Street	Aluminum siding, constructed in 1880	Heritage property listed (not designated) on the City *Heritage Registry*
323 Welland Street	Boomtown architectural style, plaster/stucco, constructed in 1890	Heritage property listed (not designated) on the City *Heritage Registry*
327 Welland Street	Aluminum siding, constructed in 1875	Heritage property listed (not designated) on the City *Heritage Registry*
331 Welland Street	Clapboard, constructed in 1880	Heritage property listed (not designated) on the City *Heritage Registry*
256 West Street	No details provided, constructed in 1924	Heritage property listed (not designated) on the City *Heritage Registry*

Table 5: Cultural heritage landmarks within 3000 m of the project area

Name	Description	Location
Locks 26 & 27	Lock 27 was constructed in 1850, operating as a ‘lift lock’, measuring 46 m in length at the time of construction.	Clarence Street and West Street

Name	Description	Location
	Lock 26 was constructed in the 1880's, built directly beside Lock 27, to regulate the seasonally fluctuating levels of Lake Erie	
Weir Channels	Constructed in the 1880's to provide a supply of water to the lift locks	Clarence Street and West Street, parallel to Lock 27
Clarence Street Lift Bridge (Bridge 21)	Constructed in 1929, uses electric motors and counterweights to raise and lower the bridge over Locks 26 & 27	North of Clarence Street
The Island	Constructed in the early 20th century to create a more direct eastern channel. The construction was completed in 1932	North of Clarence Street
Weir Dam	Constructed as part of the of the fourth iteration of the Welland Canal ca. 1972.	Crossing the Canal on Main Street West
Lock 8 and Lock 8 Gateway	Serving as a guard lock for the canal, measuring 420 m in length and is one of the longest canal locks in the world	Situated on the east side of the Island, south of Main Street West.
Ramey's Bend	The area in which the old canal meets the fourth iteration of the canal built in 1972.	North of the island, adjacent to Barber Dr on the east, and Omer Avenue on the west.
Old Robin Hood Flour Mill	Constructed in the 1940's to meet the growing demand for flour during the Second World War.	Situated on the west bank of the Welland Canal, north of the Island, along Omer Avenue.



golder.com

GOLDER
MEMBER OF WSP

ORIGINAL REPORT

Stage 2 Archaeological Assessment

Eastside Sewage Pumping Station Forcemain Replacement, parts of Lot 27, Concession 1 and Lots 26-28, Concession 2, Geographic Township of Humberstone, former County of Welland, City of Port Colborne, Regional Municipality of Niagara, Ontario

PIF Number: P390-0357-2021
Licensee: Nimal Ragavan Nithiyanantham (P390), MA, CAHP

Submitted to:

Niagara Region

1815 Sir Isaac Brock Way
P.O. Box 1042
Thorold, Ontario
L2V4T7

Submitted by:

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20139291-3000

18 October 2021

Distribution List

1 e-copy: Niagara Region

1 e-copy: Ministry of Heritage, Sport, Tourism and Culture Industries

1 e-copy: Golder Associates Ltd.

Executive Summary

The Executive Summary highlights key points from the report only, for complete information and findings as well as limitations, the reader should examine the complete report.

In 2020, Golder Associates Ltd. (Golder) was retained by Niagara Region to conduct a Stage 1 archaeological assessment in support the Municipal Class Environmental Assessment (MCEA) Study to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain in the City of Port Colborne (the Project). The Project evaluated four alternative routes generally bound by Barrick Road on the north, Highway 140/Elizabeth Street on the east, Lakeshore Road East and Kent Street on the south, and Fielden Avenue on the west. The Stage 1 archaeological assessment determined that parts of three of the four alternative route options retained archaeological potential and recommended a Stage 2 archaeological assessment (Golder 2021).

Based on the finds of the route evaluation, the Barrick Road Crossing – Seaway (Alternative Route 2B) was selected to be the preferred route. The Barrick Road Crossing – Seaway route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the Wellend Canal north of The Island to Barrick Road, southwest through 2 Sherwood Forest Lane, and west to the Seaway Wastewater Treatment Plant.

To facilitate this Project, Golder was subsequently retained by Niagara Region to conduct as Stage 2 archaeological assessment for the Barrick Road Crossing – Seaway (Map 1), referred to in this report as the “project area”. The project area is within part of Lot 27, Concession 1 and parts of Lots 26-28, Concession 2 in the Geographic Township of Humberstone, former County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

The Stage 2 archaeological assessment of the project area involved test survey at 5 m and 10 m intervals within identified areas of archaeological potential per section 2.1.2 and 2.1.8 of the Ministry of Heritage, Sport, Tourism, and Culture Industries’ MHSTCI 2011 *Standard and Guidelines for Consultant Archaeologists*. No archaeological resources were discovered during the Stage 2 archaeological assessment.

Based on the results of the Stage 2 archaeological assessment of the project area the following recommendation is provided:

1) The project area is considered free of archaeological concern. No further archaeological investigation is recommended.

The MHSTCI is requested to review, and provide a letter indicating their satisfaction with the results and recommendations presented herein, with regard to the 2011 Standards and Guidelines for Consultant Archaeologists and the terms and conditions for archaeological licences, and to enter this report into the Ontario Public Register of Archaeological Reports.

Study Limitations

Golder has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the archaeological profession currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty expressed or implied is made.

This report has been prepared for the specific site, design objective, developments, and purpose described to Golder by Niagara Region (the Client). The factual data, interpretations, and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location.

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Special risks occur whenever archaeological investigations are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain archaeological resources. The sampling strategies incorporated in this study, if any, comply with those identified in the Ministry of Tourism, Culture and Sport's 2011 *Standards and Guidelines for Consultant Archaeologists.*

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APPENDICES

APPENDIX A
City of Port Colborne - Heritage Property Registry

1.0 PROJECT CONTEXT

1.1 Development Context

In 2020, Golder Associates Ltd. (Golder) was retained by Niagara Region to conduct a Stage 1 archaeological assessment in support the Municipal Class Environmental Assessment (MCEA) Study to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain in the City of Port Colborne (the Project). The Project evaluated four alternative routes generally bound by Barrick Road on the north, Highway 140/Elizabeth Street on the east, Lakeshore Road East and Kent Street on the south, and Fielden Avenue on the west. The Stage 1 archaeological assessment determined that parts of three of the four alternative route options retained archaeological potential and recommended a Stage 2 archaeological assessment (Golder 2021).

Based on the finds of the route evaluation, the Barrick Road Crossing – Seaway (Alternative Route 2B) was selected to be the preferred route. The Barrick Road Crossing – Seaway route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the Wellend Canal north of The Island to Barrick Road, southwest through 2 Sherwood Forest Lane, and west to the Seaway Wastewater Treatment Plant.

To facilitate this Project, Golder was subsequently retained by Niagara Region to conduct as Stage 2 archaeological assessment for the Barrick Road Crossing – Seaway (Map 1), referred to in this report as the "project area". The project area is within part of Lot 27, Concession 1 and parts of Lots 26-28, Concession 2 in the Geographic Township of Humberstone, former County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

This Stage 2 archaeological assessment was conducted under professional archaeological consultant licensee, Nimal Ragavan Nithiyanantham (P390). Permission to investigation the project area was provided by Niagara Region.

1.2 Objectives

The objectives of this Stage 2 archaeological assessment, as outlined by the 2011 *Standards and Guidelines for Consultant Archaeologists* published by the *Ministry of Heritage, Sport, Tourism and Cultural Industries* (MHSTC1) (2011), are as follows:

- To provide information about the project area's geography, geology, history, previous archaeological fieldwork and current land condition.
- To document all archaeological resources within the project area through appropriate survey methodology.
- To evaluate the cultural heritage value or interest (CHVI) of any discovered archaeological resources and determine if they require further assessment.
- To recommend appropriate Stage 3 assessment strategies for any archaeological sites that have been identified as possessing CHVI.

1.3 Historical Context

To establish the historical context of the project area, a review of the geological history as well as the Indigenous settlement and historical Euro-Canadian colonization history was undertaken. This information is presented below in chronological order and is primarily based on data collected by academic and consulting archaeologists.

1.3.1 Geological History

By around 12,250 BP, the Laurentide ice sheet, which had once covered all of Canada and a large portion of northern United States, had retreated out of south-central Ontario, and what is now the north shore of Lake Ontario and the surrounding river systems feeding into it from the north were predominately ice-free. At this time, the Huron/Georgian Bay basin was occupied by proglacial Lake Algonquin, while the Ontario basin contained proglacial Lake Iroquois. As the glacial ice retreated northward, melt waters began to flow down through what became Lake Erie, the Niagara River and Lake Ontario, down to the St. Lawrence River and on to the Atlantic Ocean. There were originally five spillways from Lake Erie to Lake Ontario, however these five were eventually reduced to one, the original Niagara Falls, at the escarpment at Queenston-Lewiston. From here, the falls began its steady erosion through the bedrock. However, by about 10,500 years ago, through an interplay of geological effects including alternating retreats and re-advances of the ice and rebounding of the land when released from the intense pressure of the ice (isostatic rebound), this process was interrupted. The glacial melt waters were rerouted through northern Ontario, bypassing the southern route. For the next 5,000 years, Lake Erie remained only half the size it is today, the Niagara River was reduced to about 10 percent of its current flow, and a much-reduced Niagara Falls stalled in the area of the Niagara Glen. About 5,500 years ago, the melt waters were once again routed through Southern Ontario, restoring the Niagara River and Nagara Falls to their full power (Niagara Parks 2020). Water flowing within and off the glaciers formed glaciofluvial deposits: outwash plains, meltwater channels, kame moraines and eskers, all visible in the vicinity of the Project Area. When glacial runoff was blocked and lakes were created, fine clays, silts and sands, called lacustrine deposits, were laid down (Chapman and Putman, 1984). Where arms of the glaciers met and where the edge of the glacial advance extended to, thick sand and gravel deposits formed hilly areas called moraines. Whaleback-shaped hills called drumlins formed during the advance of the glaciers and the axis of their orientation indicates the direction of movement of the glacier that deposited them.

Beginning around 12,000 BP after the glacial retreat, water levels started to drop, and this region would have technically become habitable. By about 11,500 BP, when the St. Lawrence River outlet became established, the initial phase of Lake Ontario began, and this low water phase appears to have lasted until at least 10,500 BP. At this time the waters stood approximately 328 feet below current levels. Isostatic uplift had started to raise the outlet around Kingston so that by 10,000 BP the water level had risen to approximately 262 feet below present levels. Uplift has continued to tilt Lake Ontario upward to the northeast, propagating a gradual and transgressive expansion throughout the Lake Ontario basin (Anderson and Lewis 1985; Karrow 1967:49; Karrow and Warner 1990). Over the next 7,000 years or so the water levels of these lakes fluctuated significantly due to the continued retreat of glacial ice, followed by localized periods of glacial re-advance. The combined effect this had was to extend or reduce the total length and breadth of these waterways. Increases in water levels shortened the waterway as it became covered with water, while decreases in water levels caused rivers to extend across newly exposed areas (Karrow et al 1975; CRW NAI 2011). Present levels were reached as recently as 5,050 BP (3,050 BCE) (Roberts 1985:22-23).

1.3.2 Environmental Change

Palynological evidence for south Ontario suggests that vegetation dominated by spruce and sedge grasses covered the region from deglaciation to about 10,550 to 10,050 BP (McAndrews 1981:330, 1985:241; Yu and McAndrews 1994:142). This tundra-like environment was succeeded by boreal forest dominated first by jack and red pine and later by white pine until 7,500 to 7,050 BP. Mixed forest characterized by hemlock, beech, pine, elm, and maple followed up to the historical period when Euro-Canadian agriculture was introduced. The project area falls within the Lake Erie Lowland Ecoregion. Climax vegetation in this Ecoregion is characterized by sugar maple, beech, white and red oak, shagbark hickory, black walnut, and butternut. Moist sites are characterized by white

elm, eastern cottonwood, balsam poplar, red and black ash, and silver maple. Drier and warmer sites contain black walnut, chestnut, and chinquapin oak. Agriculture is however the predominant land use occupying 65% of the Lake Erie Lowland Ecoregion, and major crops include corn, soybeans, tobacco, and tender fruit. The other dominant land use is urbanization, including residential, commercial, and industrial uses (EFC 2020). The Niagara Peninsula contains unique landscapes and habitats including provincially significant coastal wetlands, Carolinian flora, and Niagara Escarpment features (TMCWP 2006).

1.3.3 Pre-Contact Indigenous Period

The general culture history of the Indigenous pre-contact period of southern Ontario is summarised in Table 1 and is based on Ellis and Ferris (1990).

Table 1: Overview of Pre-contact Cultural Chronology of Southern Ontario

Period		Time Period	Characteristics
Paleo	Early	10,950 – 10,350 BP	Gainey, Barnes and Crowfield traditions; small bands; mobile hunters and gatherers; utilization of seasonal resources and large territories; fluted projectiles
	Late	10,350 – 9950 BP	Holcombe, Hi-Lo and Lanceolate biface traditions; continuing mobility; campsite/way-station sites; smaller territories are utilized; non-fluted projectiles
Archaic	Early	9950 – 7950 BP	Side-notched, Corner-notched and Bifurcate Base traditions; growing diversity of stone tool types; heavy woodworking tools appear (e.g., ground stone axes and chisels)
	Middle	7950 – 4450 BP	Stemmed (Kirk, Stanly/Neville), Brewerton side- and corner-notched traditions; reliance on local resources; populations increasing; more ritual activities; fully ground and polished tools; net-sinkers common; earliest copper tools
	Late	4450 – 2900 BP	Narrow Point (Lamoka), Broad Point (Genesee) and Small Point (Crawford Knoll) traditions; less mobility; use of fish-weirs; formal cemeteries appear; stone pipes emerge; long-distance trade (marine shells and galena)
Woodland	Early	2900 – 2350 BP	Meadowood tradition; cord-roughened ceramics emerge; Meadowood cache blades and side-notched points; bands of up to 35 people
	Middle	2350 – 1400 BP	Stamped ceramics appear; large variety of projectile point styles; cobble spall scrapers; Seasonal settlements and resource utilization; post holes, hearths, middens, cemeteries and rectangular structures identified

Period		Time Period	Characteristics
	Transitional	1400 – 1050 BP	Princess Point tradition; cord roughening, impressed lines, and punctate designs on pottery; adoption of maize horticulture at the western end of Lake Ontario; oval houses and 'incipient' longhouses; first palisades; villages with up to 75 people
	Late	1050 – 650 BP	Early – Glen Meyer tradition; settled village-life based on agriculture; small villages (0.4 ha) with 75–200 people and 4–5 longhouses; semi-permanent settlements
		650 – 550 BP	Middle – Uren and Middleport traditions; classic longhouses emerge; larger villages (1.2 ha) with up to 600 people; more permanent settlements (30 years)
		550 – 350 BP	Late – Larger villages (1.7 ha); examples up to 5 ha with 2,500 people; extensive croplands; also hamlets, cabins, camps and cemeteries; potential tribal units; fur trade begins ca. 1580; European trade goods appear

1.3.3.1 Paleo Period

Occupation of south-central Ontario became possible just after the end of the Wisconsin Glacial Period. Although there were a complex series of ice retreats and advances which played a large role in shaping the local topography, south-central Ontario was finally ice free by 12,250 years ago. The first human settlement can be traced back 11,000 years, when this area was settled by Indigenous groups that had been living south of the Great Lakes. The period of these early Indigenous inhabitants is known as the Paleo Period (Ellis and Deller 1990). The Paleo period marks the beginning of human settlement in southern Ontario. It is characterized by small bands of nomadic hunter-gatherers who largely depended on the communal hunting of big game such as caribou, and possibly mammoth and/or mastodon. This early period of occupation is divided into early and late phases, which span from ca. 10,950 – 10,350 BP (Ellis and Deller 1990) and from ca. 10,350 -9950 BP (Jackson 2004), respectively.

Our current understanding of settlement patterns of Early Paleo peoples suggests that small bands, consisting of probably no more than 25 to 35 individuals, followed a pattern of seasonal mobility extending over large territories (Ellis and Deller 1990). Early Paleo sites tend to be located in elevated locations on well-drained loamy soils. Many of the known sites were located on former beach ridges associated with glacial lakes. There are a few extremely large Early Paleo sites, such as one located close to Parkhill, Ontario, which covered as much as six hectares. It appears that these sites were formed when the same general locations were occupied for short periods of time over the course of many years. Given their placement in locations conducive to the interception of migratory mammals such as caribou, it has been suggested that they may represent communal hunting camps. There are also smaller Early Paleo camps scattered throughout the interior of southwestern and south-central Ontario, usually situated adjacent to wetlands.

Research suggests that population densities were very low during the Early Paleo Period (Ellis and Deller 1990). Archaeological examples of Early Paleo sites are rare.

The Late Paleo Period (10,350 – 9950 BP) has been less researched and is consequently more poorly understood. By this time, the environment of south-central Ontario was coming to be dominated by closed coniferous forests with some minor deciduous elements. It seems that many of the large game species that had been hunted in the early part of the Paleo Period had either moved further north, or in the case of the mastodons and mammoths, became extinct.

Like the early Paleo peoples, late Paleo peoples covered large territories as they moved about in response to seasonal resource fluctuations. On a province-wide basis, Late Paleo projectile points are far more common than Early Paleo projectile points, suggesting a relative increase in population.

The end of the Late Paleo Period was heralded by numerous technological and cultural innovations that appeared throughout the Archaic Period. These innovations may be best explained in relation to the dynamic nature of the post-glacial environment and region-wide population increases.

1.3.3.2 Archaic Period

During the Early Archaic Period (9950 – 7950 BP), the jack and red pine forests that characterized the Late Paleo environment were replaced by forests dominated by white pine with some associated deciduous trees (Ellis et al. 1990). One of the more notable changes in the Early Archaic Period is the appearance of side and corner-notched projectile points. Other significant innovations include the introduction of ground stone tools such as celts and axes, suggesting the beginnings of a simple woodworking industry. The presence of these often large and not easily portable tools suggests there may have been some reduction in the degree of seasonal movement, although it is still suspected that population densities were quite low, and band territories large.

During the Middle Archaic Period (7950 – 4450 BP) the trend to more diverse toolkits continued, as the presence of netsinkers suggests that fishing was becoming an important aspect of the subsistence economy. It was also at this time that "bannerstones" were first manufactured.

Bannerstones are carefully crafted ground stone devices that served as a counterbalance for atlatls or spear throwers. Another characteristic of the Middle Archaic Period is an increased reliance on local, often poorer quality, chert resources for the manufacturing of projectile points and other stone tools. It seems that during earlier periods, when groups occupied large territories, it was possible for them to visit a primary outcrop of high-quality chert at least once during their seasonal round. However, during the Middle Archaic Period, groups inhabited smaller territories that often did not encompass a source of high-quality raw material. In these instances, lower quality materials which had been deposited by the glaciers in the local till and river gravels were utilized.

This reduction in territory size was probably the result of gradual region-wide population growth which led to the infilling of the landscape. This process forced a reorganization of Indigenous subsistence practices, as more people had to be supported from the resources of a smaller area. During the latter part of the Middle Archaic Period, technological innovations such as fish weirs have been documented, as well as stone tools especially designed for the preparation of wild plant foods.

It is also during the latter part of the Middle Archaic Period that long distance trade routes began to develop, spanning the northeastern part of the continent. In particular, native copper tools manufactured from a source located northwest of Lake Superior were being widely traded (Ellis et al. 1990). By 3500 B.C. the local environment had stabilized and began to reflect the more modern landscape (Ellis et al. 1990).

During the Late Archaic Period (4450 – 2900 BP) the trend towards decreased territory size and a broadening subsistence strategy continued. Late Archaic sites are far more numerous than either Early or Middle Archaic sites, and it seems that the local population had expanded. It is during the Late Archaic Period that the more formal cemeteries appear. The appearance of cemeteries during the Late Archaic Period has been interpreted as a response to increased population densities and competition between local groups for access to resources. It is argued that cemeteries would have provided strong symbolic claims over a local territory and its resources. These cemeteries are often located on heights of well-drained sandy/gravel soils adjacent to major watercourses.

This suggestion of increased territoriality is also consistent with the regionalized variation present in Late Archaic Period projectile point styles. It was during the Late Archaic Period that distinct local styles of projectile points appear. It was also during the Late Archaic Period that trade networks, which had been established during the Middle Archaic Period, continued to flourish. Native copper from northern Ontario and marine shell artifacts from as far away as the mid-Atlantic coast are frequently encountered as grave goods at southern Ontario sites. Other artifacts such as polished stone pipes and banded slate gorgets also appear on Late Archaic sites in southern Ontario. One of the more unusual and interesting of the Late Archaic Period artifacts is the birdstone, which are small, bird-like effigies usually manufactured from green banded slate.

1.3.3.3 Woodland Period

The Early Woodland Period (2900 – 2350 BP) is distinguished from the Late Archaic Period primarily by the addition of ceramic technology. While the introduction of pottery provides a useful demarcation point for archaeologists, it may have made less difference in the lives of the Early Woodland peoples. The first pots were thick walled, and friable. It has been suggested that they were used in the processing of nut oils by boiling crushed nut fragments in water and skimming off the oil. These vessels were not easily portable, and individual pots likely did not have a long use life. There have also been numerous Early Woodland sites located where no pottery was found, suggesting that these poorly constructed undecorated vessels had yet to assume a central position in the day-to-day lives of Early Woodland peoples.

Other than the introduction of this limited ceramic technology, the life-ways of Early Woodland peoples show a great deal of continuity with the preceding Late Archaic Period. For instance, birdstones continue to be manufactured, although the Early Woodland varieties have "pop-eyes" which protrude from the sides of their heads.

Likewise, the thin, well-made projectile points which were produced during the terminal part of the Archaic Period continue in use. However, the Early Woodland Period variants were side-notched rather than corner-notched, giving them a slightly altered and distinctive appearance.

The trade networks which were established in the Middle and Late Archaic Periods also continued to function, although there does not appear to have been as much trade in marine shell during the Early Woodland Period. During the last 200 years of the Early Woodland Period, projectile points manufactured from high quality raw materials from the American Midwest begin to appear on sites in southwestern Ontario.

In terms of settlement and subsistence patterns, the Middle Woodland Period (2350 – 1400 BP) provides a major point of departure from the Archaic and Early Woodland Periods. While Middle Woodland peoples still relied on hunting and gathering to meet their subsistence requirements, fish were becoming a more important part of the diet.

In addition, Middle Woodland peoples relied much more extensively on ceramic technology. Middle Woodland vessels are often heavily decorated with hastily impressed designs covering the entire exterior surface and upper portion of the vessel interior. Consequently, even very small fragments of Middle Woodland vessels are easily identifiable.

It is also at the beginning of the Middle Woodland Period that rich, densely occupied sites appear along the margins of major rivers and lakes. While these areas had been utilized by earlier peoples, Middle Woodland sites are significantly different in that the same location was occupied off and on for as long as several hundred years, and large deposits of artifacts often accumulated. Unlike earlier seasonally utilized locations, these Middle Woodland sites appear to have functioned as base camps, occupied off and on over the course of the year. There are also numerous small upland Middle Woodland sites, many of which can be interpreted as special purpose camps from which localized resource patches were exploited. This shift towards a greater degree of sedentism continues the trend witnessed from at least Middle Archaic times and provides a prelude to the developments that follow during the Late Woodland Period.

The Late Woodland Period began with a shift in settlement and subsistence patterns involving an increasing reliance on corn horticulture (Fox 1990; Smith 1990; Williamson 1990). Corn may have been introduced into southwestern Ontario from the American Midwest as early as 1400 BP or a few centuries before. Corn did not become a dietary staple, however, until at least three to four hundred years later, when the cultivation of corn gradually spread into south-central and southeastern Ontario.

During the Transitional Woodland Period, particularly within the Princess Point Complex (circa 1450-900 BP) , a number of archaeological material changes have been noted including: the appearance of triangular projectile point styles, first seen during this period beginning with the Levanna form; cord-wrapped stick decorated ceramics using the paddle and anvil forming technique evolving from the mainly coil-manufactured and dentate stamped and pseudo-scallop shell impressed ceramics; and if not appearance, increasing use of maize (*Zea mays*) as a food source (e.g., Bursey 1995; Crawford et al. 1997; Ferris and Spence 1995; Martin 2004 [2007]; Ritchie 1971; Spence et al. 1990; Williamson 1990).

The Late Woodland Period is widely accepted as the beginning of agricultural life ways in south-central Ontario. Researchers have suggested that a warming trend during this time may have encouraged the spread of maize into southern Ontario, providing a greater number of frost-free days (Stothers and Yarnell 1977). Further, shifts in the location of sites have also been identified with an emphasis on riverine, lacustrine and wetland occupations set against a more diffuse use of the landscape during the Middle Woodland (Dieterman 2001).

The first agricultural villages in southern Ontario date to approximately 1000 BP. Unlike the riverine base camps of the Middle Woodland Period, these sites are located in the uplands, on well-drained sandy soils.

Village sites dating between 1050 – 650 BP share many attributes with the historically reported early Late Woodland sites, including the presence of longhouses and sometimes palisades. However, these early longhouses were not large, averaging only 12.4 m in length (Dodd et al. 1990:349; Williamson 1990). It is also quite common to find the outlines of overlapping house structures, suggesting that these villages were occupied long enough to necessitate re-building.

The Jesuits reported that the Huron moved their villages once every 10 – 15 years, when the nearby soils had been depleted by farming and conveniently collected firewood grew scarce (Pearce 2010). It seems likely that early Late Woodland people occupied their villages for considerably longer, as they relied less heavily on corn than did later groups, and their villages were much smaller, placing less demand on nearby resources.

Judging by the presence of carbonized corn kernels and cob fragments recovered from sub-floor storage pits, agriculture was becoming a vital part of the early Late Woodland economy. However, it had not reached the level of importance it would in the middle and late Woodland Periods. There is ample evidence to suggest that more traditional resources continued to be exploited and comprised a large part of the subsistence economy. Seasonally occupied special purpose sites relating to deer procurement, nut collection, and fishing activities have all been identified. While beans are known to have been cultivated later in the Late Woodland Period, they have yet to be identified on early Late Woodland Period sites.

The middle Late Woodland Period (650 – 550 BP) witnessed several interesting developments in terms of settlement patterns and artifact assemblages. Changes in ceramic styles have been carefully documented, allowing the placement of sites in the first or second half of this 100-year period. Moreover, villages, which averaged approximately 0.6 ha in extent during the early Late Woodland Period, now consistently range between 1 and 2 ha in size.

House lengths also change dramatically, more than doubling to an average of 30 m, while houses of up to 45 m have been documented. This increase in longhouse length has been variously interpreted. The simplest possibility is that increased house length is the result of a gradual, natural increase in population (Dodd et al. 1990; Smith 1990). However, this does not account for the sudden shift in longhouse lengths around 700 BP. Other possible explanations involve changes in economic and socio-political organization (Dodd et al. 1990). One suggestion is that during the middle Late Woodland Period small villages were amalgamating to form larger communities for mutual defence (Dodd et al. 1990). If this was the case, the more successful leaders may have been able to absorb some of the smaller family groups into their households, thereby requiring longer structures. This hypothesis draws support from the fact that some sites had up to seven rows of palisades, indicating at least an occasional need for strong defensive measures. There are, however, other middle Late Woodland villages which had no palisades present (Dodd et al. 1990). More research is required to evaluate these competing interpretations.

The lay-out of houses within villages also changes dramatically by 650 BP. During the early Late Woodland Period villages were haphazardly planned, with houses oriented in various directions. During the middle Late Woodland Period villages are organized into two or more discrete groups of tightly spaced, parallel aligned, longhouses. It has been suggested that this change in village organization may indicate the initial development of the clans which were a characteristic of the historically known Late Woodland peoples (Dodd et al. 1990).

During the late Woodland period, the Iroquoian-speaking linguistic and cultural groups developed. Prior to European Contact, neighbouring Iroquois-speaking communities united to form several confederacies known as the Huron (Huron-Wendat), Neutral (called Attiewandaron by the Wendat), Petun (Tionnontaté or Khionontateronon) in Ontario, and the Five Nations (later Six Nations) of the Iroquois (Haudenosaunee) of upper New York State (Birch 2010; Warrick 2013). Each group was distinct but shared a similar pattern of life already established by the 16th century (Trigger 1994).

Prior to European contact, the geographic distribution of pre-contact Late Woodland sites describes two major groups east and west of the Niagara Escarpment: the ancestral Attiewandaron to the west, and the ancestral Huron-Wendat to the east (Warrick 2000). Ancestral Huron-Wendat villages have been located as far east as the Trent River watershed, where “concentrations of sites occur in the areas of the Humber River valley, the Rouge and Duffin Creek valleys, the lower Trent valley, Lake Scugog, the upper Trent River and Simcoe County” (Ramsden 1990:363). These concentrations are distributed in a triangular area along the north shore of Lake Ontario, and northward bounded by the Trent River system and the Niagara Escarpment (Ramsden 1990).

The Huron-Wendat used multiple trails, portage and watercourse routes throughout their territory to travel from the north shores of Lake Ontario inland to the upper Great Lakes. These trail systems included the Toronto Carrying Place Trail, an ancient ”highway” in use for hundreds of years by many groups that was a crucial trade and travel route. The Toronto Carrying Place Trail had two branches: the Rouge River branch, and the Humber River Branch. Both branches trailed from Lake Ontario over the Oak Ridges Moraine and up the Holland River into Lake Simcoe (Robinson 1965; TRCA 2007).

Longhouses continued to be used, with house sizes depending on the size of the extended family that inhabited it; however, archaeological evidence suggests that the average longhouse was 7.62 m by 30.48 m with heights about the same as widths (Heidenreich 1978). Village size gradually enlarged as horticulture began to take on a more central importance in subsistence patterns, particularly the farming of maize, squash, and beans, supplemented by fishing, hunting, and gathering. Sites were chosen for their proximity to sources of “water, arable soils, available firewood, [and] a young secondary forest, [as well as] a defendable position” (Heidenreich 1978:375). Later villages consisted of up to 100 longhouses clustered closely together, and only the largest villages on the edges of territories were fortified (Heidenreich 1978).

Subsistence patterns reflect a horticultural diet that was supplemented with fish rather than red meat (Heidenreich 1978). ‘Slash-and-burn’ farming was used to quickly and efficiently clear trees and brushwood for flour and flint corn fields (Heidenreich 1978). These were consistently cultivated until no longer productive, at which point the village was abandoned, an event that took place about every 8 to 12 years (Heidenreich 1978). Consequently, as horticulture became the primary mode of subsistence, pre-contact Indigenous groups gradually relocated from the northern shores of Lake Ontario to further inland, likely as a result of depleting resources and growing tension between Indigenous communities.

1.3.3.4 Contact Period

The Huron-Wendat and Haudenosaunee called those within the territory of the Niagara Peninsula the “Attiewandaron” (also spelled Attiwondaronks and Atiquandaronk) (Brown 2009: 26). According to Samuel de Champlain, who first referred to the Attiewandaron as *la Nation neutre,* the Attiewandaron inhabited forty villages and could field 4,000 warriors (Jury 1974; White 1978; Warrick 2008). It is speculated that prior to the great epidemics of the 1630s, the Attiewandaron Confederacy numbered approximately 35,000 to 40,000 individuals (White 1978; Warrick 2008).

Their territory at the western end of Lake Ontario and along the north shore of Lake Erie was favourably located for easy trade with the Erie, Haudenosaunee, Tionnontaté, and Huron-Wendat (Trigger 1994). The interior lands occupied by the Attiewandaron contained rapidly running streams, large rivers, and portage routes. A significant trail beginning at Lake Simcoe, following the Nottawasaga River to the Pine River to the source of the Irvine River and into the Grand River and banks of Lake Erie, formed an Indigenous portage route favoured for travel and trade between Huron-Wendat and Attiewandaron territorial lands (Bricker 1934).

From 1649 to 1650, the Haudenosaunee engaged in warfare with the Huron-Wendat Confederacy, destroying several Huron-Wendat villages throughout Southern Ontario (Trigger 1994). The small groups that remained of the Huron-Wendat Confederacy became widely dispersed throughout the Great Lakes region, ultimately resettling in Quebec (Schmalz 1991). Many Huron-Wendat groups sought refuge and protection within the Attiewandaron, until the Haudenosaunee attacked in the 1650s (Trigger 1994; Warrick 2008). Many were captured and incorporated into the Haudenosaunee or sought refuge within other tribes (Lennox and Fitzgerald 1990; Trigger 1994). The last mention of the Attiewandaron in French writing was in 1671 (Noble 2012).

1.3.3.5 Post-Contact Period

Although their territory was located south of the lower Great Lakes, the Haudenosaunee controlled most of southern Ontario after the 1660s, occupying no less than a half dozen villages along the north shore of Lake Ontario and further north into the interior (Schmalz 1991; Williamson 2013). The Haudenosaunee established "settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. Their settlements were on canoe-and-portage routes that linked Lake Ontario to Georgian Bay and the upper Great Lakes" (Williamson 2013:60). The Haudenosaunee had established a village named Ganatsekwyagon at the mouth of the Rouge River, and Teiaiagon at a bend near the mouth of the Humber River to exploit both branches of the Toronto Carrying Place Trail (Robinson 1965; Schmalz 1991). Because of the French being allies of the Huron-Wendat, the Haudenosaunee prevented French explorers and missionaries from utilizing the St. Lawrence River and traveling within their territory north of Lake Ontario (Lajeunesse 1960).

At this time, several Algonquian-speaking linguistic and cultural groups within the Anishinaabeg (or Anishinaabe) began to challenge the Haudenosaunee dominance in the region (Johnston 2004; Gibson 2006). The Anishinaabeg were originally located primarily in northern Ontario. Before contact with the Europeans, the Ojibwa territorial homeland was situated inland from the north shore of Lake Huron (MNCFN nd:3). The English referred to those Algonquian-speaking linguistic and cultural groups that settled in the area bounded by Lakes Ontario, Erie, and Huron as Chippewas or Ojibwas (Smith 2002). In 1640, the Jesuit fathers had recorded the name "Oumisagai" or "Mississaugas", for the group of Algonquins (speaking group) residing alongside the Mississagi River on the northwestern shore of Lake Huron. The French, and later English would apply this same name to all Algonquian-speaking peoples that resided on the north shore of Lake Ontario (Smith 2002; Smith 2013). "The term 'Mississauga' perplexed the Algonquins, or Ojibwas, on the north shore of Lake Ontario, who knew themselves as the Anishinaabeg" (Smith 2013:20).

After a major smallpox epidemic and combined with the capture of New Netherland by the British, access to guns and powder became increasingly restricted for the Haudenosaunee. After a series of successful attacks against the Haudenosaunee by groups within the Anishinaabeg from 1653 to 1662, the Haudenosaunee dominance in the region began to fail (Warrick 2008; Schmalz 1991). Prior to 1680, groups within the Anishinaabeg had begun to settle just north of the evacuated Huron-Wendat territory and with the British entering the fur-trading market, began to expand further into southern Ontario (Gibson 2006; Schmalz 1991). By the 1690s, Haudenosaunee settlements along the northern shores of Lake Ontario were abandoned (Williamson 2013). By 1701, after a series of battles throughout Ontario, the Anishinaabeg replaced the Haudenosaunee in southern Ontario (Gibson 2006; Schmalz 1991; Coyne 1895).

In 1701, representatives of several groups within the Anishinaabeg and the Haudenosaunee, collectively known as the First Nations, assembled in Montreal to participate in Great Peace negotiations, sponsored by the French (Johnston 2004; Trigger 2004). The Mississaugas secured sole possession of the territory along and extending northward of Lake Ontario and Lake Erie (Hathaway 1930).

From 1701 to the fall of New France in 1759, the fur trade continued in Ontario with both the Ojibwa and Mississauga and various other groups within the Anishinaabeg trading with both the English and the French. Subsistence patterns include a primary focus on hunting, fishing, and gathering with little focus on agriculture (McMillian and Yellowhorn 2004). Groups within the Anishinaabeg, such as the Ojibwa and Mississauga, utilized housing known as a wigwam, a temporary and moveable structure that was easy to construct and disassemble, allowing them to travel swiftly throughout their territory (McMillian and Yellowhorn 2004).

The Seven Years War brought warfare between the French and British in North America. In 1763, the Royal Proclamation declared the Seven Years War over, giving the British control of New France. The British did not earn the respect of the Anishinaabeg, as the British did not honour fair trade nor the Anishinaabeg occupancy of the land as the French had. Consequently, the Pontiac Uprising, also known as the Beaver Wars, began that same year (Schmalz 1991; Johnston 2004). This uprising involved both groups within the Haudenosaunee and groups within the Anishinaabeg. After numerous attacks on the British, the Pontiac Uprising was over by 1766 when a peace agreement was concluded with Sir William Johnson, the Superintendent of Indian Affairs (Schmalz 1991). The fur-trade continued throughout southern Ontario until the beginning of British colonization.

The project area is located within the area covered by the Between the Lakes Treaty (Treaty No. 3). On 22 May 1784, for the sum of £1180 worth of trade goods, the Mississaugas of the Credit ceded to the Crown approximately 3,000,000 acres of land located between Lakes Huron, Ontario, and Erie.

This purchase was to procure a permanent place of residence for that part of the Six Nations coming into Canada. As written in the below passage, the Between the Lakes Treaty (Treaty No. 3) includes (Government of Canada 2016):

> *"All that parcel or tract of land lying and being between the Lakes Ontario and Erie, beginning at Lake Ontario, four miles south' westerly from the point opposite to Niagara Fort, known by the name of Mississaugue Point, and running from thence along the said lake to the creek that falls from a small lake, known by the name of Washquarter into the said Lake Ontario, and from thence north forty-five degree west, fifty miles; thence south forty-five degrees west, twenty miles; and thence south until it strikes the River La Tranche; then down the stream of the said river to that part or place where a due south course will lead to the mouth of Catfish Creek emptying into Lake Erie, and from the above mentioned part or place of the aforesaid River La Tranche, following the south course to the mouth of the said Catfish Creek; thence down Lake Erie to the lands heretofore purchased from the Nation of Mississague Indians; and from thence along the said purchase at Lake Ontario at the place of beginning as above mentioned together with all the woods, ways, paths, waters, watercourses and appurtenances thereunto belonging."*

1.3.4 Euro-Canadian Period

1.3.4.1 The Township of Humberstone, Welland County

During the American War of Independence, in the late 1700s, a large number of United Empire Loyalists, who were granted land for staying loyal to the British crown, began to move into the Niagara Peninsula, putting greater demand on the quantity of available lands for settlement within what would become Welland County (Brown 2009). These land grants were very liberal, with field officers being given allowances to select 5,000 acres, captains 3,000 acres, subalterns 2,000 acres and privates 200 acres (Murphy 1887; Michael 1967). By 1784, about 40 families had settled on the territory now comprising the County of Welland (Murphy 1887).

In 1784, the Mississauga at the western end of Lake Ontario ceded a large tract of land that "included the Niagara Peninsula, lands close to the head of Lake Ontario, and the north shore of Lake Erie as far west as Cat Fish Creek" (Surtees 1994:103). The British purchased this land for £1,180 worth of trade goods, and it became known as the Between the Lakes Purchase (Surtees 1994). The tract included over one million hectares of land, and a tract of land nearly ten kilometres deep on either side of the Grand River was awarded to the Six Nations (Surtees 1994). In 1792, a land sale document was produced to confirm the actual limits of this purchase, which includes the Township of Humberstone (Surtees 1994).

The Township of Humberstone was first surveyed by Deputy Surveyor Thomas Welsh in 1794 and was bounded by the Township of Crowland to the north, the Township of Bertie on the east, the Township of Wainfleet to the west, and Lake Erie to the south (Ott 1967; Murphy 1887). Humberstone was surveyed with concession roads running east and west, and side roads running north-south (Ott 1967). The township contains about 32,000 acres of fertile soil “which is more or less alluvial and varies in quality from black muck to clay loam, [ranking] the township amongst the best agricultural districts in Ontario” (Murphy 1887:275). A ridge of high land runs on the southern side of the township parallel to Lake Erie and the land slopes to the lake consists of well-timbered hills of “oak, ash, hemlock, cedar, linden, butternut, walnut, beech, and whole groves of sugar maple” (Murphy 1887:275). The north-western portion of the township is lower and contains extensive marshes (Murphy 1887:276).

During the War of 1812, the Niagara Peninsula was heavily bombarded by both American and British artillery and much of the countryside was destroyed during the invasion and defence of Upper Canada. In 1814, an American force led by General Duncan McArthur traveled from Detroit along the shore of the lake, burning nearly everything in their path from the Detroit River to the Grand River (Brown 2009). The distinctively shaped lake-side hill named Sugarloaf Hill, which was located along the southern half of the Township of Humberstone and reminded “early settlers of a tasty loaf eaten by former immigrants from Pennsylvania”, was used as a “signal beacon to warn of impending American attacks” (City of Port Colborne 2013).

1.3.4.2 Welland Canal

Credit for building the first Welland Canal is attributed to William Hamilton Merritt. In 1818, Merritt, a farmer and the owner of a mill on the bank of Twelve Mile Creek, petitioned the Legislature of Upper Canada to construct a canal to divert water from the Welland River due to the seasonal variations of the water supply available from Twelve Mile Creek (Westwater 2010). However, it was discovered that an extensive ridge ran between the two waterways and the idea was given up (Westwater 2010). A month later that Merritt proposed building a canal that would allow boats to travel between Lake Ontario and Lake Erie (Westwater 2010).

After several surveys and much debate over route, a path was decided on that would utilize natural waterways as much as possible. Wooden locks would be used to lift and lower the boats to the heights required between the two lakes.

Starting from Lake Ontario, Twelve Mile Creek would be taken as far south as the town of St. Catharines. Here, Dick's Creek, a tributary of Twelve Mile Creek was followed briefly north and then south again starting a slow climb upward which eventually culminated in a rapid succession of locks that took the canal up the escarpment (Old Welland Canals Field Guide nd). From here it continued south where it eventually met up with another tributary of Twelve Mile Creek and eventually the same ridge that had prevented Merritt's original idea of a water diversion ditch. While a tunnel through the ridge was originally conceived of, the final plan called for a channel or "Deep Cut" to continue south a distance of two miles to the Welland River (Old Welland Canals Field Guide nd). The Welland River would then be followed to the Niagara River (above Niagara Falls), allowing access to Lake Erie. The Welland Canal Company was formed in January 1824 to build and manage the canal with construction starting on November 30, 1824 (Old Welland Canals Field Guide nd).

In 1828, after several years of construction an unexpected problem arose at the Deep Cut. To resolve these problems, as well as time constraints, a decision was made to dig a shallower channel and to use locks to transfer ships down to the Welland River. However, due to difference in elevation, a new source of water at a higher elevation was needed to fill the canal. Therefore, a new channel, a "Feeder Canal" was commission to divert water from the Grand River to the Welland Canal. After it was completed in 1829 the canal operated this way until 1832.

In 1833, the route along the Welland River was considered too time consuming, and a new route was dug that incorporated part of the Feeder Canal and continued south through the project area and all the way to Lake Erie. The canal was run this way for 11 years from 1833 to 1844.

The Second Welland Canal was designed to follow the route of the First Welland Canal with a few small modifications. Stone was also used instead of wood. The canal was rebuilt 1842-45. The Feeder Canal was also enlarged during this time to allow ship traffic. In 1851 the Feeder Canal was also extended to Lake Erie and provided an alternative route for ships.

The Third Welland Canal was designed to provide a new and straighter route that would allow bigger ships and shorter transit times. The canal was built 1872-81, while modifications continued until 1887. The Second Welland Canal remained a distinct canal north of Allanburg and operated until 1915. The Feeder Canal was no longer the source of water for the canal but handled boat traffic until the 1920's.

The Fourth Welland Canal was constructed between the years of 1913 and 1932. The canal now runs perpendicular to the Niagara Escarpment and is the most direct route of all three previous canals. The canal starts at the man-made Port Weller piers on Lake Ontario and continues south as straight as possible to Port Colborne.

1.3.4.3 City of Port Colborne

The community of Port Colborne grew significantly after the construction of the Welland Canal was complete in 1832 (Mika and Mika 1983; Brown 2009). Prior to that, a small village had begun to develop around Sugarloaf Hill after the area's first settler, Christian Zavitz, built a gristmill (Brown 2009). Permanent settlement occurred by 1832 along the lakeshore at Gravelly Bay, and was named after the Lieutenant Governor, Sir John Colborne (Mika and Mika 1983). In 1834, a new village site was laid out further inland, whose early economy relied almost entirely on the operation of the canal (Mika and Mika 1983). By 1850, Port Colborne became a major wheat-shipping and industrial hub where the Buffalo and Lake Huron Railway, the Welland Railway, and the horse-drawn streetcar line, known as the Toronto and St. Catherine's Railway, intersected (Mika and Mika 1983; Brown 2009).

In 1866, Irish nationalists from America, wanting to separate Ireland from the British Empire known as Fenians, attacked several locations along the Canadian board, including Port Colborne (Masters, 1948). In May of 1866, a small Canadian force, the Welland Canal Field Battery, was stationed to protect Port Colborne, but failed to do so (Mika and Mika, 1983). Other Canadian troops arrived, forcing the Fenians to withdraw to the United States where they were promptly arrested (Grodzinski 2014). By 1890, Port Colborne was incorporated as a village that contained, "four churches, a public school, separate school, grist mill, sawmill, three planning mills, a sash and door factory, a branch of the Imperial Bank, offices of the Montreal and Dominion Telegraph and a grain elevator" (Mika and Mika 1983:232). Towards the end of the 19th Century, commercial and manufacturing works began to be displaced by larger industrial conglomerates supported by improvements to the canal and harbour (City of Port Colborne, 2013), and as the 20th Century progressed, Port Colborne became one of the world's largest centres of the flour milling industry (*ibid*).

Port Colborne was officially declared a town in 1918, with a recorded population of 2,837 (City of Port Colborne, 2013), and continued growth and spread, eventually encompassing the Village of Humberstone, which was officially amalgamated in 1952.

1.3.4.4 Project Area

The project area is located within parts of Lot 27, Concession 1, and Lots 26 – 28, Concession 2 in the Geographic Township of Humberstone, former County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

To understand the 19th century land use history of the project area, the 1862 *Tremaine's Map of the Counties of Lincoln and Welland, Canada* West and 1876 Illustrated Historical Atlas of the Counties of Lincoln and Welland, Ontario were examined (Map 2). A review of these resources reveals the project area to cross several properties owned by various individuals in the 19th century. Also, the project area either crosses and/or is in proximity to several historical features, including, historical villages and transportation routes (i.e., railways, roads, and the Welland Canal).

Topographic maps from 1907 through 1938 and aerial photographs from 1921 through 1968 were reviewed to understand the 20th century land use history of the project area and immediate surroundings (Map 3 to Map 7). In the early 1900s, settlement continued to flourish outward from the villages of Humberstone and Port Colborne, whereas north Humberstone village and areas east of the Welland Canal remained under agricultural use. By 1929, the Fourth Canal is visible on topographic maps within Port Colborne, and settlement east of the canal begins to slowly fill in. By the middle of the 20th century, the City of Port Colborne had expanded to encompass much of the areas encompassed by the project area.

1.4 Archaeological Context

1.4.1 Existing Conditions

The project area is situated in the City of Port Colborne and crosses the Welland Canal north of The Island. Urban residential is the primary land use within the project area east of the Welland Canal, and current/former industrial/commercial lands (now predominantly covered in dense forest regrowth) occupies the remainder of the land use within the project area on the west side of the Welland Canal. Overall, the area is in general, extensively disturbed. This disturbance is primarily a result of previous road construction, utilities installation, infrastructure development and dispersed building footprints.

1.4.2 Physiography

The project area is in the Haldimand Clay Plain physiographic region of southern Ontario. The Haldimand Clay Plain is a series of parallel belts, which lie between the Niagara Escarpment and Lake Erie, and occupies all of the Niagara Peninsula except for the fruit belt below the escarpment. Although it was once completely submerged in Lake Warren, the till is not all buried by stratified clay and generally comes to the surface on the low morainic ridges in the north (Chapman and Putnam 1984).

Soil texture can be an important determinant of past settlement, usually in combination with other factors, such as topography. The project area consists primarily miscellaneous (Dump) material from the construction of the Welland Canal and various past and present industrial/commercial operations. This miscellaneous soil material is classified as very young deposits derived from canal dump sites, derived from excavated areas and rocky ledges, with variable drainage and historically utilised as pasture, woodlots or for minor crop production of corn, root vegetables and hay. These areas of dumped miscellaneous soils reside within an area originally consisting of Farmington Loam soils, albeit only now exhibited in pockets amongst the otherwise disturbed landscape. Farmington Loam is a light brown stony loam overtop limestone bedrock, usually found on smooth topography with fair to good natural drainage and typically reserved for pastureland and woodlots (Dominion Department of Agriculture 1935). The topography of the project area and surrounding area slopes north to south and undulates east to west. The northern portion of the project area is at an elevation of approximately 184 m asl and the southern portion is at approximately 177 m asl.

Potable water is an important resource necessary for any extended human occupation or settlement. As water sources have remained relatively stable in Ontario since post-glacial times, proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Hydrological features such as primary water sources (i.e., lakes, rivers, creeks, streams) and secondary water sources (i.e., intermittent streams and creeks, springs, marshes, swamps) would have helped supply plant and food resources to the surrounding area. The multiple incarnations of the Welland Canal and lengthy episodes of construction and alterations that began in the mid 19th century and continued well into the 20th century, along with the industrial/commercial and residential development of the City of Port Colborne have all contributed to effectively obliterating the original natural waterways and smaller tributaries that once flowed over the landscape and into Lake in the vicinity of the project area. Today, Lake Erie and the mouth of the Welland Canal are located approximately 1.9 km south of the project area (Map 1).

1.4.3 Registered Archaeological Sites

Per MHSTCI (2011), to compile an inventory of archaeological resources, the registered archaeological site records maintained by the MHSTCI in the Ontario Archaeological Site Database (OASD) were consulted. Table 2 provides a list of 35 registered archaeological sites within 1 km of the project area.

Table 2: Registered archaeological sites within 1 km of the project area.

Borden Number	Name	Time Period	Cultural Affiliation	Site Type	Current Development Review Status
AfGt-5	Solid Comfort Cemetery	Pre-Contact	Indigenous	--	--
AfGt-6	Pinelli	--	--	--	--
AfGt-26	Kikkert-Murray	--	--	--	--
AfGt-27	Ansari Site	Post-Contact, Pre-Contact	--	--	No Further CHVI
AfGt-40	Kikkert 3	Early Woodland	Indigenous	--	--
AfGt-38	Kikkert 1	--	--	--	--
AfGt-39	Kikkert 2	--	--	--	--
AfGt-43	Augustine 3	--	--	--	--
AfGt-44	Canada Starch 1	Archaic	Indigenous	Unknown	--
AfGt-72	Salsbury/Loyalist Park	Archaic	Indigenous	--	--
AfGt-73	--	Other	--	Other: tool manufacturing	--
AfGt-76	--	Pre-Contact	Indigenous	Other: camp/campsite	--
AfGt-78	--	Pre-Contact	Indigenous	Other: camp/campsite	--
AfGt-79	--	Pre-Contact	Indigenous	Other: camp/campsite	--
AfGt-80	--	Pre-Contact	Indigenous	Other: camp/campsite	--
AfGt-82	Wildwood	Post-Contact, Pre-Contact	Aboriginal, Euro-Canadian	Unknown	--
AfGt-89	Meadow Heights I	Late Archaic	Aboriginal	Other: camp/campsite	--
AfGt-90	McIntyre-Evans	Middle Archaic	Aboriginal	Other: camp/campsite	--

Borden Number	Name	Time Period	Cultural Affiliation	Site Type	Current Development Review Status
AfGt-98	Stonebridge	Early Archaic, Late Archaic, Late Woodland, Middle Woodland	Aboriginal	Other: camp/campsite	--
AfGt-99	Stonebridge II	Pre-Contact	Aboriginal	scatter	--
AfGt-100	Stonebridge III	Pre-Contact	Indigenous	scatter	--
AfGt-101	Sugarloaf	Late Archaic	Indigenous	Other: camp/campsite/workshop	--
AfGt-102	--	Pre-Contact	Indigenous	scatter	--
AfGt-135	--	--	--	--	--
AfGt-136	--	--	--	--	--
AfGt-137	--	--	--	--	--
AfGt-138	--	--	--	--	--
AfGt-139	--	--	--	--	--
AfGt-140	--	--	--	--	--
AfGt-141	--	--	--	--	--
AfGt-142	--	--	--	--	--
AfGt-143	--	Other	--	Other: findspot	--
AfGt-196	Chppawa1	Pre-Contact	Indigenous	--	--
AfGt-197	Chippawa 2	Pre-Contact	Indigenous	--	--
AfGt-201	Port Colborne P1 site	Pre-Contact	Indigenous	Other: camp/campsite	No Further CHVI

'--'*denotes information was not available on the OASD.*

1.4.4 Previous Archaeological Assessments

A review of previous archaeological assessments undertaken within the limits of the project area, or within 50 m the project area, was completed and provided below.

1.4.4.1 Stage 1 Archaeological Assessment

In 2020, Golder completed a Stage 1 archaeological assessment in support the MCEA to assess alternative routes for the Eastside SPS forcemain in the City of Port Colborne. The Stage 1 archaeological assessment evaluated four alternative routes generally bound by Barrick Road on the north, Highway 140/Elizabeth Street on the east, Lakeshore Road East and Kent Street on the south, and Fielden Avenue on the west. The Stage 1 archaeological assessment determined that parts of three of the four alternative route options retained archaeological potential and recommended a Stage 2 archaeological assessment (2021).

1.4.4.2 Other Archaeological Assessments

In 2013, Archeoworks Inc. undertook a Stage 1 archaeological assessment for a proposed elevated storage tank as part of the Port Colborne water and wastewater servicing within part of Lot 28, Concession 3, in the City of Port Colborne (Archeoworks Inc. 2013). The archaeological assessment determined the investigation area to have archaeological potential, and a Stage 2 archaeological assessment was recommended. In 2014, Archeoworks undertook the Stage 2 archaeological assessment and identified a pre-contact Indigenous site, Port Colborne P1 Site (AfGt-201) (Archeoworks Inc. 2014a). The site was determined to have further CHVI, and a Stage 3 archaeological assessment was recommended. The Stage 3 archaeological assessment was completed in 2014

and resulted in the recovery of 266 pre-contact Indigenous lithic artifacts; therefore, Stage 4 mitigation through excavation was recommended (Archeoworks Inc. 2014b). The Stage 4 excavation was subsequently completed in 2015, wherein the site was fully mitigated (Archeoworks Inc. 2015).

In 2016, Archeoworks Inc. completed a Stage 1-2 archaeological assessment for the proposed upgrades to the Eastside SPS, within part of Lot 27, Concession 1, in the City of Port Colborne (Archeoworks Inc. 2016). The Stage 1 archaeological assessment determined the property to have archaeological potential and a Stage 2 test pit survey was completed. No archaeological resources were encountered, and the property was recommended to be of no further archaeological concern.

1.4.5 Cultural Heritage Resources

According to the City of Port Colborne's *Heritage Property Registry* (Revised as of June 2020), there is one listed property within 50 m of the project area, located at 110 Saint Arnaud Street. There are an additional 15 listed properties within 300 m of the project area. There are no designated properties within 300 m of the project area (APPENDIX A).

1.4.6 Date of Fieldwork

The Stage 2 archaeological survey was undertaken on 28 July 2021. The weather during the Stage 2 archaeological assessment is provided in Table 3. The lighting conditions during the survey permitted good visibility of all parts of the project area and were conducive to the identification and recovery of archaeological resources.

Table 3: Date of fieldwork and weather conditions

Date	Temperature	Weather Condition
28 July 2021	24°C	Clear and sunny

2.0 FIELD METHODS

The Stage 2 archaeological assessment of the project area was conducted in compliance with the MHSTCI (2011) under the direction of Martha Tildesley (R399). Photographic images of the investigation are presented in Section 8.0, while the results are illustrated on Map 8.

Areas of archaeological potential within the project area were subjected to a Stage 2 shovel test pit survey at 5 m and 10 m intervals per section 2.1.2 and 2.1.8 of the MHSTCI (2011) (Image 1 to Image 5). Excavation of 30 cm diameter test pits was conducted by hand and were excavated within 1 m of built structures and/or disturbances. All soils excavated were screened through 6 mm wire mesh to facilitate the recovery of artifacts. All test pits were examined for stratigraphy, cultural features, and evidence of fill. All test pits were excavated into the first 5 cm of subsoil. All test pits were backfilled.

Generally, topsoil across the project area was heavily disturbed, and consisted of either various layers of compact fill material, or a conglomerated mottled mixture of a variety of soil and fill types. Disturbed fill material consisted of heavy mixed clays, mixed gravel/aggregate, mixed mottled soils and sporadic asphalt fragments in some locations (Image 6 to Image 10). The topsoil in undisturbed context is characterised as a slightly moist, dark brown clay loam 25 to 40 cm in depth and subsoil was generally characterised as light brown to grey-brown clay (Image 11).

Disturbances consisting of previous extensive grading and filling, ditching, gravel infilling, asphalt roadways and pathways, gravel parking lots, the Welland Canal and all accompanying infrastructure (i.e., concrete retaining walls, facilities/utilities) were encountered in parts of the project area (Image 12 to Image 19). When test pits exhibited signs of extensive subsurface disturbance the test pit survey interval increased to a 10 m grid to confirm the extent of disturbances. When disturbed ground conditions were not present, test survey intervals continued on the 5 m grid as per the Stage 1 archaeological assessment recommendations.

Approximately 82% (8.03 ha) of the project area was previous assessed (Stage 1 archaeological assessment) and determined to have no archaeological potential. Approximately 12.5% (1.22 ha) was subject to test pit survey at 10 m intervals, and 2% (0.18 ha) subject to test pit survey at 5 m intervals. The remaining 3.5% (0.34 ha) of the project area was confirmed as disturbed and not subject to Stage 2 test pit survey.

No archaeological resources or sites were discovered during the Stage 2 archaeological assessment of the project area.

3.0 RECORD OF FINDS

No archaeological resources or sites were discovered during the Stage 2 archaeological assessment of the project area.

3.1 Inventory of Documentary Record

Table 4 provides an inventory of the documentary record for the Stage 2 archaeological assessment.

Table 4: Inventory of Documentary Record

Document Type	Current Location of Document	Comments
Field notes	Scanned and stored digitally in electronic project folder	12 pages of field notes
Field maps	Scanned and stored digitally in electronic project folder	5 page of field maps
Photographs	Scanned and stored digitally in electronic project folder	53 digital images

4.0 ANALYSIS AND CONCLUSION

No archaeological resources or sites were identified during the Stage 2 archaeological assessment of the project area. The project area is considered free of further archaeological concern.

5.0 RECOMMENDATIONS

Based on the results of the Stage 2 archaeological assessment of the project area, the following recommendation is provided:

1) The project area is considered free of archaeological concern. No further archaeological investigation is recommended.

The MHSTCI is requested to review, and provide a letter indicating their satisfaction with the results and recommendations presented herein, with regard to the 2011 Standards and Guidelines for Consultant Archaeologists and the terms and conditions for archaeological licences, and to enter this report into the Ontario Public Register of Archaeological Reports.

6.0 ADVICE ON COMPLIANCE WITH LEGISLATION

This report is submitted to the MHSTCI 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 it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ontario Ministry of Heritage, Sport, Tourism and Culture Industries, 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 Sections 48 and 69 of *the Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such 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 undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of *the Ontario Heritage Act*.

The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33, requires that any person discovering or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the Registrar of Cemeteries at the Ontario Ministry of Consumer Services is also immediately notified.

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 licence.

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8.0 IMAGES



Image 1: Test pit survey at 10 m intervals. South of Killaly Street East, looking west-southwest.



Image 2: Test pit survey at 5 m intervals. East of Barber Drive in forested block, looking southeast.



Image 3: Test pit survey at 10 m intervals. East of Barber Drive, looking northeast.



Image 4: Test pit survey at 10 m intervals. North of Omer Drive, looking northwest.



Image 5: Test pit survey at 10 m intervals. West of Omer Drive, looking southeast.



Image 6: Disturbed soil conditions south of Killaly Street East. Looking down/north.



Image 7: Gravel disturbance in test pits east of Barber Drive, looking down/north.



Image 8: Gravel and clay disturbance in test pits, east of Barber Drive, looking down/north.



Image 9: Disturbed test pits north of Omer Drive. Conglomerated mixture of fill materials, looking down/north.



Image 10: Disturbed test pits west of Omer Drive. Heavy mottled clay and gravel fill, looking down/north.



Image 11: Natural soil profile within forested block east of Barber Drive, looking down/north.



Image 12: Disturbed. Gravel filled commercial lot east of Barber Drive, looking northwest.



Image 13: Disturbed. Gravel stockpiles and metal shipping containers, east of Barber Drive, looking south.



Image 14: Disturbed. Areas of deep ditching east of Barber Drive, looking east.



Image 15: Disturbed. Deep ditching through raised gravel filled areas, east of Barber Drive, looking northeast.



Image 16: Disturbed. Deep ditching and raised gravel area used as construction laydown area east of Barber Drive, looking south.



Image 17: Disturbed. Construction debris piles (asphalt/concrete/gravel), south of Omer Drive, looking southwest.



Image 18: Disturbed. Gravel lot, north of commercial property, south of Omer Drive, looking north.



Image 19: Disturbed. Welland Canal and all associated disturbances, looking east-northeast.

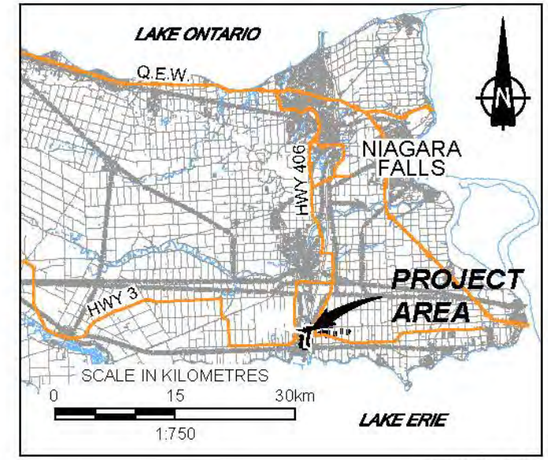
9.0 MAPS

Client: Regional Municipality of Niagara

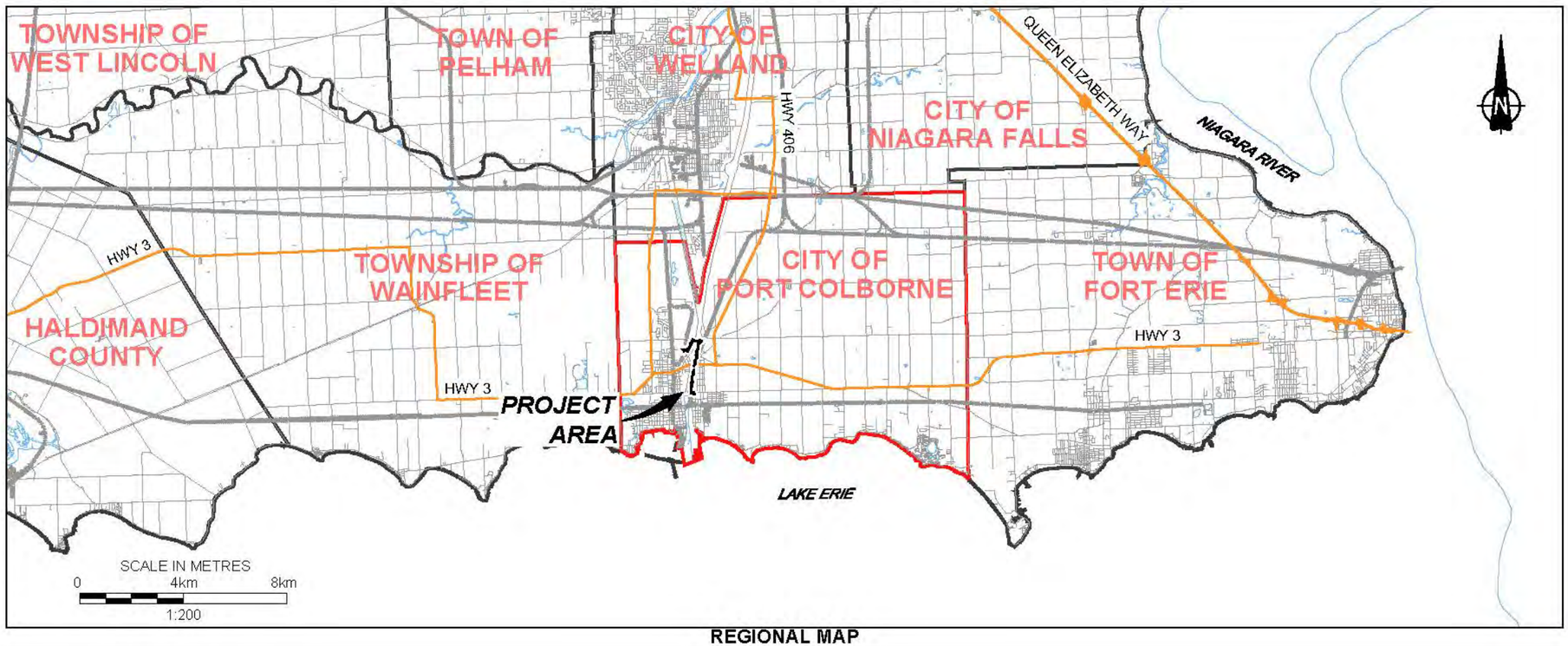
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AERIAL IMAGERY and OBM MAPPING



KEY PLAN



REGIONAL MAP

LEGEND

- BARRICK ROAD CROSSING - SEAWAY
- 15m BUFFER FROM BARRICK ROAD CROSSING - SEAWAY (APPROXIMATE PROJECT AREA)

REGIONAL MAP

- APPROXIMATE PROJECT AREA
- CITY OF PORT COLBORNE BOUNDARY
- TOWNSHIP/MUNICIPALITY BOUNDARY
- WELLAND TOWNSHIP/MUNICIPALITY

REFERENCE

DRAWING BASED ON MNR LIO, OBTAINED 2020, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020; AERIAL IMAGERY AND PARCEL DATA PROVIDED BY THE REGION OF NIAGARA; AND ROUTE ALTERNATIVES PROVIDED BY GM BLUEPLAN, SEPTEMBER 29 - 2020.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

STAGE 2 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
VARIOUS LOTS AND CONCESSIONS, GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
FORMER COUNTY OF WELLAND, CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

TITLE

PROJECT AREA

GOLDER
MEMBER OF WSP

PROJECT No.			20139291
CADD	BCH	Aug 10/21	
CHECK			

FILE No. 20139291-3000-R01001
SCALE AS SHOWN REV.

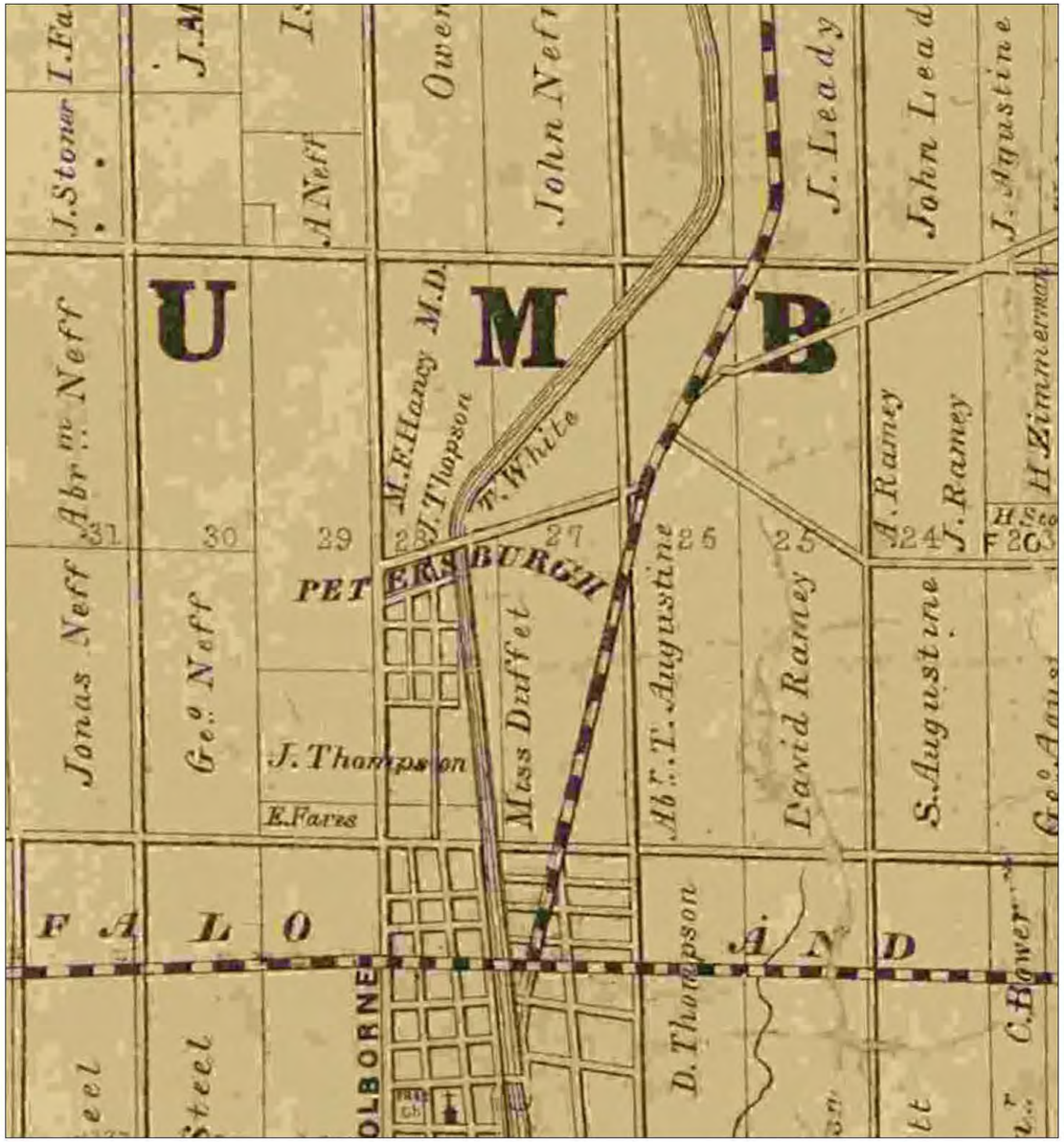
MAP 1

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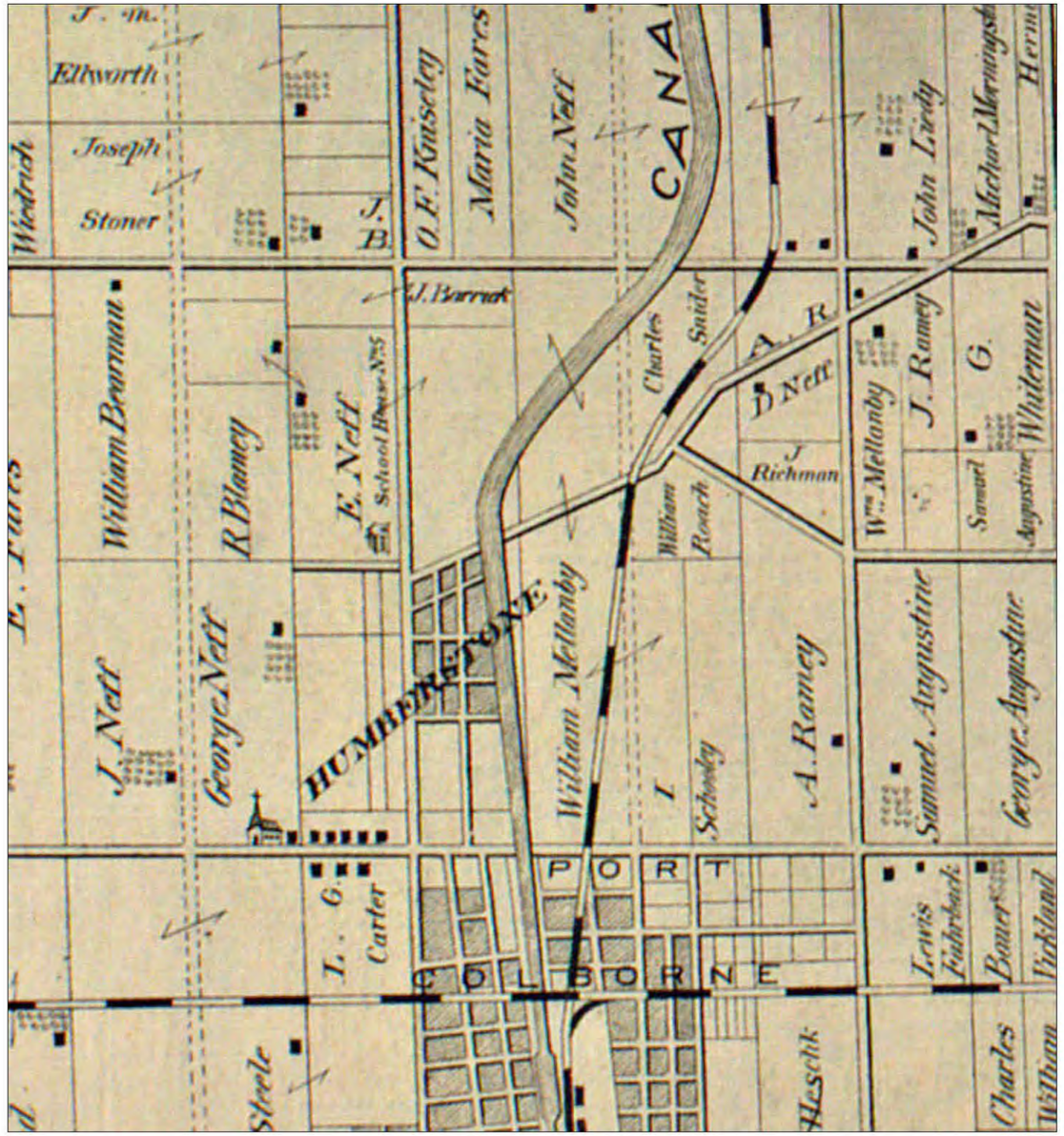
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1862



1876



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

1862 TREMAINE'S MAP OF THE COUNTIES OF LINCOLN AND WELLAND, CANADA WEST, COMPILED & DRAWING FROM ACTUAL SURVEYS, PUBLISHED BY GEO. R. & G. TREMAINE, TORONTO.

1876 ILLUSTRATED HISTORICAL ATLAS OF THE COUNTIES OF LINCOLN AND WELLAND, ONTARIO, COMPILED, DRAWN, AND PUBLISHED FROM PERSONAL EXAMINATIONS AND SURVEYS BY H.R. PAGE, TORONTO.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

STAGE 2 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
VARIOUS LOTS AND CONCESSIONS, GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
FORMER COUNTY OF WELLAND, CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

TITLE

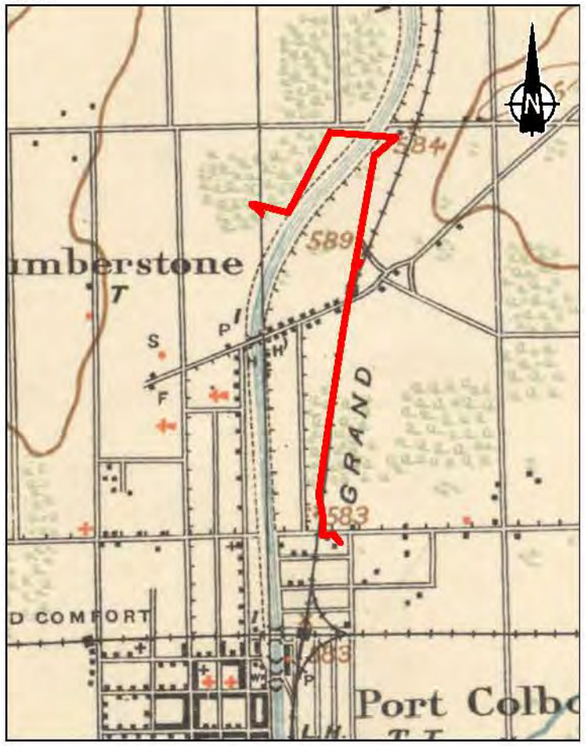
PROJECT AREA OVERLAID ON 19th CENTURY HISTORICAL MAPS

GOLDER
MEMBER OF WSP

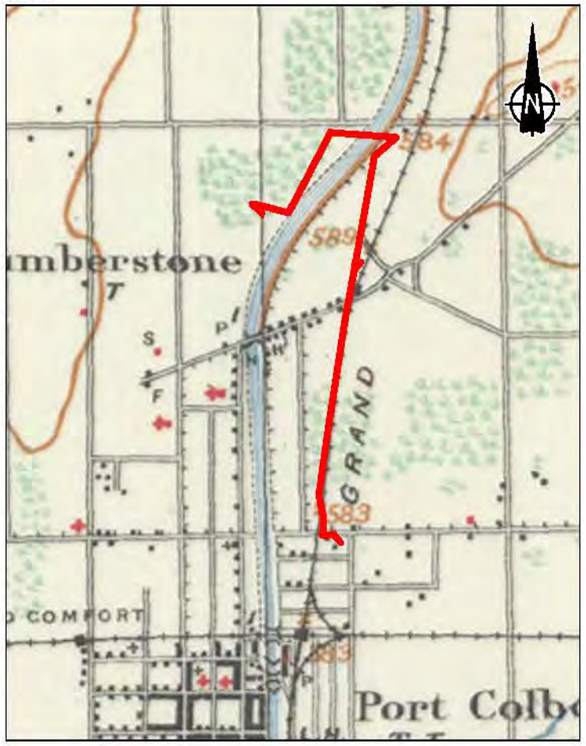
PROJECT No.		20139291	FILE No. 20139291-3000-R01002
DESIGN			SCALE -S SHOWN REV.
C-DD	DCH	-ug 10/21	
CHECK			MAP 2
REVIEW			

Client: Regional Municipality of Niagara
Original Format is Tabloid 279mm x 432mm
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Aug 10, 2021 - 4:18pm
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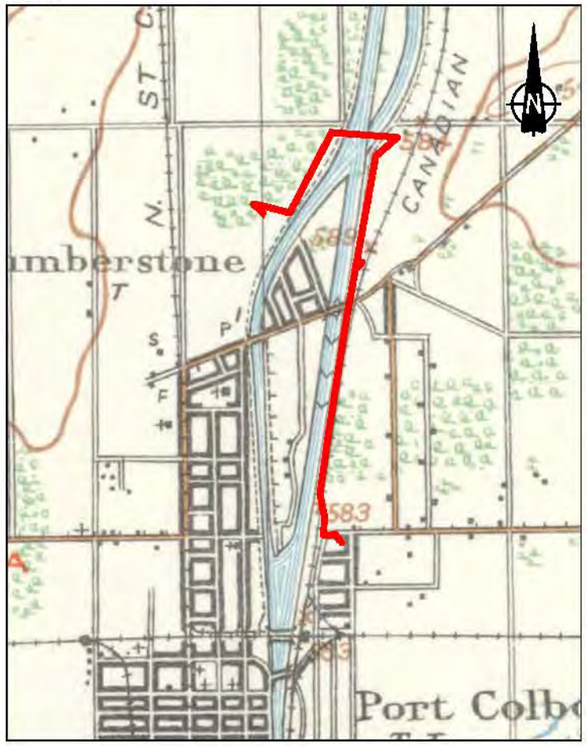
1907



1923



1929



1934



1938



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

1907 WELLAND, ONTARIO. 1:63,360. MAP SHEET 030L14, [ED. 1]. SURVEY DIVISION, DEPARTMENT OF MILITIA AND DEFENCE;
1923 WELLAND, ONTARIO. 1:63,360. MAP SHEET 030L14, [ED. 3]. SURVEY DIVISION, DEPARTMENT OF MILITIA AND DEFENCE;
1929 WELLAND, ONTARIO. 1:63,360. MAP SHEET 030L14, [ED. 4]. GEOGRAPHICAL SECTION, GENERAL STAFF, DEPARTMENT OF NATIONAL DEFENCE;
1934 WELLAND, ONTARIO. 1:63,360. MAP SHEET 030L14, [ED. 5]. GEOGRAPHICAL SECTION, GENERAL STAFF, DEPARTMENT OF NATIONAL DEFENCE;
1938 WELLAND, ONTARIO. 1:63,360. MAP SHEET 030L14, [ED. 6]. GEOGRAPHICAL SECTION, GENERAL STAFF, DEPARTMENT OF NATIONAL DEFENCE.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

SCALE IN KILOMETRES
0 0.5 1km
1:30

PROJECT
STAGE 2 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
VARIOUS LOTS AND CONCESSIONS, GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
FORMER COUNTY OF WELLAND, CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

TITLE
PROJECT AREA OVERLAID ON 20th CENTURY TOPOGRAPHICAL MAPS

GOLDER
MEMBER OF WSP

PROJECT No.		20139291	FILE No. 20139291-3000-R01002
DESIGN			SCALE AS SHOWN REV.
CADD	DCH	Aug 10/21	MAP 3
CHECK			
REVIEW			



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

[NIAGARA AIR PHOTO DIGITAL IMAGES, 1921 SERIES]. [1921-H21-33]. ST. CATHARINES, ON: BROCK UNIVERSITY MAPS, DATA & GIS, 2016. AVAILABLE: HTTPS://WWW.ARCGIS.COM/APPS/WEBAPPVIEWER/INDEX (ACCESSED 15/JAN/2021).

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT
STAGE 2 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
VARIOUS LOTS AND CONCESSIONS, GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
FORMER COUNTY OF WELLAND, CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

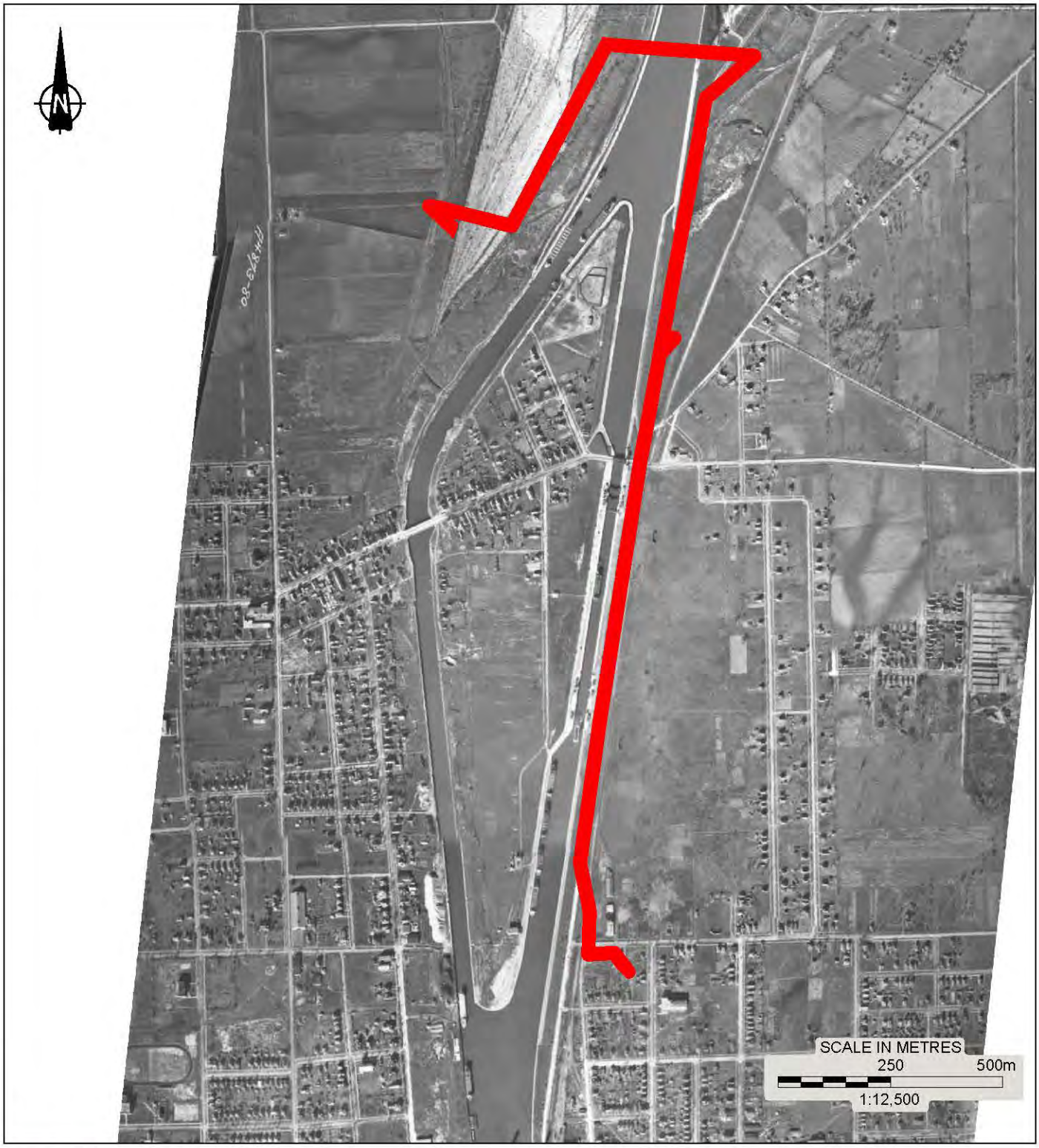
TITLE

PROJECT AREA OVERLAID ON 1921 AERIAL PHOTOGRAPH

GOLDER
MEMBER OF WSP

PROJECT No.		20139291	FILE No.20139291-3000-R01004
DESIGN			SCALE -S SHOWN REV.
C-DD	DCH	-ug 10/21	
CHECK			MAP 4
REVIEW			

Client: Regional Municipality of Niagara
Original Format is Letter 279mm x 216mm
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Aug 10, 2021 - 4:04pm
Drawing file: 20139291-3000-R01004.dwg



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

[NIAGARA AIR PHOTO DIGITAL IMAGES, 1934A SERIES]. [A4873-84]. ST. CATHARINES, ON: BROCK UNIVERSITY MAPS, DATA & GIS, 2016. AVAILABLE: HTTPS://WWW.ARCGIS.COM/APPS/WEBAPPVIEWER/INDEX (ACCESSED 15/JAN/2021).

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT
STAGE 2 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
VARIOUS LOTS AND CONCESSIONS, GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
FORMER COUNTY OF WELLAND, CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

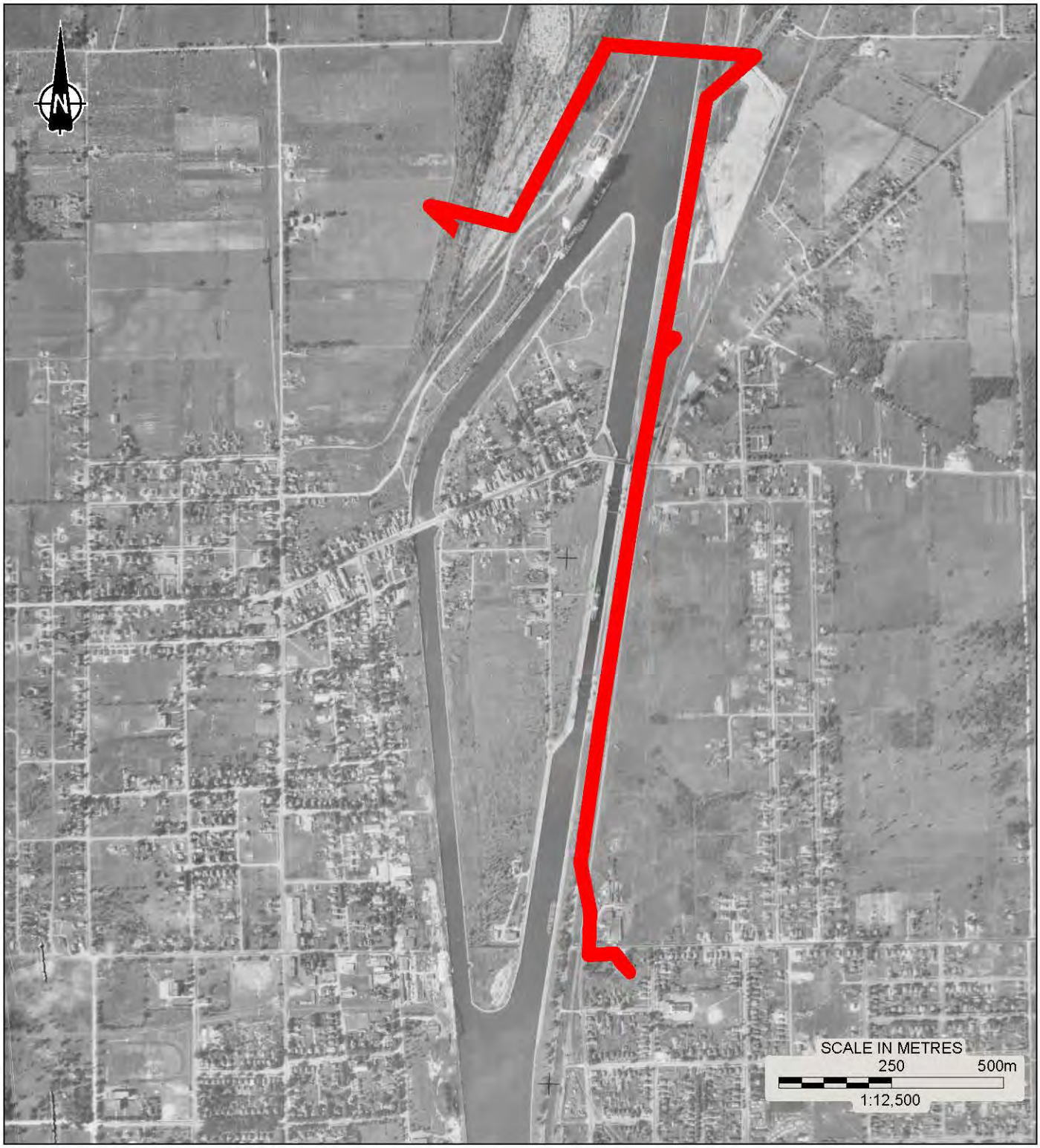
TITLE

PROJECT AREA OVERLAID ON 1934 AERIAL PHOTOGRAPH

GOLDER
MEMBER OF WSP

PROJECT No.		20139291	FILE No 20139291-3000-R01004
DESIGN			SCALE -S SHOWN REV.
CADD	DCH	-ug 10/21	
CHECK			MAP 5
REVIEW			

Client: Regional Municipality of Niagara
Original Format is Letter 279mm x 216mm
25mm
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Aug 10, 2021 - 4:07pm
Drawing file: 20139291-3000-R01004.dwg



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

[NIAGARA AIR PHOTO DIGITAL IMAGES, 1948 SERIES]. [11612-3]. ST. CATHARINES, ON: BROCK UNIVERSITY MAPS, DATA & GIS, 2016. AVAILABLE: HTTPS://WWW.ARCGIS.COM/APPS/WEBAPPVIEWER/INDEX (ACCESSED 15/JAN/2021).

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT
STAGE 2 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
VARIOUS LOTS AND CONCESSIONS, GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
FORMER COUNTY OF WELLAND, CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

TITLE

PROJECT AREA OVERLAID ON 1948 AERIAL PHOTOGRAPH

GOLDER
MEMBER OF WSP

PROJECT No.		20139291	FILE No.20139291-3000-R01004
DESIGN			SCALE -S SHOWN REV.
CADD	DCH	-ug 10/21	
CHECK			MAP 6
REVIEW			

Client: Regional Municipality of Niagara
Original Format is Letter 279mm x 216mm
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Aug 10, 2021 - 4:06pm
Drawing file: 20139291-3000-R01004.dwg



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

[NIAGARA AIR PHOTO DIGITAL IMAGES, 1968 SERIES]. [20444-35]. ST. CATHARINES, ON: BROCK UNIVERSITY MAPS, DATA & GIS, 2016. AVAILABLE: HTTPS://WWW.ARCGIS.COM/APPS/WEBAPPVIEWER/INDEX (ACCESSED 15/JAN/2021).

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT
STAGE 2 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
VARIOUS LOTS AND CONCESSIONS, GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
FORMER COUNTY OF WELLAND, CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

TITLE

PROJECT AREA OVERLAID ON 1968 AERIAL PHOTOGRAPH

GOLDER
MEMBER OF WSP

PROJECT No.		20139291	FILE No.20139291-3000-R01004
DESIGN			SCALE -S SHOWN REV.
CADD	DCH	-ug 10/21	
CHECK			MAP 7
REVIEW			

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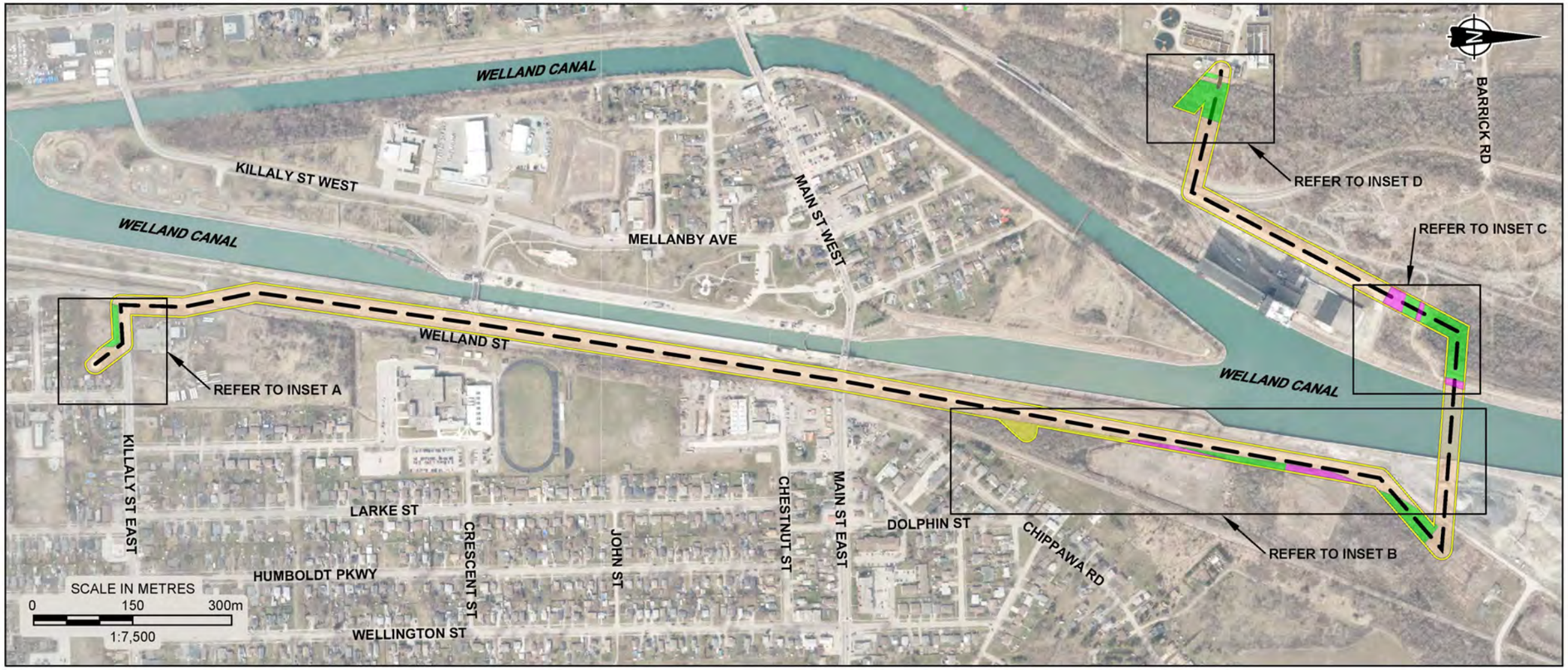
Client: Regional Municipality of Niagara

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Drawing file: 20139291-3000-R01008.dwg





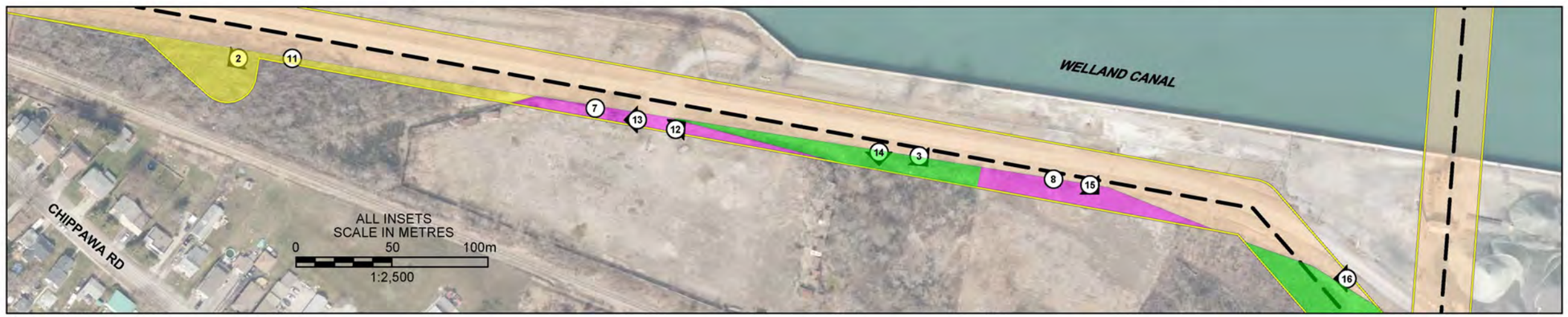
INSET D



INSET C



INSET A



INSET B

LEGEND

- BARRICK ROAD CROSSING - SEAWAY
- 15m BUFFER FROM BARRICK ROAD CROSSING - SEAWAY (APPROXIMATE PROJECT AREA)
- (1) PHOTOGRAPH LOCATION, VIEWING DIRECTION, AND PLATE NUMBER
- (6) PHOTOGRAPH LOCATION, LOOKING DOWN, AND PLATE NUMBER

STAGE 2 METHODS AND RESULTS:

- STAGE 2 TEST PIT SURVEY AT 5m INTERVALS
- STAGE 2 TEST PIT SURVEY AT 10m INTERVALS
- DISTURBED; NO FURTHER ARCHAEOLOGICAL CONCERN
- PREVIOUSLY ASSESSED; NO FURTHER ARCHAEOLOGICAL CONCERN

REFERENCE

DRAWING BASED ON AERIAL IMAGERY AND PARCEL DATA PROVIDED BY THE REGION OF NIAGARA; ROUTE ALTERNATIVES PROVIDED BY GM BLUEPLAN, SEPTEMBER 29 - 2020;

NOTES

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PROJECT

STAGE 2 ARCHAEOLOGICAL ASSESSMENT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
VARIOUS LOTS AND CONCESSIONS, GEOGRAPHIC TOWNSHIP OF HUMBERSTONE
FORMER COUNTY OF WELLAND, CITY OF PORT COLBORNE,
REGIONAL MUNICIPALITY OF NIAGARA, ONTARIO

TITLE

STAGE 2 ARCHAEOLOGICAL ASSESSMENT RESULTS

GOLDER
MEMBER OF WSP

PROJECT No.		20139291	FILE No.20139291-3000-R01008
			SCALE AS SHOWN REV.
CADD	DCH	Aug 11/21	
CHECK			MAP 8

Signature Page

We trust that this report meets your current needs. If you have any questions, or if we may be of further assistance, please contact the undersigned.

Golder Associates Ltd.



Nimal Ragavan Nithiyanantham, MA, CAHP
Archaeologist/ Cultural Heritage Specialist



Michael Teal, MA
Associate, Senior Archaeologist

SB/RN/MT/ca

https://golderassociates.sharepoint.com/sites/123072/project files/6 deliverables/03 stage 2 aa/final report/p390-0357-2021_18oct2021_re_st2_portcolbornefm.docx

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APPENDIX A

City of Port Colborne - Heritage Property Registry

PORT COLBORNE HERITAGE PROPERTY REGISTRY

June 17, 2008 Rev. 1

			CURRENT INFORMATION											
STREET/ROAD	BUILDING NO.	Yr Designated	YEAR CONSTRUCTION COMMENCED/ COMPLETED	AGE KNOWN/ ESTIMATED	BUILDING NAME	LOT NO.	CONCESSION NO.	PRESENT OWNER	ADDRESS OF CURRENT OWNER	PREVIOUS OWNER (SURVEY 1982)	ADDRESS OF PREVIOUS OWNER	PRESENT USE	ORIGINAL USE	ZONING
Adelaide	21		1875	ESTIMATED		28	1			Romeo & Marguerite Rochon	Same	Single Detached Residential	Single Detached Residential	R4
Adelaide	27		1895	ESTIMATED		28	1			Leo M. & Linda St. John	Same	Duplex Residential	Single Detached Residential	R4
Adelaide	55		1880	ESTIMATED		28	1			James E. Pifer	Same	Multiple Unit Residential	Single Detached Residential	R4
Adelaide	66		1875	ESTIMATED		28	1	Tara Grabell	Same	Rose Katona	Same	Single Detached Residential	Single Detached Residential	R4
Adelaide	67		1870	ESTIMATED		28	1			David Ploughman	Same	Single Detached Residential	Single Detached Residential	R4
Adelaide	79		1880	ESTIMATED		28	1			Leo & Olive MacMitchell	Same	Single Detached Residential	Single Detached Residential	R4
Adelaide	87		1880	ESTIMATED		28	1			Cecil & Gwen Purdy	Same	Single Detached Residential	Single Detached Residential	R4
Adelaide	109		1902	ESTIMATED		28	1			Alex Balogh	Same	Single Detached Residential	Single Detached Residential	R4
Adelaide	115		1890	ESTIMATED		28	1			Helen & Donald Ford	Same	Single Detached Residential	Single Detached Residential	R4
Ash	167		N/A			29	1			Ontario Water Resources Commission (1969)	N/A	Residential	Residential	R2
Barrick	264		1876	ESTIMATED		31	3			Weldon B. & Vera G. Misener	Same	Single Detached Residential	Single Detached Residential	R1
Barrick	315		N/A			32	2			Director, Veteran's Land Act	N/A	Single Detached Residential	Single Detached Residential	R1
Beach	14		1900	ESTIMATED		29	2			Walter & Louise Neff	Same	Single Detached Residential	Single Detached Residential	R2
Beach	25		1910	ESTIMATED		29	2			Antonio Sceppacerqua & Wife	Same	Duplex Residential	Unknown	R2
Beach (Road)	5251		N/A			3	1			Vera Matthews, Myra Ellsworth	N/A	Single Detached Residential	Single Detached Residential	RU
Bell	146		N/A			26	1			Roman Catholic Episcopal Corp Diocese of Toronto	N/A	Residential	Residential	R2
Bell	160		1895	ESTIMATED		26	1			Martha Eigner	Same	Single Detached Residential	Single Detached Residential	R2
Bell	206		N/A			26	1			Rhea Cloutier	Same	Residential	Residential	R2
Bell	245		N/A			26	1			Cleone Seeman	N/A	Residential	Residential	R2
Borden	1		1863	ESTIMATED		29	2			Louis Bartok	Same	Single Detached Residential	Duplex Residential	R2
Borden	133		1890	ESTIMATED		29	2			Bruce Benner	Same	Single Detached Residential	Single Detached Residential	R2
Borden	183		1862	ESTIMATED		29	2			Elanor Schmidtke	114 Ost Ave	Single Detached Residential	Multiple Residential	R2
Brookfield	1623		1870	ESTIMATED		10	2			L. Troup	Same	Single Detached Residential	Single Detached Residential	A
Brookfield	3986		1870	ESTIMATED		11	4			Jacob Henry	Same	Residential	Residential	A
Canal Bank	25		1880	ESTIMATED		28	2			Edward Durant	Same	Single Detached Residential	Single Detached Residential	R2
Canal Bank	35		1910	ESTIMATED		28	2			Joseph Blaszynski	Same	Residential	Residential	R2

			CURRENT INFORMATION											
STREET/ROAD	BUILDING NO.	Yr Designated	YEAR CONSTRUCTION COMMENCED/ COMPLETED	AGE KNOWN/ ESTIMATED	BUILDING NAME	LOT NO.	CONCESSION NO.	PRESENT OWNER	ADDRESS OF CURRENT OWNER	PREVIOUS OWNER (SURVEY 1982)	ADDRESS OF PREVIOUS OWNER	PRESENT USE	ORIGINAL USE	ZONING
Canal Bank	37		1877	ESTIMATED		28	2			Dan & Patricia Parker	Same	Single Detached Residential	Single Detached Residential	R2
Canal Bank	45		1890	ESTIMATED		28	2			Rose Cserveyak	Same	Single Detached Residential	Single Detached Residential	R2
Catharine	13		1895	ESTIMATED		28	1			Cory J. Seeley	Same	Duplex Residential	Single Detached Residential	R4
Catharine	14	1986	1890	ESTIMATED	WILDWOOD	28	1			Bruce & Imogene Reid	Same	Single Detached Residential	Single Detached Residential	R4
Catharine	28		N/A			28	1			Nickel Basin Properties Ltd.	N/A	Residential	Residential	R4
Catharine	29		1908	ESTIMATED		28	1			International Nickel Co. of Canada	N/A	Residential	Residential	R4
Catharine	90		1880	ESTIMATED		28	1			Rudolph Hurealt	Same	Duplex Residential	Single Detached Residential	R4
Catharine	96		1880	ESTIMATED		28	1			Lametti Construction Ltd.	N/A	Single Detached Residential	Single Detached Residential	R4
Catharine	133		1870	ESTIMATED		28	1			Rudolph Hurealt	64 Tennessee Ave	Duplex Residential	Single Detached Residential	R4
Catharine	136		1910	ESTIMATED		28	1			Bessie Rudolph	N/A	Residential	Residential	R4
Catharine	140		1890	ESTIMATED		28	1			Gerardus & Eliza Veldman	Same	Duplex Residential	Single Detached Residential	R4
Catharine	172		1910	ESTIMATED		28	1			Rose & Margaret Mirrless	N/A	Residential	Residential	R4
Catharine	206		1906	ESTIMATED		28	1			Gerald Richard	N/A	Duplex Residential	Unknown	CC-31
Catharine	254		1927	ESTIMATED		28	1			John Buscarino	N/A	N/A	N/A	CC-31
Catharine	262		1885	ESTIMATED		28	1			Fernand Gibbs	Same	Office	Single Detached Residential	Business Improvement Area
Catharine	304		N/A			28	1			Roland Rickard & Wife	Same	Residential	Residential	R2
Catharine	310		1876	ESTIMATED		28	1			James Kelly	Same	Single Detached Residential	Single Detached Residential	R2
Catharine	326		1910	ESTIMATED		28	1			Keith & Patricia Moorhouse	Same	Residential	Residential	R2
Catharine	346	1988	1874	KNOWN	St. James Rectory	28	1			Mary Thompson	Same	Duplex Residential	Single Detached Residential	R2
Catharine	358		1905	ESTIMATED		28	1			Port Colborne Warehousing Ltd.	N/A	Residential	Unknown	R2
Cedar Bay (Road)	621		1875	ESTIMATED		12	1			Slavko Janjic	Same	Multiple Unit Residential	Single Detached Residential	RU
Cedar Bay (Road)	666		1900	ESTIMATED		13	1			B. Hilborn	Same	Single Detached Residential	Single Detached Residential	RU
Charles	42		1900	ESTIMATED		28	2			Leonard & Helen Kramer	Same	Single Detached Residential	Single Detached Residential	R2
Charles	44		N/A			28	2			Monique Audit	Same	Residential	Unknown	R2
Charles	66		1895	ESTIMATED		28	1			Marshall E. Doan	Same	Multiple Unit Residential	Single Detached Residential	R2
Charlotte	17		1860	ESTIMATED		28	1			Don & Kim Lee	Same (Upper floor)	Restaurant	Single Detached Residential	CC-31
Charlotte	20		1910	ESTIMATED		28	1			Mione Ltd.	N/A	Mercantile - Retail	Unknown	CC-31
Charlotte	21		1880	ESTIMATED		28	1			Clifford & Lila Kramer	N/A	Insurance Office/ Medical (Apt Upstairs)	Unknown	CC-31

			CURRENT INFORMATION											
STREET/ROAD	BUILDING NO.	Yr Designated	YEAR CONSTRUCTION COMMENCED/ COMPLETED	AGE KNOWN/ ESTIMATED	BUILDING NAME	LOT NO.	CONCESSION NO.	PRESENT OWNER	ADDRESS OF CURRENT OWNER	PREVIOUS OWNER (SURVEY 1982)	ADDRESS OF PREVIOUS OWNER	PRESENT USE	ORIGINAL USE	ZONING
Charlotte	50		1890	ESTIMATED		28	1			E & M Reichart	RR#1 Fenwick	Retail store, Apt	Single Detached Residential	CC-31

			CURRENT INFORMATION											
STREET/ROAD	BUILDING NO.	Yr Designated	YEAR CONSTRUCTION COMMENCED/ COMPLETED	AGE KNOWN/ ESTIMATED	BUILDING NAME	LOT NO.	CONCESSION NO.	PRESENT OWNER	ADDRESS OF CURRENT OWNER	PREVIOUS OWNER (SURVEY 1982)	ADDRESS OF PREVIOUS OWNER	PRESENT USE	ORIGINAL USE	ZONING
Charlotte	54		1896	KNOWN		28	1			Giovanna Defelice	96 Adelaide Street	Retail store, Apt	Single Detached Residential	CC-31
Charlotte	55		1916	KNOWN	St. James Anglican Church	28	1			Trustees of St. JamesAnglican Church	N/A	Church	Same	CC-31
Charlotte	56		1890	ESTIMATED		28	1			N/A	N/A	N/A	N/A	CC-31
Charlotte	72		1906	KNOWN	Guild Hall	28	1			Wardens of St. James Church	N/A	Church Hall	Same	CC-31
Charlotte	112		1890	ESTIMATED		28	1			Paul & Marie Wilgosh	Same	Duplex Residential	Single Detached Residential	CC-31
Charlotte	119		1860	ESTIMATED		28	1			Partnership Holdings Inc. & Assoc.	N/A	Single Detached Residential	Single Detached Residential	CC-31
Charlotte	122		1890	ESTIMATED		28	1			Paul & Marie Wilgosh	112 Charlotte St	Duplex Residential	Single Detached Residential	CC-31
Charlotte	169		1890	ESTIMATED		29	1			Richard Millard	Same	Single Detached Residential	Single Detached Residential	CC-31
Charlotte	2/12/14		N/A			28	1			Charles & Gert Plentai	N/A	Mercantile - Retail	Unknown	CC-31
Charlotte	29-33		1890	ESTIMATED		28	1			Laurier Labelle	N/A	Specialty store, workshop	Unknown	CC-31
Charlotte	32-34		1920			28	1			Belmont Hotel Ltd.	Same	Tavern/Saloon	Unknown	CC-31
Chippawa (Road)	153		N/A			26	2			Cecil & Violet Bowman	Same	Multiple Unit Residential	Unknown	R2
Chippawa (Road)	205		N/A			25	2			Roderick Standish	Same	Residential	Unknown	R1
Chippawa (Road)	352		N/A			26	2			Clarence & Cathryn Shields	N/A	Residential	Unknown	R1
Chippawa (Road)	572		N/A			23-24	3			Gilbert & Catharine Murray	N/A	Residential	Unknown	A
Chippawa (Road)	975		1913	KNOWN						Babion	Same	Residential	Residential	
Chippawa (Road)	998		N/A			21	3			Paul Babion	Same	Residential	Unknown	RU-1
Chippawa (Road)	1024		1850	ESTIMATED		20	3			J. Kramer	Same	Residential	Unknown	RU-1
Chippawa (Road)	1245		1885	ESTIMATED		19	3			Ray Middel	Same	Residential	Unknown	HD
Chippawa (Road)	1246		N/A			19	3			Rudolph & Olga Koch	Same	Residential	Unknown	HR
Chippawa (Road)	1445		1884	KNOWN	Matthew Stoner House	19	3			Raymond & Letitia Stoner	Same	Residential	Unknown	HR
Chippawa (Road)	2703	2011	1915	KNOWN	Humberstone School No. 6	18	3	City of Port Colborne				Community Centre	School	
Chippawa (Road)	2831		N/A			19	3			Melanson	Same	Residential	Unknown	HR
Chippawa (Road)	2950		N/A			18	3			Mittlestead	Same	N/A	Unknown	HD
Church	24		1899	ESTIMATED		27	2			Ancel & Alma Young	Same	Single Detached Residential	Single Detached Residential	R2
Church	28		1910			27	2			Henry & Cecilia Wagner	Same	Single Detached Residential	Unknown	R2
Clarence	1		1928	KNOWN		28	1			Barbara Thomas	Runymede Road	Medical Office	Unknown	Business Improvement Area
Clarence	67		1923	KNOWN		28	1			PC Branch - Royal Cdn Legion	N/A	Club/Lodge	Unknown	Business Improvement Area
Clarence	78		1870	ESTIMATED		28	1			Angelo & Maria Aliberti	N/A	Specialty shop	Single Detached Residential	Business Improvement Area
Clarence	170		1904	ESTIMATED		28	1			Gertrude Campbell	N/A	Single Detached Residential	Single Detached Residential	R2

			CURRENT INFORMATION											
STREET/ROAD	BUILDING NO.	Yr Designated	YEAR CONSTRUCTION COMMENCED/ COMPLETED	AGE KNOWN/ ESTIMATED	BUILDING NAME	LOT NO.	CONCESSION NO.	PRESENT OWNER	ADDRESS OF CURRENT OWNER	PREVIOUS OWNER (SURVEY 1982)	ADDRESS OF PREVIOUS OWNER	PRESENT USE	ORIGINAL USE	ZONING
Clarence	178		1878	KNOWN		29	1			Christy & Colleen Malone	N/A	Administrative	Single Detached Residential	R2
Clarence	216		1890	ESTIMATED		29	1			Ron & Myrna Davis	Same	Single Detached Residential	Single Detached Residential	R2
Clarence	217		1907	ESTIMATED		29	1			Gaetana & Marie Ruggiero	Same	Single Detached Residential	Unknown	R2
Clarence	232		1904	ESTIMATED		29	1			Frank & Anna Vasko	N/A	Residential		R2
Clarence	264		1877	KNOWN		29	1			Jean Leitch	N/A	Single Detached Residential	Single Detached Residential	R2
Clarence	208/210		1860	ESTIMATED		29	1			Douglas & Helen Gross	N/A	Duplex Residential	Single Detached Residential	R2
Clarence	302/304		1906	ESTIMATED		30	1			Robert Noyes & wife, Frances West	N/A	N/A	Unknown	R2
Clark (Road)	1152		1816	ESTIMATED		8	2			Brian Jones	Same	Single Detached Residential	Single Detached Residential	A
Colborne	75		1894	ESTIMATED		25	1			Marie Miniou & Suzanne Torok	Same	Single Detached Residential	Single Detached Residential	R2
David	15		1912	ESTIMATED		28	1			Christopher & Bertha MacPhail	Same	Duplex Residential	Unknown	R4
Davis	128		1909	ESTIMATED		26	1			Anne Mason	N/A	Residential	Unknown	R3
Davis	346		N/A			26	1			Joseph Mazerolle Jr.	N/A	Multiple Unit Residential	Unknown	R3
Davis	413		N/A			26	1			Joseph Mazerolle Jr.	N/A	Residential	Unknown	R3
Davis	473		N/A			26	1			Silvino & Marcella Buffa	N/A	Residential	Unknown	R3
Delhi	57		1900	ESTIMATED		28	1			John Shedden	N/A	Single Detached Residential	Unknown	R2
Division	252		1900	ESTIMATED		30	1			John & Alice Weaver	N/A	Single Detached Residential	Single Detached Residential	R2
Durham	93		1900	ESTIMATED		27	1			Frank Bulatko	N/A	Single Detached Residential	Single Detached Residential	R3
Durham	101		1895	ESTIMATED		27	1			Carlo Salicco	N/A	Vacant & single dwelling	Emporium & single residential dwelling	R3
Durham	129		N/A			27	1			Lionel Nolet	N/A	Residential	Unknown	R3
Durham	133		1890	ESTIMATED		27	1			Canadian Labour Congress of PC	N/A	Social	Unknown	R3
Durham	159		1910	ESTIMATED		26	1			Clifford & Jean Grist	Same	Single Detached Residential	Unknown	R3
Elgin	63		1910	ESTIMATED		28	1			Vera Ungarian	N/A	Residential	Unknown	R2
Elgin	69		1910	ESTIMATED		28	1			Marshall E. Doan	N/A	Single Detached Residential	Unknown	R2
Elgin			1923	KNOWN	Port Colborne High School	29	1			PC Board of Education (PC High School)	N/A	School	Unknown	I
Elm	56		1893	KNOWN		29	1			Albert Schrader	Same	Single Detached Residential	Single Detached Residential	R4
Elm	78		1895	ESTIMATED		29	1			Paul Sherk	N/A	Single Detached Residential	Single Detached Residential	R4
Elm	82		1895	ESTIMATED		29	1			Carlton Weaving	Same	Single Detached Residential	Single Detached Residential	R4
Elm	102		1890	ESTIMATED		29	1			Leopold Koeber	Same	Single Detached Residential	Single Detached Residential	R4

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Elm	114		1885	ESTIMATED		29	1			Arnold Woods	RR#3 Wainfleet	Multiple Unit Residential	Single Detached Residential	R4
Elm	262		1881	KNOWN		29	1			Helen Augustine	Same	Single Detached Residential	Single Detached Residential	R4
Elm	610		1875	ESTIMATED		29	2			Gerald & Ava Dalcourt	Same	Duplex Residential	Single Detached Residential	R2
Elm	625		1910	ESTIMATED		28	2			Evelyn Campbell	N/A	Single Detached Residential	Unknown	R2
Elm	688		1862	KNOWN	First Lutheran Church	29	2			Church Trustees		Church		I
Elm	795		1880	ESTIMATED		28	2			Eliza Curcio	Same	Single Detached Residential	Single Detached Residential	R2
Elm	803		1870	ESTIMATED		28	2			Douglas & Dolores Shibley	Same	Single Detached Residential	School	R2
Elm	825		1885	ESTIMATED		28	2			Albert & Margaret Chambers	Same	Single Detached Residential	Specialty store	LI
Elm			1870	ESTIMATED	Knisley Home	28	3			Babcock Wilcox	N/A	N/A	N/A	LI
Empire	532		N/A			5	1			Edward Schatzline	Same	Single Detached Residential	Unknown	LR
Empire	573		1875	ESTIMATED		4	1			Bruce Shesler	Same	Single Detached Residential	Single Detached Residential	RO
Empire	731		N/A		Sherkston Community Church	4	1			Trustees of Sherkston Community Church	N/A	Church	Unknown	RO
Erie	83		1900	ESTIMATED		28	2			Steve & Jayne Seha (?) Jr.		Single Detached Residential	Single Detached Residential	R2
Erie	173		1900	ESTIMATED		28	2			Fay M. Dunning	Same	Single Detached Residential	Single Detached Residential	R2
Erie	183		1880	ESTIMATED		28	2			Ercole & Elvira Trasati	Same	Single Detached Residential	Single Detached Residential	R2
Erie	187		1880	ESTIMATED		28	2			Ercole Trasati	183 Erie Street	Single Detached Residential	Single Detached Residential	R2
Erie	220				Carpenters' Hall	28	2			City of Port Colborne	N/A	Social	Club/lodge	R2
Fares	55		1850	ESTIMATED		27	1			Percy Elliot		Single Detached Residential	Single Detached Residential	R2
Fares	120		1890	ESTIMATED		27	1			Albert Beck		Single Detached Residential	Single Detached Residential	R2
Fares	126					27	1			Rene Gingras		Single Detached Residential	Single Detached Residential	R2
Fares	163		1875	ESTIMATED		26	1			Andrew Timmons		Single Detached Residential	Single Detached Residential	R2
Fares	184					27	1			June A. Williams		Single Detached Residential	Unknown	R2
Fares	216					27	1			David G. Lee		Single Detached Residential	Unknown	R2

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Fares	222					27	1			Kenneth R. Mitchell		Single Detached Residential	Unknown	R2
Fares	227		1910	ESTIMATED	Thurston Machines	26	1			Thurston Machine Co. Ltd.	Same	Workshop	Unknown	NC
Fares	247					26	1			Alfred & Jean Dagenais	Same	Single Detached Residential	Unknown	R2
Fares	257					27	1			John Polc		Single Detached Residential	Unknown	R2
Fares	272					27	1			Leonard Trebley	Same	Single Detached Residential	Unknown	N/A
Fares	277					27	1			Pasquale & Caroline Donato	Same	Residential	Unknown	R2
Fares	283		1880	ESTIMATED		27	1			Joseph Mazerolle		Single Detached Residential	Single Detached Residential	R2
Fares	292		1900	ESTIMATED		27	1			Christina Yallin		Single Detached Residential	Single Detached Residential	R2
Fares	329		1890	ESTIMATED		26	1			Marianne Mazerolle		Single Detached Residential	Single Detached Residential	R2
Fares	344		1890	ESTIMATED		27	1			Marianne Mazerolle		Single Detached Residential	Single Detached Residential	R2
Fares	349		1850	ESTIMATED		27	1			Tekla Shibley		Multiple Unit Residential	Multiple Residential	R2
Fares	367		1904	ESTIMATED		27	1			Frank R. DiBartolomeo, Susan A. Kietz		Single Detached Residential	Unknown	R2
Fares	379		1875	ESTIMATED	Church Rectory	27	1			RC Church, Diocese of Toronto		Rectory	Single Detached Residential	I
Fares	447					27	1			Herbert B. Cox		Residential	Unknown	R2
Fares			1912		DeWitt Carter School	26	1			Board of Education Trustees PC	N/A	School	School	I
Fielden	238		1873	KNOWN		29	1			Mary T. Kerr (?)		Multiple Unit Residential	Single Detached Residential	R3
Fielden	252		1882	KNOWN		29	1			Mary Spencer	Same	Duplex Residential	Single Detached Residential	R3
Fielden	296	1993	1866	KNOWN	Roselawn / Port Colborne Club	29	1			The Port ColborneClub	Same	Social	Single Detached Residential	I
Fielden	320		1924	KNOWN	McKay Senior Public School	29	1			Municipal Board of Education		School	School	I
Fielden	547		1900	ESTIMATED		29	2			Gordon & Elsie Kittie	Same	Single Detached Residential	Single Detached Residential	R2
Fielden	550		1860	ESTIMATED		29	2			Leonard & Ethel Hardy	Same	Single Detached Residential	Single Detached Residential	R2
Fielden	557		1900	ESTIMATED		29	2			Violet Kramer	Same	Single Detached Residential	Single Detached Residential	R2
Fielden	583		1880	ESTIMATED		29	2			Reta McNeil	Same	Single Detached Residential	Single Detached Residential	R2

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Fielden	592		1845	ESTIMATED		29	2			Thomas & Dorothea Hicks	Same	Single Detached Residential	Single Detached Residential	R2
Fielden	605		1880	ESTIMATED		29	2			Gerard & Nettie Guindon	Same	Single Detached Residential	Unknown	R2
Fielden	730		1890	ESTIMATED		29	2			Peter & Margaret Vida	Same	Single Detached Residential	Single Detached Residential	R2
Fielden					Vimy School	29	2			Niagara South Board of Education	Thorold Rd, Welland	Empty	School	I
Firelane No. 1	1001	2004			William Brown House									
Forkes	3757		1883	ESTIMATED		9	4			Clarence Geyer	Same	Residential		A
Forkes	4261		1890	ESTIMATED		8	4			L. G. Durlait (?)	Same	Residential	Unknown	A
Fraser	76/80		1879	ESTIMATED		27	1			Gordon Davison		Display Room	Unknown	R3
George	33		1902	ESTIMATED		28	2			Richard Laplante		Residential	Unknown	R2
George	34		1896	ESTIMATED		28	2			Anna L. Krieger		Single Detached Residential	Single Detached Residential	R2
George	41		1900	ESTIMATED		28	2			JoAnn S. Silli		Single Detached Residential	Single Detached Residential	R2
George	62		1890	ESTIMATED		28	2			George & Lillian Kelly	Same	Single Detached Residential	Single Detached Residential	R2
Highway #3 East	770									Jack & Charline Hellinga	Same	Residential		
Highway #3 East	1097					20	2			Edgar Kramer		Residential	Unknown	A
Highway #3 East	1331					19	2			Daniel McNeil		Residential	Unknown	A
Highway #3 East	2309					15	2			Minnie Neff, Muriel Daniels	Same	Residential	Unknown	HD
Highway #3 East	2481					15	2			William J. Whalen		Tavern (House)	Unknown	HC
Highway #3 East	2652					14	2			Brian & Marianne Heaslip	Same	Residential	Unknown	HR
Highway #3 East	2665					14	1			Reid	Same	Single Detached Residential	Unknown	HR
Highway #3 East	2702					14	2			Francis Sneek, Peter Franson		Single Detached Residential	Unknown	HR
Highway #3 East	2739					13	1			Estate of Annie Kerag (?)		Residential	Unknown	HD
Highway #3 East	2790					13	2			Agnes Craig	Same	Residential	Unknown	HR
Highway #3 East	2935					13	1			Beverly Biel		Single Detached Residential	Unknown	I
Highway #3 East	3278					11	2			Rae Thompson & Mary E. Thompson	Same	Residential	Unknown	HD
Highway #3 East	3436					11	2			Mary F. Bearss		Residential		HD
Highway #3 East	3493					11	1			Antonio B. Correia		Residential	Unknown	I

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Highway #3 East	4109					8	1			Elaine Fischer			Unknown	RU-1
Highway #3 East	4181					8	1			Maurice & Madeline Soucy		Residential	Unknown	RU-1
Highway #3 East	5346					3	2			Donald & Anne w. Mauchlen (?)	Same		Unknown	A
Highway #3 East	1326/9		1912	ESTIMATED						Burt Kampius (John Kampius - Tenant)		Residential	Unknown	
Highway #3 West	698		1880			33	1			Philip & Dennis Richard		Residential	Unknown	RD
Kent	8-10		1885	ESTIMATED	Called the Saltbox House	28	1			Melville H. O'Neill	142 Kenilworth, Ottawa	Duplex Residential	Single Detached Residential	CC-31
Kent	19-21		1910	ESTIMATED		28	1			Roderick Flaherty & John D. Tuck		Residential	Unknown	CC-31
Kent	22		1890	ESTIMATED		28	1			Murray, Cora & Martin Miller		Single Detached Residential	Single Detached Residential	CC-31
Kent	44		1870	ESTIMATED		28	1			Paul & Felicia Hill	Same	Single Detached Residential	Single Detached Residential	CC-31
Kent	48		1880	ESTIMATED		28	1			Sidney & Adeline Thomas	Same	Single Detached Residential	Single Detached Residential	R4
Kent	52		1885	ESTIMATED		28	1			Patricia Augustine	Same	Single Detached Residential	Single Detached Residential	R4
Kent	56		1880	ESTIMATED		28	1			Allen Augustine	52 Kent St	Single Detached Residential	Single Detached Residential	R4
Kent	57		1900	ESTIMATED		28	1			Maurice & Wende Rochon	Same	Single Detached Residential	Single Detached Residential	R4
Kent	60		1895	ESTIMATED		28	1			Mary Justin (?)	Same	Single Detached Residential	Single Detached Residential	R4
Kent	65		1870	ESTIMATED		28	1			Robert H. Lang & Donna H. Millar		Duplex Residential	Single Detached Residential	R4
Kent	66		1895	ESTIMATED		28	1			Alex & Melita Gughielmi	Same	Single Detached Residential	Single Detached Residential	R4
Kent	77		1900	ESTIMATED		28	1			John & Zofie Radvilas	Same	Single Detached Residential	Single Detached Residential	R4
Kent	93/95		1900	ESTIMATED		28	1			Hendrick Regeling		Duplex Residential	Unknown	R4
Kent	94/96		1907	ESTIMATED		28	1			Thomas Shickluna		Duplex Residential	Unknown	R4
Kent	101		1902	ESTIMATED		28	1			Patricia Herbert		Residential	Unknown	R4
Kent	104		1907			28	1			Annie & Alfred Revirs (?)	Same	Residential	Unknown	R4
Kent	109		1903	ESTIMATED		28	1			Clifford & Dianne Robihs (?)	Same	Residential	Unknown	R4
Kent	110		1910	ESTIMATED		28	1			A. Evelyn Augustine		Residential	Unknown	R4
Kent	114		1909	ESTIMATED		28	1			Isaac & Violet Helson (?)		Residential	Unknown	R4
Kent	115		1907	ESTIMATED		28	1			Charles & Gertrude Garth		Residential	Unknown	R4
Kent	123		1905	ESTIMATED		28	1			Earl & Eileen Davis	Same	Single Detached Residential	Unknown	R4
Killaly St East	327		N/A			25	1			Silvio & Malvina Bettito		Residential	Unknown	R1
Killaly St East	398					24	2			Lorne & Erma Augustine		Residential	Unknown	RD
Killaly St East	741					22	1			Christina Demers		Residential	Unknown	RD
Killaly St East	758					22	2			INCO		Residential	Unknown	RD
Killaly St East	770					22	2			Jack & Charline Hellinga	Same	Residential	Unknown	RD
Killaly St East	791					22	1			Benjamin & Sibbelina Verdonk	Same	Residential	Unknown	RD
Killaly St East	1193					20	1			Rudolph & Joean Huneault	Same	Single Detached Residential	Unknown	RU-1
Killaly St East	1379					19	1			Joseph & June Muise	Same	Residential	Unknown	RU-1
Killaly St East	1627					18	1			Leonard & Gertrude Hallborg		Residential	Unknown	A

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Killaly St East	1739		1875	ESTIMATED		17	1			R. Toepp	Same	Single Detached Residential	Single Detached Residential	A
Killaly St West	135		1865	ESTIMATED	Wilson Estate	29	2			Bonato Bros. Co. Ltd.		Multiple Unit Residential	Single Detached Residential	R4
Killaly St West	149		1890	ESTIMATED		29	2			Harold Biederman	Same	Single Detached Residential	Single Detached Residential	R2
Killaly St West	157		1902	ESTIMATED		29	2			Herbert & Joy Dekker	Same	Single Detached Residential	Unknown	R2
Killaly St West	171		1863	KNOWN		29	2			Roland Turmel		Single Detached Residential	Single Detached Residential	R2
Killaly St West	185		1850	ESTIMATED		29	2			S.Z. Bendes & Margaret Bendes	510 Fielden Ave	Single Detached Residential	Single Detached Residential	R2
Killaly St West	211		1865	ESTIMATED		29	2			Brian & Alice Morgan	Same	Single Detached Residential	Single Detached Residential	R2
Killaly St West	269	1995	1890	ESTIMATED	Old Mennonite Church	30	2			Steve & Mary Mucha	Same	Single Detached Residential	Church	R2
Killaly St West	29/31		1900	ESTIMATED		28	2			Robert Reilly & Joseph Quinn		Duplex Residential	Single Detached Residential	RD
King	44		1860	ESTIMATED		28	1			Frank & Irene Lisicky	81 Homewood Ave	Duplex Residential	Single Detached Residential	R4
King	62		1866	ESTIMATED		28	1			Gerald & Isabelle Currie	Same	Single Detached Residential	Single Detached Residential	R4
King	86		1872	ESTIMATED		28	1			Fares H. Shibley	Same	Single Detached Residential	Single Detached Residential	R4
King	87		1865	ESTIMATED		28	1			Jack & Betty O'Neil	Same	Single Detached Residential	Single Detached Residential	R4
King	101		1877	ESTIMATED		28	1			Emil & Doris Manger		Duplex Residential	Single Detached Residential	R4
King	104		1870	ESTIMATED		28	1			William & Marjorie Frank	Same	Single Detached Residential	Single Detached Residential	R4
King	112		1870	ESTIMATED		28	1			Leslie & Annie Seko	17 Margaret St, Welland	Single Detached Residential	Single Detached Residential	R4
King	123		1869	ESTIMATED	St. Patrick's Rectory	28	1			Roman Catholic Episcopal Corp.		Single Detached Residential	Single Detached Residential	R4
King	126		1870	ESTIMATED		28	1			George & Yolande Czerlau		Single Detached Residential	Single Detached Residential	R4
King	134		1890	ESTIMATED		28	1			Robert Y. & Berthe M. Leveille	Lwr, 134 King St	Multiple Unit Residential	Single Detached Residential	R4
King	137					28	1			Bruce & Irene Robinson	Same	Duplex Residential	Unknown	R4
King	138		1870	ESTIMATED		28	1			Anthony Evans	Same	Single Detached Residential	Specialty store/single dwelling residential	R4
King	143		1900	ESTIMATED		28	1			Winnifred Wilkins	Same	Single Detached Residential	Single Detached Residential	R4
King	150		1897	ESTIMATED		28	1			Donald & Edna Workman	Same	Single Detached Residential	Single Detached Residential	R4
King	164		1867	ESTIMATED		28	1			Wilfred & Dorothy Fritz	Same	Office & single detached dwelling	Single Detached Residential	R4
King	172		1901	KNOWN		28	1			Edward & Marguerite Reichert	RR#1 Fenwick	Single Detached Residential	Single Detached Residential	R4
King	180		1860	ESTIMATED		28	1			Edward & Marguerite Reichert	RR#1 Fenwick	Single Detached Residential	Single Detached Residential	R4
King	215		1870	ESTIMATED		28	1			Julius E. Premi	171 Alexandra St	Barber shop & duplex residential	Unknown	CC-31
King	239		1925	KNOWN	Old City Hall	28	1			City of Port Colborne		City Hall	Unknown	BIA

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King	265		1925	KNOWN	Train Station	28	1			Buffalo & Lake Huron Railway Co.		Train Station	Train Station	BIA
King	280		1869	ESTIMATED	PC Historical & Marine Museum	28	1			City of Port Colborne	City Hall	Museum	Single Detached Residential	P
King	322	1987			Ingelside									
King	354		1917	ESTIMATED		28	1			Catharine Shibley		Unknown	Unknown	CC
King	368		1873	ESTIMATED		28	1			Charles Lee	Same	Duplex Residential	Single Detached Residential	CC
King	380	1994	1909	ESTIMATED	Thomas E. Reeb	28	1			Peter G. Tupen & Peter F. Wiltshire		Office - dentist	Unknown	CC
King	293	Federally Designated	1925	Known	Chickluna Garage	28	1			Imperial Oil Company		Vacant	Gas Station	
King	422		1926	ESTIMATED	McNab Lodge	28	1			Trustees of McNab Lodge		Lodge	Lodge	CC
King	518	1983	1863	ESTIMATED	The Ott House	28	2			Herman & Clara Ott	Same	Vacant	Single Detached Residential	RD
King	521		1905	ESTIMATED		28	2			Clara E. Pew	Same	Residential	Unknown	RD
King	524		1908	ESTIMATED		28	2			James & Margaret Nealon		Residential	Unknown	RD
King	530		1910	ESTIMATED		28	2			Daniel & Francis Legault		Single Detached Residential	Unknown	RD
King	537		1895	ESTIMATED		28	2			Joseph & Agnes Gobel	Same	Single Detached Residential	Single Detached Residential	RD
King	547		1905	ESTIMATED		28	2			Elfred & Simone Smith	Same	Residential	Unknown	RD
King	561		1900	ESTIMATED		28	2			Agro Midtown Bowling Ltd.	571 King St	General retail store	Unknown	RD
King	593		1860	ESTIMATED	(Known also as 589 King St)	28	2			Mary Frolak	Same	Restaurant & multiple residential dwelling	Single Detached Residential	RD
King	599		1880	ESTIMATED		28	2			Glen & Donna White	Same	Single Detached Residential	Single Detached Residential	RD
King	602					28	2			William & Traute (?) Benjatscich		Single Detached Residential	Unknown	RD
King	613		1919	ESTIMATED		28	2			Governing Council of the Salvation Army		Church	Unknown	RD
King	620				Imperial Courts	28	2			Tykes Holding Ltd.		Multiple Unit Residential	Unknown	NC
King	625					28	2			Bernie Davis		Residential	Unknown	RD
King	626					28	2			Tykes Holding Ltd.		Single Detached Residential	Single Detached Residential	RD
King	632		1875	ESTIMATED		28	2			Kenneth & Jeannette Anthes	Same	Duplex Residential	Single Detached Residential	RD
King	640		1875	ESTIMATED		28	2			Joseph Pavzolis	Same	Multiple Unit Residential	Single Detached Residential	RD
King	646		1860	ESTIMATED		28	2			Patricia G. Akins	Same	Duplex Residential	Single Detached Residential	RD
King	664		1860	ESTIMATED		28	2			Charles Given	Same	Single Detached Residential	Single Detached Residential	RD
King	665		1890	ESTIMATED		28	2			Carl H. Snider	Same	Single Detached Residential	Unknown	RD
King	675		1890	ESTIMATED	Zudels	28	2			George & Rita Zudel		Specialty store	Single Detached Residential	RD
King	681		1890	ESTIMATED		28	2			Myna Tokar	Same	Specialty shop & single residential dwelling	Single Detached Residential	RD
King	688		1890	ESTIMATED		28	2			Garry M. Savage		Single Detached Residential	Single Detached Residential	RD

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King	693		1900	ESTIMATED		28	2			Clarence Kells	128 River Rd, Welland	Duplex Residential	Single Detached Residential	RD
King	698		1885	ESTIMATED		28	2			Mona Mancuso & Ina Shibley		Duplex Residential	Single Detached Residential	RD
King	707		1877	ESTIMATED		28	2			City of Port Colborne		Demolished	Hotel/Inn	RD
King	720		1880	ESTIMATED		28	2			Tony & Carmella Tedesco	179 Erie St	Duplex Residential	Single Detached Residential	RD
King	725		1902	ESTIMATED		28	2			Rudolph L. Huneault		Duplex Residential	Unknown	RD
King	740		1862	ESTIMATED		28	2			John E. Carver		Demolished	Single Detached Residential	RD
King	747		1902	ESTIMATED		28	2			Morley A. Currie		Residential	Unknown	RD
King	748		1885	ESTIMATED		28	2			Cecil & Charlotte Armstrong	Same	Single Detached Residential	Single Detached Residential	RD
King	755		1900	ESTIMATED		28	2			Laszlo Gyorffy	Same	Multiple Unit Residential	Single Detached Residential	RD
King	761		1900	ESTIMATED		28	2			Cecil & Doris Shisler	Same	Convent	Single Detached Residential	RD
King	765		1900	ESTIMATED		28	2			Matilda Landsky	Same	Single Detached Residential	Single Detached Residential	RD
King	771		1870	ESTIMATED		28	2			William & Ruby Beechteller	Same	Single Detached Residential	Single Detached Residential	RD
King	774		1894	KNOWN		28	2			Segefrid & Cecile Houde	Same	Single Detached Residential	Single Detached Residential	RD
King	782		1860	ESTIMATED		28	2			Romeo Dersap	Same	Single Detached Residential	Single Detached Residential	RD
King	783		1890	ESTIMATED		28	2			Helen A. Danis		Single Detached Residential	Single Detached Residential	RD
King	786		1890	ESTIMATED		28	2			Gordon & Eileen Marr	Same	Single Detached Residential	Single Detached Residential	RD
King	791		1855	ESTIMATED		28	2			Raymond Guitara		Single Detached Residential	Single Detached Residential	RD
King	803					28	2			William R. & Rosemary Armstrong		Funeral home	Unknown	RD
King	821		1860	ESTIMATED		28	2			T.A. & Mary Hicks	Same	Barber shop & single residential	Single Detached Residential	RD
King	120/124					28	1			Geza & (?) Gegg	Same	Residential	Unknown	R4
King	548/550		1905	ESTIMATED		28	2			Jack R. May		Doctor's office	Single Detached Residential	RD
King	605/607					28	1			Rene & Helen Lascelle	981 Elm St	Multiple Unit Residential	Single Detached Residential	RD
King			1879	KNOWN	St. Patrick's RC Church	28	1			Roman Catholic Episcopal Corp.		Church	Church	R4
Lake (Rd)			1852	KNOWN	Jacob North Home	26	1			Canada Furnace Office (Algoma Steel)		Office	Brewery & Residential	L1
Lakeshore	121/123		1880	ESTIMATED		25	1			Eric & Ferne Goss	Same	Duplex Residential	Single Detached Residential	RD
Lakeshore			1887	ESTIMATED	Sugarloaf Farm	33	1			E.G. Marsh	111 Oakridge Cres, PC	Residential	Unknown	RD
Learn			1850	ESTIMATED		3	3			J. Bitner	Same	Single Detached Residential	Single Detached Residential	A
Lever	4841					5	4			William J. Woodruff		Residential	Unknown	A
Lever	5100					4	4			Martin Vanderkant		Residential	Unknown	A

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Lever	5245		1880	ESTIMATED		3	4			E. Redman		Residential	Unknown	A
Lorraine	606					21	1			John & Ada Schouter	Same	Residential	Unknown	A
Lorraine	650					21	1			Charles Spiteri		N/A	Unknown	A
Lorraine	708					21/22	1			Allen Davidson		Residential	Unknown	A
Lorraine	773					20	1			Irwin M. Walker		Residential	Unknown	A
Lorraine	854					21	1			Nathan & Anne Davidson	Same	Residential	N/A	A
Main St West	27		1902	ESTIMATED		27	2			His Majesty, King George V	PO Box 370, St. Kitts	Single Detached Residential	Single Detached Residential	R2
Main St West	37		1902	ESTIMATED		27	2			Aldo Palmer	160 Ersking, Apt 1911, TO	Duplex Residential	Single Detached Residential	R2
Main St West	45		1912	ESTIMATED		27	2			John & Mary Kviring	Same	Single Detached Residential	Unknown	R2
Main St West	53		1910	ESTIMATED		27	2			John Elcich		Residential	Unknown	R2
Main St West	56		1912	ESTIMATED		27	2			John & Mary Kviring		Residential	Unknown	R2
Main St West	76	1982	1852	KNOWN	Humberstone Town Hall	27	2			City of Port Colborne	City Hall	Community hall	City Hall	P
Main St West	85		1902	ESTIMATED		27	2			Eugene & Gloria Fancy		Single Detached Residential	Single Detached Residential	CC
Main St West	91		1874	ESTIMATED		27	2			Margaret W. Sorenson	Same	General retail store	Single Detached Residential	CC
Main St West	100		1875	ESTIMATED	Lukac's Plumbing	27	2			Joe & Suzie Lukacs		Specialty shop & single residential dwelling	Single Detached Residential	CC
Main St West	105					27	2			Muhammad A. Hashmi		Auto facility	Unknown	CC
Main St West	106		1875	ESTIMATED		27	2			John & Mary Balint	Same	Duplex Residential	Single Detached Residential	CC
Main St West	114		1874	ESTIMATED		27	2			James & Mary Gyursci	127 Joyce Ave, Welland	Multiple Unit Residential	Funeral Parlour	CC
Main St West	115		1875	ESTIMATED		27	2			Columbus Club of Port Colborne	150 Kent St	Mixed Use	Unknown	CC
Main St West	120		1870	ESTIMATED		27	2			Virginia Willick	Same	Specialty shop & single residential dwelling	Single Detached Residential	CC
Main St West	124		1896	ESTIMATED		27	2			Lorena Johnson		Specialty shop	Single Detached Residential	CC
Main St West	129					27	2			Elisa Spinosa		N/A	N/A	
Main St West	130		1862	ESTIMATED		27	2			Mr. Cross	Same	Single Detached Residential	Single Detached Residential	CC
Main St West	142		1885	ESTIMATED	Appleyard House	27	2			Alex & Enid Gillespie	Same	Duplex Residential	Single Detached Residential	CC
Main St West	145	1986	1872	ESTIMATED	Elias Augustine House	27	2			Charles A. Smith	Same	Duplex Residential	Single Detached Residential	CC
Main St West	155	2006	1896	ESTIMATED	The Century House	27	2			James & Sophia Bruno	Same	Multiple Unit Residential	Unknown	CC
Main St West	185		1880	ESTIMATED		28	2			R.V. Sales & Service	Same	Specialty shop	Single Detached Residential	CC
Main St West	189		1877	ESTIMATED		28	2			Guido Vecchi	14 Highview, Downsview	Duplex Residential	Unknown	CC
Main St West	196		1880	ESTIMATED		28	2			Gladys Amell	Same	Single Detached Residential	Single Detached Residential	CC

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Main St West	201					28	2			Fares H. Shibley	86 King St	Restaurant	Unknown	CC
Main St West	202		1860	ESTIMATED		28	2			Moskalyk Hotel & Enterprise		Hotel	Unknown	CC
Main St West	207		1870	ESTIMATED		28	2			James C. Leaney	Springfield Ave, Welland	Multiple Unit Residential	Single Detached Residential	CC
Main St West	220		1909	ESTIMATED	Cdn Imperial Bank of Commerce	28	2			C.I.B.C.	Toronto, ON	Bank	Bank	CC
Main St West	223		1887	ESTIMATED		28	2			Patricia L. Cook		Specialty shop & single residential dwelling	Single Detached Residential	CC
Main St West	229		1890	ESTIMATED		28	2			Silvio Buffa	6 Hawthorne Blvd, PC	Office & double dwelling	Unknown	CC
Main St West	237		1860	ESTIMATED		28	2			Klaas & Carrie Schoen	Same	General retail store & single residential dwelling	Single Detached Residential	CC
Main St West	247		1890	ESTIMATED		28	2			Margery McAvoy	Same	Medical clinic & single residential dwelling	Single Detached Residential	CC
Main St West	255		1913	ESTIMATED		28	2			Coleman & Olga Tolkei	Same	Residential	Unknown	CC
Main St West	256		1870	ESTIMATED		28	2			Alfredo Battista	240 Kingsway, Welland	Single Detached Residential	Single Detached Residential	CC
Main St West	280		1860	ESTIMATED		28	2			Alec & Steve Danch	115 Grassie Ave, PC	Duplex Residential	Single Detached Residential	CC
Main St West	296		1880	ESTIMATED		28	2			Albert & Viola Avolio	Same	Single Detached Residential	Single Detached Residential	CC
Main St West	354		1905	ESTIMATED		29	2			Bruce & Joanne Beauchamp	Same		Unknown	CC
Main St West	357		1900	ESTIMATED		29	2			Walter M. Hamm		Duplex Residential	Single Detached Residential	R2
Main St West	360		1865	ESTIMATED		29	2			Keith Larve	Same	Multiple Unit Residential	Single Detached Residential	R2
McCain	36		1860	ESTIMATED		29	2			Harry & Sharon Chevalier	Same	Single Detached Residential	Single Detached Residential	R2
McCain	38		1880	ESTIMATED		29	2			Mary O'Bilinsky	Same	Single Detached Residential	Single Detached Residential	R2
McCain	46		1880	ESTIMATED		29	2			Ewen & Maisie Castle	Same	Single Detached Residential	Single Detached Residential	R2
McCain	62		1900	ESTIMATED		29	2			Susan M. Neale	58 McCain, PC	Duplex Residential	Single Detached Residential	R2
Mellanby	168		1900	ESTIMATED		27	2			Frederick & Cindy Jennings		Single Detached Residential	Single Detached Residential	R2
Mellanby	226		1880	ESTIMATED		27	2			Percy & Phylis Herbert	Same	Single Detached Residential	Single Detached Residential	R2
Mellanby	231		1905	ESTIMATED		27	2			Lulu Stoner		Single Detached Residential	Unknown	R2
Mellanby	249		1884	ESTIMATED		27	2			Marcel Desroaches		Single Detached Residential	Single Detached Residential	R2
Michael	507		1870	ESTIMATED		7	1			James Quesnel	Same	Single Detached Residential	Single Detached Residential	A
Michener	5363					2	1			Kenneth & Catharine Warner	Same	Single Detached Residential	Unknown	RU
Michener	5591		1863	ESTIMATED		2	1			Markland		Barn	Barn	RU
Miller	1359		1901	ESTIMATED		16	2			H. Miller		Single Detached Residential	Single Detached Residential	A

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Miller	1580		1895	ESTIMATED		17	2			J. Gibson		Single Detached Residential	Single Detached Residential	A
Miller	1836		1890	ESTIMATED		17	2			W.J. Middlekoop		Single Detached Residential	Single Detached Residential	A
Miller	2506					17	3			John & Helen Lebocki	Same	Single Detached Residential	Unknown	RU-1
Miller	2575					16	3			Jack Doan	Same	Single Detached Residential	Unknown	RU-1
Miller	2882					17	3			Franklin & Monique Weasner	Same	Single Detached Residential	Unknown	RU-1
Miller	3104					17	4			Reginald & Margaret Goodyear	Same	Single Detached Residential	Unknown	RU-1
Miller	3603					16	4			Blake & Rose Steele	Same	Single Detached Residential	Unknown	RU-1
Mitchell	181		1908	ESTIMATED		26	1			Susie Lukacs		Residential	Unknown	R3
Mitchell	209		1880	ESTIMATED		26	1			Bernard Gervais		Single Detached Residential	Single Detached Residential	R3
Mitchell	210		1880	ESTIMATED		27	2			Ernest Avoit		Duplex Residential	Duplex Residential	R3
Mitchell	234		1880	ESTIMATED		26	1			Job Shibley		Single Detached Residential	Single Detached Residential	R3
Mitchell	265					26	1			John & Enrica Scopazzi	Same	Single Detached Residential	Unknown	R3
Mitchell	274		1890	ESTIMATED		26	1			Guiseppi Trapasso		Single Detached Residential	Single Detached Residential	R3
Mitchell	311		1896	ESTIMATED		26	1			Miriam Olsiuk		Single Detached Residential	Single Detached Residential	R3
Mitchell	337		1880	ESTIMATED		26	1			Raymond Charette		Duplex Residential	Duplex Residential	R3
Neff	9		1900	ESTIMATED		28	2			Eda D'Angelo	Same	Single Detached Residential	Single Detached Residential	R2
Neff	27					26	2			Moskalyk Hotel & Enterprise		Single Detached Residential	Unknown	R2
Neff	50		1848	ESTIMATED		28	2			Betty S. Lavechia	72 Nickel St, PC	Duplex Residential	Single Detached Residential	R2
Neff	58		1910	ESTIMATED		28	2			Aldo & Olivia Miani	Same	Residential	Unknown	R2
Neff	146		1902	ESTIMATED		29	2			Norman & Louise Davis		Residential	Unknown	R2
Neff	149		1906	ESTIMATED		29	2			William & Carole Russel	Same	Residential	Unknown	R2
Neff	164		1905	ESTIMATED		29	2			Alex & June McNay	Same	Single Detached Residential	Unknown	R2
Neff	165		1880	ESTIMATED		29	2			William & Lamoyle MacSweyn	Same	Single Detached Residential	Single Detached Residential	R2
Neff	86/88		1860	ESTIMATED		28	2			Marion Laverdiere	88 Neff St, PC	Duplex Residential	Single Detached Residential	R2
Neff (Rd)	1402					7	2			Nancy A. Smith		Single Detached Residential	Unknown	A
Nickel	25					27	1			John & Theresa Lyrette	Same	Single Detached Residential	Unknown	NC
Oakwood	111		1851	ESTIMATED	Neff House	30	2			Ellen Beauparlant	Same	Duplex Residential	Single Detached Residential	R2
Omer	150		1890	ESTIMATED		29	2			Bruce & Mary Haymes	1932 Elm St, PC	Duplex Residential	Single Detached Residential	R2
Park	4					28	1			Christina Morrison		Single Detached Residential	Unknown	BIA
Park	16		1840	ESTIMATED		28	1			Donald & Mary Richardson	Same	Single Detached Residential	Unknown	BIA

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Park	22		1875	ESTIMATED		28	1			William Wehlann	Same	Duplex Residential	Single Detached Residential	BIA
Park	26		1855	ESTIMATED		28	1			Olive Benner	Same	Single Detached Residential	Unknown	BIA
Park	30		1855	ESTIMATED		28	1			Marguerite Deline	151 Sybella Ave, Oakville	Single Detached Residential	Single Detached Residential	BIA
Park	34		1870	ESTIMATED		28	1			Gladys Michener		Single Detached Residential	Unknown	BIA
Park	44		1890	ESTIMATED		28	1			John Rose Securities & Construction Ltd	87 Clarence, PC	Single Detached Residential	Single Detached Residential	BIA
Pine	34		1908	ESTIMATED		29	2			Thomas & Rachel Blanchard		Single Detached Residential	Unknown	R2
Pine	35		1908	ESTIMATED		29	2			Ermanno P. & Dorothy Santarella	Same	Residential	Unknown	R2
Pine	41		1890	ESTIMATED		29	2			James & Mary Vittie	Same	Single Detached Residential	Single Detached Residential	R2
Pine	42		1906	ESTIMATED		29	2			Ivan & Carrol Duquette		Single Detached Residential	Unknown	R2
Pine	57		1869	ESTIMATED		29	2			Harry & Kathleen Town	Same	Single Detached Residential	Single Detached Residential	R2
Pinecrest	663					14	1			Edwin & Joyce Knoll	Same	Single Detached Residential	Unknown	A
Pinecrest	736		1899	ESTIMATED		15	1			H. Nigh	Same	Single Detached Residential	Single Detached Residential	A
Pleasant Beach	484					3	1			William J. Holmes		Single Detached Residential	Unknown	RU
Pleasant Beach	566		1875	ESTIMATED		3	1			Debbie Scherer		N/A	N/A	RU
Pleasant Beach	591					2	1			William & Myra J. Green	Same	Single Detached Residential	Unknown	RU
Pleasant Beach	666					3	1			Cora Michael		Residential	Unknown	RU
Pleasant Beach						3	1			Pleasant Beach Residents' Association		Social	Unknown	LR
Ramey	34		1904	ESTIMATED		27	2			Evan & Audrey Garrett		Residential	Unknown	R2
Ramey	72		1854	ESTIMATED		27	2			Ladovica & Josephine Foresi	100 West St, PC	Single Detached Residential	Single Detached Residential	R2
Ramey	76		1900	ESTIMATED		27	2			Lorenzo & Barbara Rowe	Same	Single Detached Residential	Single Detached Residential	R2
Rodney	83					26	1			Rojer J. Mahaffey & Margery Dean		Residential	Unknown	R3
Second Concession	3288		1870	ESTIMATED		11	3			Ivan Sahs	Same	Single Detached Residential	Unknown	A
Second Concession	3930		1880	ESTIMATED		9	3			Gary & Margaret Scott	Same	N/A	N/A	A
Second Concession	5167					4	2			Donald Washburn		Single Detached Residential	Unknown	A
Second Concession	5222		1850	ESTIMATED		4	3			L. Rossnagel		Single Detached Residential	Single Detached Residential	A
Second Concession	5625					2	2			Eldon & Lenona Minor	Same	Single Detached Residential	Unknown	A
Sherk	1271	2003	1875	ESTIMATED	Sherkwood	12	2			Suzanna Dumins		N/A	N/A	HD
Sherkston	4250		1870	ESTIMATED		6	1			John Susich	Same	Single Detached Residential	Single Detached Residential	RU-1
Sherkston	4838		1869	ESTIMATED		5	1			Donald C. Loney	Same	Single Detached Residential	Single Detached Residential	HR
Sherkston	5031		1870	ESTIMATED		4	1			Robert E. Sherk	Same	Single Detached Residential	Unknown	HD

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Sherkston	5065					4	1			Robert & Vera Sherk		Residential	Unknown	HD
Sherkston	5080					4	1			Raymond Damude Jr.		Single Detached Residential	Unknown	HR
Sherkston	5212		1860	ESTIMATED		3	1			Keith Reaman		General retail store	General retail store	HR
Sherkston	5306					3	1			Stanley & Lucille Patterson	Same	Single Detached Residential	Unknown	HD
Sherkston	5420					3	1			Ethel B. Johnston		Single Detached Residential	Unknown	HD
Sherkston	5446					2	1			Alvin & Catharine Benner	Same	Single Detached Residential	Unknown	HR
Sherkston	5488					2	1			David & Betty Diplock	Same	Single Detached Residential	Unknown	HR
Sherkston	5966					1	1			Petrus & Jeanette Hassleman	Same	Single Detached Residential	Unknown	HC
Silver	86		1890	ESTIMATED		29	2			Wm. & Carol Beechteller	Same	Single Detached Residential	Single Detached Residential	R2
St. Arnaud	79					26	2			Helen Gottwald		Residential	Unknown	R2
St. Arnaud	110		1880	ESTIMATED		26	1			Walter Dimond		Single Detached Residential	Single Detached Residential	R2
Steele	20		1865	ESTIMATED		30	1			Alma Robb & Isabel Bulleyment	Same	Single Detached Residential	Single Detached Residential	R1
Steele	34		1885	ESTIMATED		30	1			Wallace & Catharine Gretton	Same	Duplex Residential	Single Detached Residential	R1
Steele	64		1900	ESTIMATED		30	1			John & Wilhelmina Skinner	Same	Single Detached Residential	Single Detached Residential	R2
Steele	178		1909	ESTIMATED		30	1			Michael & Irene Ruzylo	Same	Single Detached Residential	Unknown	R2
Steele	210		1915	ESTIMATED	Steele Street School	30	1			Niagara South Board of Education	Welland, ON	School	School	I
Steele	228		1886	KNOWN		30	1			Audrey Cow	Same	Single Detached Residential	Single Detached Residential	R2
Steele	246					30	1			Gerald & Vivian Dalcourt	Same	Duplex Residential	Unknown	R2
Sugarloaf	21		1868	ESTIMATED		28	1			Ruby Z. Horne	198 Charlotte, PC	Multiple Unit Residential	Single Detached Residential	RD
Sugarloaf	25		1868	ESTIMATED		28	1			Rudolph L. Huneault	64 Tennessee Ave	Multiple Unit Residential	Single Detached Residential	RD
Sugarloaf	51		1924	ESTIMATED		28	1			William & Hope Avery	Same	Single Detached Residential	Unknown	R4
Sugarloaf	65		1875	ESTIMATED		28	1			Robert & Esther McWatters	Same	Single Detached Residential	Single Detached Residential	R4
Sugarloaf	77		1880	ESTIMATED		28	1			John C. & Phyllis C. Hill	19 Thorncrest, PC	Duplex Residential	Single Detached Residential	R4
Sugarloaf	86		1918	ESTIMATED		28	1			Clifford, Lawrence & Allistair McAllister		N/A	N/A	R4
Sugarloaf	87		1890	ESTIMATED		28	1			Alfred & Helen Strath	Same	Single Detached Residential	Single Detached Residential	R4
Sugarloaf	90		1868	ESTIMATED		28	1			Gerrit & Elizabeth Sherk	Same	Single Detached Residential	Single Detached Residential	R4
Sugarloaf	100					28	1			William & Mary Mione	Same	Single Detached Residential	Unknown	R4
Sugarloaf	108		1890	ESTIMATED		28	1			The Director, Veterans' Land Act		Single Detached Residential	Single Detached Residential	R4
Sugarloaf	117		1867	N/A		28	1			Frank & Helen L. Hammond	Same	Single Detached Residential	Single Detached Residential	R4

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Sugarloaf	334	1983		Tennessee Gates										
Tennessee	3	1983		Tennessee Gates										
Tennessee	19		1912	KNOWN	Old Casino	30	1			Shaheen Ansari	Same	Single Detached Residential	Casino/social club	R1
Tennessee	33		1875	ESTIMATED		30	1			James Walter	Same	Single Detached Residential	Social club	R1
Tennessee	34		1890	ESTIMATED		30	1			Donato & Helene Pinelli	Same	Single Detached Residential	Social club	R1
Tennessee	49		1890	ESTIMATED		30	1			Doris Clark	Same	Single Detached Residential	Social club	R1
Tennessee	59		1875	ESTIMATED		31	1			Stanley & Edna Box	Same	Residential	Social club	R1
Tennessee	83		1890	ESTIMATED		31	1			Waldo Morgan	Same	Single Detached Residential	Social club	R1
Tennessee	89		1880	ESTIMATED		31	1			Charles & Mary Marton	Same	Single Detached Residential	Social club	R1
Tennessee	91		1880	ESTIMATED		31	1			Donald & Edna Workman	150 King St, PC	Duplex Residential	Social club	R1
Tennessee	101		1880	ESTIMATED		31	1			Horatio Knoll	Same	Single Detached Residential	Social club	R1
Tennessee	105		1890	ESTIMATED		31	1			Mary Green	Same	Single Detached Residential	Social club	R1
Tennessee	109		1890	ESTIMATED		31	1			Leslie & Marjorie Seward	Same	Single Detached Residential	Social club	R1
Tennessee	113		1890	ESTIMATED		31	1			John & Catherine Wilson	Same	Single Detached Residential	Social club	R1
Tennessee	119		1880	ESTIMATED		31	1			Thomas & Grace Kirkwood	Same	Single Detached Residential	Social club	R1
Tennessee	125		1890	ESTIMATED		31	1			Charles Magee	Same	Single Detached Residential	Social club	R1
Tennessee	133		1910	ESTIMATED		31	1			Maurice & Isabel K. Smith	Same	Single Detached Residential	Social club	R1
Third Concession	1598					18	4			Bruce & Marylyn Currie	Same	Single Detached Residential	Unknown	HR
Third Concession	1724		1883	KNOWN	Bethel United Church	18	4			Trustees of Bethel UnitedChurch		Church	Church	HR
Third Concession	1795					17	3			Theodore & Catharines Ruiter	Same	N/A	Unknown	HR
Third Concession	1870		1865	ESTIMATED		18	4			J. Evans		Single Detached Residential	Unknown	HR
Third Concession	2148		1870	ESTIMATED		16	4			Lionel & Marjorie Rodrigue	Same	Single Detached Residential	Unknown	RU-1
Third Concession	2352		1840/1906	ESTIMATED		15	4			Patrick & Gloria J. Trombley	Same	Single Detached Residential	Unknown	A
Third Concession	2437					15	3			Charles & Helen Johnson	Same	Single Detached Residential	Unknown	A
Third Concession	2562		1877	ESTIMATED		14	4			W. Smith		Single Detached Residential	Unknown	A
Third Concession	2784					13	4			Howard J. Schleffel		Single Detached Residential	Unknown	A
Troup	1152					9	2			Ida Chastelet	Same	Single Detached Residential	Unknown	A
Troup	1170					9	2			Ida Chastelet	Same	N/A	Unknown	A

			CURRENT INFORMATION											
STREET/ROAD	BUILDING NO.	Yr Designated	YEAR CONSTRUCTION COMMENCED/ COMPLETED	AGE KNOWN/ ESTIMATED	BUILDING NAME	LOT NO.	CONCESSION NO.	PRESENT OWNER	ADDRESS OF CURRENT OWNER	PREVIOUS OWNER (SURVEY 1982)	ADDRESS OF PREVIOUS OWNER	PRESENT USE	ORIGINAL USE	ZONING
Union	43		1900	ESTIMATED		28	2			Donald & Florette Webber	Same	Duplex Residential	Single Detached Residential	R2
Victoria	26		1867	ESTIMATED		28	1			Karl Varga	Same	Multiple Unit Residential	Single Detached Residential	I
Victoria	49		1865	ESTIMATED		28	1			Kevin & Helen Thompson	Same	Single Detached Residential	Single Detached Residential	R4
Victoria	50		1880	ESTIMATED		28	1			Elmer & Doreen Pull	54 Victoria, PC	Duplex Residential	Single Detached Residential	R4
Victoria	59		1880	ESTIMATED		28	1			Charles & Vera Keillor	Same	Single Detached Residential	Single Detached Residential	R4
Victoria	60		1910	ESTIMATED		28	1			George & Frances Sinko	Same	N/A	Unknown	R4
Victoria	64		1870	ESTIMATED		28	1			Victor & Sharon Huffman	Upper 64 Victoria, PC	Duplex Residential	Single Detached Residential	R4
Victoria	86		1880	ESTIMATED		28	1			Delia Dobson		Single Detached Residential	Single Detached Residential	R4
Victoria	90		1880	ESTIMATED		28	1			Ronald Hardman	Same	Single Detached Residential	Single Detached Residential	R4
Victoria	94		1865	ESTIMATED		28	1			Jacqueline Ayres & Kerry Hill	Same	Single Detached Residential	Single Detached Residential	R4
Victoria	95					28	1			Albert & Emma Smyth	Same	Single Detached Residential	Unknown	R4
Victoria	108		1908	ESTIMATED		28	1			Lloyd & Yvonne Leslie	Same	N/A	Unknown	R4
Victoria	113		1890	ESTIMATED		28	1			William & Kathleen Devoe	Same	Single Detached Residential	Single Detached Residential	R4
Victoria	117		1890	ESTIMATED		28	1			Frances Dale		Single Detached Residential	Unknown	R4
Victoria	118		1885	ESTIMATED		28	1			Mary O'Hanlon	Same	Single Detached Residential	Single Detached Residential	R4
Wallace	18		1890	ESTIMATED		29	2			Gerrard & June Guillemette	Same	Single Detached Residential	Single Detached Residential	R2
Walnut	12		1912	ESTIMATED		33	1			John Tuck	Same	Single Detached Residential	Single Detached Residential	R1
Weaver	736					19-20	1			Roger & Janice Lampman	Same	Residential	Unknown	A
Weaver	856		1890	ESTIMATED		19	1			Wallace & Anne Bankert	Same	Single Detached Residential	Unknown	A
Welland	43		1880	ESTIMATED		27	2			Dominique Morin		Single Detached Residential	Single Detached Residential	R3
Welland	49					26	1			Constant & Rosemary Morin		Residential	Unknown	R3
Welland	63		1903	ESTIMATED		26	1			James & Lucille Hoyle	Same	Residential	Unknown	R3
Welland	77		1875	ESTIMATED		27	1			Sidney Weaver		Single Detached Residential	Single Detached Residential	R3
Welland	83		1875	ESTIMATED		27	1			Alex Sutherland		Single Detached Residential	Single Detached Residential	R3
Welland	89		1875	ESTIMATED		26	1			Danny & Rosemari Drummond		Single Detached Residential	Single Detached Residential	R3
Welland	95		1895	ESTIMATED		26	1			John Thompson		Duplex Residential	Single Detached Residential	R3
Welland	155		1890	ESTIMATED		27	1			Jean Provost		Single Detached Residential	Single Detached Residential	R3
Welland	165		1890	ESTIMATED		27	1			Piroska Balant		Single Detached Residential	Single Detached Residential	R3
Welland	173		1890	ESTIMATED		27	1			Francois Ladouceur		Single Detached Residential	Single Detached Residential	R3
Welland	177		1875	ESTIMATED		27	1			Raymond Lacroix	Same	Single Detached Residential	Single Detached Residential	R3
Welland	185		1885	ESTIMATED		27	1			Cornelius Dekoning	Same	Bowling Lanes	Unknown	R3

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STREET/ROAD	BUILDING NO.	Yr Designated	YEAR CONSTRUCTION COMMENCED/ COMPLETED	AGE KNOWN/ ESTIMATED	BUILDING NAME	LOT NO.	CONCESSION NO.	PRESENT OWNER	ADDRESS OF CURRENT OWNER	PREVIOUS OWNER (SURVEY 1982)	ADDRESS OF PREVIOUS OWNER	PRESENT USE	ORIGINAL USE	ZONING
Welland	203		1875	ESTIMATED		27	1			Albert & Elizabeth Toth	Same	Single Detached Residential	Single Detached Residential	R3
Welland	247		1900	ESTIMATED		27	1			Frank Bulatko		General retail store	Unknown	R3
Welland	281		1900	ESTIMATED		27	1			Emile Lafontaine	Same	Multiple Unit Residential	Multiple Residential	HC
Welland	289		1875	ESTIMATED		27	1			Paul Stewart	Same	Single Detached Residential	Single Detached Residential	HC
Welland	293		1880	ESTIMATED		27	1			Frances Bellizi		Single Detached Residential	Single Detached Residential	HC
Welland	323		1890	ESTIMATED		27	1			Marriette Yates	Same	Multiple Unit Residential	Multiple Residential	R2
Welland	327		1875	ESTIMATED		27	1			Catherine Riccini	Same	Single Detached Residential	Single Detached Residential	R2
Welland	331		1880	ESTIMATED		27	1			Teresa Desapio	Same	Multiple Unit Residential	Multiple Residential	R2
West	56		1890	ESTIMATED		28	1			Gordon & Lorraine Lee	Same	Multiple Unit Residential	Unknown	RD
West	62		1850	ESTIMATED		28	1			Lillian Thomas	Same	Single Detached Residential	Tavern	RD
West	70		1890	ESTIMATED		28	1			Trustees of Cdn Corps Assn.	Same	Military	Single Detached Residential	RD
West	84		1905	ESTIMATED		28	1			PC Warehousing Ltd.	Same	N/A	N/A	RD
West	136		1892	ESTIMATED		28	1			Steve & Danica Marinich	508 Bell St, PC	Multiple Unit Residential	Single Detached Residential	RD
West	140		1890	ESTIMATED		28	1			Alvin F. & Pearl A. Massey	199 Knoll St, PC	Multiple Unit Residential	Single Detached Residential	RD
West	144		1911	ESTIMATED		28	1			Helena E. Mahaffey	Same	Storage/warehouse & multiple residential dwelling	Unknown	RD
West	146		1900	ESTIMATED		28	1			Dennis Richard & Kim Lundy	Same	Multiple Unit Residential	Single Detached Residential	RD
West	148		1924	ESTIMATED		28	1			Joseph, Elias, Marie, John Gannam	Same	N/A	Unknown	RD
West	152		1895	ESTIMATED		28	1			Alfred & Mavis Foresi	465 Fares St, PC	Multiple Unit Residential	Single Detached Residential	CC-31
West	158		1869	ESTIMATED		28	1			John & Karstina R. Fokkens	Same	Workshop & Multiple Residential Dwelling	Unknown	CC-31
West	162		1926	ESTIMATED		28	1			Melville H. O'Neill	Same	N/A	Unknown	CC-31
West	176					28	1			Daniel A. & Wray E. Minor	Same	N/A	Unknown	CC-31
West	182		1900	ESTIMATED	Lotus Gardens	28	1			How & Soting Pang	Upper 182 West	Restaurant & single residential dwelling	Unknown	CC-31
West	192		1852	ESTIMATED	Sniders	28	1			Louis & Ruth Haydu	Same	Specialty store	Unknown	CC-31
West	196		1936	ESTIMATED		28	1			G. Smith MacDonald		N/A	Unknown	CC-31
West	256		1924	ESTIMATED		28	1			Everett M. Collins		N/A	N/A	CC-31

			CURRENT INFORMATION											
STREET/ROAD	BUILDING NO.	Yr Designated	YEAR CONSTRUCTION COMMENCED/ COMPLETED	AGE KNOWN/ ESTIMATED	BUILDING NAME	LOT NO.	CONCESSION NO.	PRESENT OWNER	ADDRESS OF CURRENT OWNER	PREVIOUS OWNER (SURVEY 1982)	ADDRESS OF PREVIOUS OWNER	PRESENT USE	ORIGINAL USE	ZONING
West	260		1875	ESTIMATED		28	1			Harold & Donald B. Cross	65 Linwood/94 Tennessee	General retail store	Unknown	CC-31
West	266					28	1			Star Hotel of Port Colborne Ltd.		N/A	Unknown	CC-31
West	172/174		1910	ESTIMATED		28	1			Clarence Schilling	56 Edgar St, PC	Hairdressing & Multiple Residential Dwelling	Unknown	CC-31
West	212/214	1983		CIBC Building										
West	188/190		1869	ESTIMATED		28	1			Felix & Edeltraud Gieger	71 Mercury Ave, PC	Denture clinic & multiple residential dwelling	Unknown	CC-31
West	262/264		1925	ESTIMATED		28	1			City of Port Colborne		N/A	Unknown	CC-31
Westside	46		1880	ESTIMATED		30	2			Ronald & Dorothy Winger	50 West St, PC	Vacant	Single Detached Residential	R1
White	1715					14	2			John & Antonio Vankezewyk	Same	Single Detached Residential	Unknown	A
White	1866					14	2			Tunis Koudys (?)	Same	Single Detached Residential	Unknown	A
White	2207					15	2			Koole	Same	Single Detached Residential	Unknown	A
White	2464					15	3			Bernard & Wanda Kordijjoka	Same	Single Detached Residential	Unknown	RU-1
White	2577					14	3			Richard T. Beauchamps		Single Detached Residential	Unknown	A
Wilhelm	3980		1880	ESTIMATED		4	2			H. Gamble	Same	Single Detached Residential	Single Detached Residential	A
Wyldewood	895					8	1			John & Bernice Lambie Jr.	Same	N/A	Unknown	RU-1
Yager	3247		1880	ESTIMATED		19	4			Gerrit J. Roseboom	Same	Single Detached Residential	Unknown	A
Yager	3670					18	4			Mike & Mary Krizan	Same	N/A	Unknown	RU-1
Zavitz	3499		1925			2	4			Wm. Hamm		Single Detached Residential	Unknown	A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Adelaide	21		Stucco/Plaster	Unknown	Single detached unit, plan is L shaped, saltbox roof shape, dormer	N/A	Sidewalk leading to house has "C.D. Winn" imprinted on it. Winn was the second owner of the house.	Silas D. Winn	Teamster	N/A	N/A
Adelaide	27	Classic Revival (est)	Possibly concrete	Unknown	Rectangular plan, 1 1/2 storeys, high gable roof	N/A	Main door glazing - partly glazed, some stained glass	Daniel S. Shickluna	N/A	N/A	N/A
Adelaide	55	Classic Revival (est)	Stucco/Plaster	Unknown	Single detached unit, rectangular plan	N/A	Storeys (2 Front, 1 Rear) Basement full under original house	Susanna Harbison	N/A	N/A	N/A
Adelaide	66	Classic Revival (est)	Vinyl siding over clapboard	Unknown	Single detached, rectangular, 2 storeys front, 1 1/2 storey rear, high gable roof, attached barn or garage/shed	Most original trim, some doors, most original windows, leaded window, oak turned staircase	Returned to single dwelling in 2001, fieldstone crawlspace, 3 porches (1 enclosed)	John Watts	N/A	N/A	N/A
Adelaide	67		Stucco/Plaster	Unknown	Single detached, rectangular, 1 1/2 storey front, 1 storey rear, gable-flat	N/A	Partial basement, closed porch	Unknown		N/A	N/A
Adelaide	79	Regency (est)	Stucco/Plaster, Nailed Frame	Unknown	Single detached, square, 1 1/2 storey		Open porch with wood columns, garage/coach house	William Kingston	N/A	N/A	N/A
Adelaide	87	Regency (est)	Stucco/Plaster, Nailed Frame	Unknown	Single detached, square, rear extension, 1 1/2 storey	N/A	Open porch with posts, garage, garden feature	Unknown		N/A	N/A
Adelaide	109		Wood	Unknown	Single detached, rectangular, dormers, high hip roof	N/A	Open porch	Unknown		N/A	N/A
Adelaide	115	Classic Revival (est)	Stucco/Plaster, Nailed Frame	Unknown	Single detached, square, 1 1/2 storey, high gable roof	N/A	Open porch, posts, garage, garden feature	Unknown		N/A	N/A
Ash	167		Stucco	Unknown	L-shaped plan, high gable roof	N/A	Porch	Jennie Fortier	N/A	N/A	N/A
Barrick	264		Brick	Unknown	Single detached, rectangular, 2 storeys, medium gable roof	N/A	Closed porch on side	Unknown		N/A	N/A
Barrick	315	Regency (est)	Wood - horizontal plank	Unknown	Single detached, rectangular plan	N/A	Open porch on front	Unknown		N/A	N/A
Beach	14	Classic Revival (est)	Plaster, sheathed building, wood frame	Unknown	Single detached, rectangular, 1 1/2 storeys, medium gable	N/A	Full basement, garage, barn	Unknown		N/A	N/A
Beach	25	Classic Revival (est)	Stucco	Unknown	Square plan, high gable roof, 1 1/2 storeys	N/A	Bay window, closed porch, fence	Henry P. Knisley	Farmer	N/A	N/A
Beach (Road)	5251	Regency (est)	Wood - horizontal plank	Unknown	Rectangular, high gable roof	N/A	Open porch with columns	Unknown		N/A	N/A
Bell	146	Italiante (est)	Stucco	Unknown	Single detached, square with rear extension wing, dormer in front façade, 2 storeys	N/A	Front porch enclosed, mansard roof (4 sides), bay window on 1st & 2nd storey, decorated frieze in 1st storey roof (porch)	Unknown		N/A	N/A
Bell	160	Regency (est)	Plaster/stucco, sheathed building, nailed frame	Unknown	Single detached, square, front & rear wing, 2 storeys, medium gable roof	N/A	Closed porch, balcony, garage, garden	Unknown		N/A	N/A
Bell	206	Classic Revival (est)	Wood - horizontal plank	Unknown	Single detached, square, medium gable roof, dormer over door in front façade	N/A	Garage	Unknown		N/A	N/A
Bell	245		Wood - horizontal plank	Unknown	Square, 2 storeys, left wing extensions, gable roof (cross gable)	N/A	Open front porch, arched windows	Unknown		N/A	N/A
Borden	1	Regency (est)	Stucco, wood frame	Unknown	Single detached, T-shaped, 1 1/2 storeys, low centre gable, foundation - concrete blocks covering squared rubble	N/A	Eyebrow & semi-circular windows, garage, outbuilding, fence, garden, open porch, balcony	Unknown		N/A	N/A
Borden	133	Classic Revival (est)	Stucco, wood frame	Unknown	Single detached, rectangular, 1 1/2 storeys, high gable	N/A	N/A	Sarah Niger	N/A	N/A	N/A
Borden	183	Classic Revival (est)	Brick, stone wall construction (exterior)	Unknown	Single detached, rectangular, 2 storeys, medium gable roof	N/A	Semi-circular windows, balcomy, attached garage, outbuilding, fence, walls almost 2 feet thick - brick frame, front windows - 1st floor segmental, 2nd floor semi-circular, main entrance - embrosure	Eliha Neff (Elisha?)	Farmer	N/A	N/A
Brookfield	1623	Regency (est)	Brick (stretcher bond), nailed frame	Unknown	Single detached, square, 1 1/2 storeys, medium gable	N/A	Open porch, garage, barn, outbuilding, fence, garden, water feature	Peter Neff	N/A	N/A	N/A
Brookfield	3986		Horizontal log-wood	Unknown	Single detached, square, 1 1/2 storeys, medium gable	N/A	Open porch, garage, barn (est 1875)	Possibly Jacob Bearss	Farmer	N/A	N/A
Canal Bank	25		Stone-rock faced, building not sheathed, brick wall construction	Unknown	Single detached, L-shaped, 2 storeys, pyramidal roof shape	N/A	Rear building wall made of rubble, windows 1 ft thick, possibly original building, garage, garden feature	F. Francke	N/A	N/A	N/A
Canal Bank	35		Plaster/stucco	Unknown	Single detached, square, 1 1/2 storey, low gable	N/A	Side closed porch	Samuel I. Dickinson	N/A	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Canal Bank	37		Plaster/stucco	Unknown	Single detached, rectangular, 1 1/2 storey, medium gable	N/A	Cement covering older foundations, garage is clapboard (house may have been once covered also), fence, garden	Unknown		N/A	N/A
Canal Bank	45	Regency (est)	Stucco, wood frame	Unknown	Single detached, 1 storey, pyramidal roof	N/A	Outbuilding, garden	Unknown		N/A	N/A
Catharine	13		Stretcher bond brick	Unknown	Single detached, square, 2 storeys, low hip roof, additional gable without window	N/A	Open porch, arcade, 13A Catharine is main entrance of original building, main façade is facing a laneway off Catharine, partial basement	Unknown		N/A	N/A
Catharine	14	Queen Anne Revival (est)	Stucco	Unknown	Single detached, rectangular, 2 storeys, high gable roof, drop pendant on roof, spire, 4 porches/verandas in total (double front, double side - 2 storeys)	N/A	Bay windows, stained glass window, outbuildings, lions on front lawn, concrete statues	Alice, Joseph Dickinson	N/A	N/A	N/A
Catharine	28	Neo-classic (est)	Stucco	Unknown	Single detached, rectangular, 2 storeys	N/A	Balcony, statue	Alice E Dickinson	N/A	N/A	N/A
Catharine	29		Brick	Unknown	Single detached, square, low gable roof	N/A	Open front porch, bay window	Unknown		N/A	N/A
Catharine	90		Shingle, nailed frame wall construction	Unknown	Single detached, rectangular, 1 1/2 storeys	N/A	Semi-circular windows, open porch, garage, garden	Alice E Dickinson	N/A	N/A	N/A
Catharine	96	Regency (est)	Plaster/stucco, nailed frame construction	Unknown	Single detached, L-shaped, gable roof	N/A	Crawlspace, balcony, garden	Possibly Eliza Williams	N/A	N/A	N/A
Catharine	133		Composition shingle or sheet	Unknown	Single detached, L-shaped, medium gable	N/A	Cross gable (but only 3 gables), more than one main entrance, partial basement, porch on first storey, balcony, garage	Possibly Robert Blackhall	N/A	N/A	N/A
Catharine	136		Brick	Unknown	Single detached, square, 2 storeys, cross gable roof	N/A	Stained glass window, open porch	John Boylen	N/A	N/A	N/A
Catharine	140		Plaster/stucco, nailed frame construction	Unknown	Single detached, square, 2 1/2 storeys	N/A	Open porch, fence, garden feature	Wm. Hiscott	N/A	N/A	N/A
Catharine	172	Queen Anne Revival (est)	Horizontal plank wood	Unknown	Single detached, rectangular, pyramidal roof	N/A	Dormer (front façade), rounded bay window, side porch (open to 1st storey)	Moses Mills	N/A	N/A	N/A
Catharine	206	Queen Anne Revival (est)	Brick	Unknown	Single detached, rectangular, hipped roof	N/A	Semi-circular window in dormer on side (transom-like), ctd-bay window	Hiram Hanham	N/A	N/A	N/A
Catharine	254		Brick	Unknown	Single detached, L-shaped, low gable	N/A	Open porch, pendant in gable end (front façade)	WilliamReeb	N/A	N/A	N/A
Catharine	262		Brick (stretcher bond), sheathed building, nailed frame	Unknown	Rectangular floor plan, 1 1/2 storeys	N/A	Special windows - round semi-circular, stained glass, open porch, double bay windows, fence, garden, water feature	Unknown		N/A	N/A
Catharine	304	Regency (est)	Stucco	Unknown	Single detached, square, 1 1/2 storeys, medium gable roof	N/A	Dormer in front façade, garage	Lewis Carter	Grocer	N/A	N/A
Catharine	310		Asbestos cement sheet, wood frame	Unknown	Single detached, 2 storeys, medium gable roof	N/A	Verandah (fancy detail on verandah support), garage, garden	Unknown		N/A	N/A
Catharine	326	High Victorian	Brick (upper), stucco (lower)	Unknown	Single detached, apsidial plan, 2 storeys, pyramidal roof with offset gable	N/A	Bay dormer (2nd storey), special windows - semi-eliptical, palladian windows (rear), rounded porch, balcony, decorative trim on windows	George Nichols	N/A	N/A	N/A
Catharine	346	Queen Anne Revival (est)	Brick - stretcher bond	Unknown	Single detached, 2 storeys	N/A	Eliptical & semi-circular windows, bay window on both storeys, garage, garden, water feature	Possibly Jessie Narcross	N/A	N/A	N/A
Catharine	358		Stucco	Unknown	Square plan, 1 1/2 storeys, medium hip roof	N/A	Closed porch, dormer (front façade), semi-circular window	Lewis Carter	Grocer	N/A	N/A
Cedar Bay (Road)	621		Brick - stretcher bond	Unknown	Single detached, L-shaped, 1 1/2 storeys, medium gable roof	N/A	Closed porch, garage, outbuilding, fence, water feature	Possibly Mary Kanold	N/A	N/A	N/A
Cedar Bay (Road)	666		Brick - stretcher bond, nailed frame	Unknown	Single detached, L-shaped, 1 1/2 storeys, high gable roof with offset gable	N/A	Semi-circular & oval windows, closed porch, garage	Unknown		N/A	N/A
Charles	42		Clapboard with wood frame	Unknown	Single detached, 1 1/2 storeys, rectangular plan, medium gable roof	N/A	Monumental pediment on roof, verandah, garage, garden	Unknown		N/A	N/A
Charles	44		Stucco	Unknown	Single detached, rectangular, high gable roof, 2 storeys	N/A	Open porch, bay window	Mary Augusta Doig	N/A	N/A	N/A
Charles	66	Regency (est)	Aluminum siding, wood frame	Unknown	Single detached, square, 1 1/2 storeys, medium hip roof	N/A	Verandah, garden	Unknown		N/A	N/A
Charlotte	17	Regency (est)	Brick	Unknown	Single detached, rectangular, 2 storeys, medium hip roof	N/A	Round windows	Helen Thompson	N/A	N/A	N/A
Charlotte	20		Brick - wood	Unknown	Rectangular, attached to other buildings, flat roof	N/A	N/A	Christopher Armstrong's Heirs	N/A	N/A	N/A
Charlotte	21		Brick - stretcher bond	Unknown	Row-related units, rectangular, flat roof	N/A	N/A	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Charlotte	50		Plaster	Unknown	Row-related, rectangular plan, 2 storeys, high gable roof	N/A	Bay window	James S. Scholfield	Clerk/Landing Waiter	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Charlotte	54	Regency (est)	Stucco	Unknown	Row-related, rectangular, 2 storeys, high gable roof	N/A	Store built on front of house, roof flat over store, but gabled over house	WilliamLewis	Barber	N/A	N/A
Charlotte	55	Classic Revival (est)	Brick	Unknown	Single detached, rectangular, spire on end façade, 2 storeys, high gable roof	N/A	Urn on roof trim, belvedere on roof spire, pointed windows, curved transom over main door, projecting frontispiece, garden	William Pope	N/A	N/A	N/A
Charlotte	56		No details	Unknown	No details	N/A	N/A	Trustees of St. James	N/A	N/A	N/A
Charlotte	72	Queen Anne Revival (est)	Brick - common bond	Unknown	Single detached, rectangular, 2 front storeys, 1 rear, high gable roof around outside of building dimension, flat roof in interior, additional gables on roof	N/A	Boxed cornice on roof trim, bay window, arcade, balcony	N/A	N/A	N/A	N/A
Charlotte	112		Shingle, nailed frame	Unknown	Single detached, 2 storeys	N/A	Corner brackets on roof trim, bay window, semi-circular, garden	Wardens of St. James	N/A	N/A	N/A
Charlotte	119	Classic Revival (est)	Clapboard, nailed frame	Unknown	Single detached, L-shaped, 1 1/2 storeys	N/A	Semi-circular windows, verandah, garage, garden	Samuel Hopkins	Dentist	N/A	N/A
Charlotte	122		Clapboard, nailed frame	Unknown	Single detached, L-shaped, 2 1/2 storeys, centre gable in roof	N/A	Semi-circular window	Unknown		N/A	N/A
Charlotte	169	Classic Revival (est)	Aluminum siding, nailed wood frame	Unknown	Single detached, L-shaped, 1 1/2 storeys, high gable	N/A	Garage	Samuel Hopkins	Dentist	N/A	N/A
Charlotte	2/12/14		Brick (lower), wood (upper)	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Charlotte	29-33		Brick - stretcher bond	Unknown	Row-related units, rectangular plan, 2 storeys, flat roof	N/A	N/A	Unknown		N/A	N/A
Charlotte	32-34	Italiante (est)	Brick	Unknown	Flat roof, row-related, rectangular, 2 storeys	N/A	Cornice on roof edge, ornamental pediment at corner of building	Peter Gibbons	Dealer of hardware, drygoods, provisions	N/A	N/A
Chippawa (Road)	153		Stucco	Unknown	Square plan, 2 storeys, hip roof	N/A	Open verandah, garage (gable roof)	Unknown		N/A	Was candy store
Chippawa (Road)	205		Stucco	Unknown	Single detached, square, 1 1/2 storeys, medium gable, cross gables in front façade	N/A	Open porch, arched window in dormer, garage	Unknown		N/A	N/A
Chippawa (Road)	352	Regency (est)	Stucco	Unknown	Semi-detached, square, medium gable roof	N/A	Bay window	Unknown		N/A	N/A
Chippawa (Road)	572	Renaissance Revival (est)	Wood - horizontal plank	Unknown	Semi-detached, rectangular, 2 storeys, gable roof with gable in front façade	N/A	Open verandah with decorative support beams, dormer with palladian window in front façade	Unknown		N/A	N/A
Chippawa (Road)	975		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Chippawa (Road)	998		Aluminum siding	Unknown	L-shaped, medium gable roof, 2 storeys	N/A	Open verandah, garden	Unknown		N/A	N/A
Chippawa (Road)	1024		Stucco, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, high gable roof with offset gable	N/A	Barn (1847 - concrete siding), finial or urn roof trim, verandah, garage, outbuilding, water feature	Unknown		N/A	N/A
Chippawa (Road)	1245		Stucco, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, high gable roof with a centre and offset gable	N/A	Finial/urn roof trim, garage, poultry barn (est 1875), outbuilding, fence, garden, water feature, ctd-verandah, projecting frontispiece	Unknown		N/A	N/A
Chippawa (Road)	1246		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Chippawa (Road)	1445		Stucco, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, medium gable roof with offset gables	N/A	Verandah, garage, outbuilding	Unknown		N/A	N/A
Chippawa (Road)	2703		red brick	Unknown	"one room" red brick schoolhouse	N/A	N/A				
Chippawa (Road)	2831		No details	Unknown	No details	N/A	N/A	Matthew Stoner	N/A	N/A	N/A
Chippawa (Road)	2950		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Church	24	Regency (est)	No details	Unknown	Single detached, rectangular, medium gable	N/A	Open porch, garage, outbuilding, garden, 1/2 building is 1 storey, other is 1 1/2 storey	Unknown		N/A	N/A
Church	28	Regency (est)	Aluminum siding	Unknown	L-shaped, 1 1/2 storeys (front), 1 storey at rear, medium gable roof	N/A	Porch	Joanna O'Leary	N/A	N/A	N/A
Clarence	1		Stucco	Unknown	Row-related, square, flat roof	N/A	N/A	Possibly Martha Babion	N/A	N/A	N/A
Clarence	67		Brick	Unknown	Rectangular, flat roof, 2 storeys	N/A	Dormer over front foor, parking lot	Unknown		N/A	N/A
Clarence	78		Brick - heather bond	Unknown	Row-related, rectangular, 2 storeys	N/A	Fence with gate	Unknown		N/A	N/A
Clarence	170		Wood - horizontal plank	Unknown	Single detached, square plan, 2 storeys, medium hip roof with centre gable	N/A	Open verandah, bay window (double), garage	Possibly James Scholfield	N/A	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Clarence	178		Stucco	Unknown	Single detached, rectangular plan, 2 1/2 storeys, pyramidal roof	N/A	Stained glass windows, verandah, balcony, double bay window, garage	Unknown		N/A	N/A
Clarence	216		Brick - stretcher bond	Unknown	Single detached, square plan, 2 storeys, pyramidal roof with offset gable	N/A	Half-round windows, verandah	Brown	N/A	N/A	N/A
Clarence	217	Regency (est)	Plaster/stucco	Unknown	Square plan, medium gable roof	N/A	N/A	Possibly John Kennaid	N/A	N/A	N/A
Clarence	232		Brick	Unknown	Single detached, square plan, 2 storeys, pyramidal roof with centre and offset gables	N/A	Verandah, half-rounded windows, decorated dormer in front façade	Unknown		N/A	N/A
Clarence	264	Picturesque Revival (est)	Clapboard, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys	N/A	Quarter round and semi-circular windows, verandah, balcony, garage, garden	Unknown		N/A	N/A
Clarence	208/210		Brick - stretch bond	Unknown	Double semi-detached, rectangular plan, 1 1/2 storeys, mansard (4-sided) roof, truncated roof with a cross gable	N/A	Open porch, garage	Possibly A. Snider	N/A	N/A	N/A
Clarence	302/304		Plaster/stucco	Unknown	Hip roof with dormer in façade	N/A	Garage	Unknown		N/A	N/A
Clark (Road)	1152		Clapboard, nailed frame	Unknown	Single detached, rectangular, 2 split storeys, medium gable roof with centre gables	N/A	Oval windows, open porch, garage, stable/barn (barn - 1851 est, woodshed - 1850 est - both stone siding), outbuilding, fence, garden, water feature	Unknown		N/A	N/A
Colborne	75	Regency (est)	Stucco, nailed frame	Unknown	Single detached, square plan, 1 storey, medium gable	N/A	Outbuilding, fence, garden	Possibly William Haun	Farmer	N/A	N/A
David	15	Second Empire (est)	Stucco	Unknown	Single detached, square plan, 2 storeys, mansard roof with two sides	N/A	Arcades over front entrance, garage with mansard roof and rounded windows	Possibly John McRae	N/A	N/A	N/A
Davis	128	Classic Revival (est)	Stucco	Unknown	Single detached, rectangular plan, high gable roof, 1 1/2 storeys	N/A	N/A	Possibly Azibah (?) L. (Scholfield) Dalton	N/A	N/A	N/A
Davis	346	Classic Revival (est)	Stucco	Unknown	Single detached, rectangular, medium hipped roof, 2 storeys	N/A	Open porch, garage	Possibly Charles D. Winn	N/A	N/A	N/A
Davis	413		Stucco	Unknown	Single detached, L-shaped, 2 storeys	N/A	Dormers over windows, verandah, main entrance has shelf with flat transom, two decorated panels	Unknown		N/A	N/A
Davis	473	Classic Revival (est)	Stucco	Unknown	L-shaped, hip roof	N/A	Open porch, semi-round transom over front door, garage attached	Unknown		N/A	N/A
Delhi	57	Classic Revival (est)	Stucco	Unknown	Single detached, rectangular plan, hipped roof, 1 1/2 storeys	N/A	Closed porch	Unknown		N/A	N/A
Division	252		Stucco, nailed frame, sheathed bldg	Unknown	Single detached, irregular plan, 1 1/2 storeys	N/A	Eyebrow windows, garage, roof, chimney, added storey	Unknown		N/A	N/A
Durham	93	Regency (est)	Stucco, nailed frame	Unknown	Single detached, rectangular plan, 2 storeys, low gable	N/A	Garage	Unknown		N/A	N/A
Durham	101	Boomtown	Stucco, nailed frame, sheathed bldg	Unknown	Row related, rectangular, 2 storeys, boomtown roof	N/A	Garage	Possibly John O'Conner	N/A	N/A	N/A
Durham	129	Classic Revival (est)	Stucco (lower), wood (upper)	Unknown	Single detached, rectangular, 1 1/2 storeys, medium gable roof	N/A	N/A	Unknown		N/A	N/A
Durham	133	Classic Revival (est)	Brick, (stretcher bond) sheathed, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, low gable roof	N/A	N/A	Unknown		N/A	N/A
Durham	159	Regency (est)	Wood - horizontal plank	Unknown	Single detached, rectangular plan, 1 storey	N/A	Open porch	Unknown		N/A	N/A
Elgin	63		Stucco, sheathed	Unknown	Single detached, L-shaped, hip roof, 2 storeys	N/A	Closed porch	Unknown		N/A	N/A
Elgin	69	Classic Revival (est)	Stucco, sheathed	Unknown	Single detached, rectangular plan, 2 storeys, high gable roof	N/A	Decorated gable end (façade), open verandah, garage	Unknown		N/A	N/A
Elgin			Brick	Unknown	Rectangular, 3 storeys, flat roof	N/A	N/A	Unknown		N/A	N/A
Elm	56	Regency (est)	Shingle/sheet, sheathed, nailed frame	Unknown	Single detached, square plan, 2 storeys	N/A	Voissoirs surrounding main entrance, garage, fence, garden	Unknown		N/A	N/A
Elm	78	Classic Revival (est)	Poured concrete, sheathed, nailed frame	Unknown	Single detached, rectangular plan, 1 1/2 storeys, high gable roof	N/A	Open porch, garage, garden	Lewis Carter	N/A	N/A	N/A
Elm	82		Clapboard, sheathed, nailed frame	Unknown	Single detached, L-shaped, 1 1/2 storeys	N/A	Open porch, garage, garden	Possibly Alex Griswald	N/A	N/A	N/A
Elm	102		Aluminum siding	Unknown	Single detached, L-shaped, 1 1/2 storeys, hip roof with centre and offset gables	N/A	Garage	Possibly Alex Griswald	N/A	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Elm	114	Regency (est)	Clapboard, sheathed, nailed frame	Unknown	Single detached, square plan, 1 1/2 storeys, clapboard	N/A	Open porch, garage	Unknown		N/A	N/A
Elm	262	Picturesque Revival (est)	Clapboard	Unknown	Single detached, irregular plan, 1 1/2 storeys, centre gable in roof	N/A	Ogee window, closed porch, garage	Lewis Carter	N/A	N/A	N/A
Elm	610	Second Empire (est)	Aluminum siding, sheathed, nailed frame	Unknown	Single detached, square plan, 2 storeys, low hip roof	N/A	Boxed cornice with frieze (roof trim), garage	Lewis Carter	N/A	N/A	N/A
Elm	625		Stucco	Unknown	Single detached, L-shaped plan, high gable roof	N/A	Closed porch, bay window	Daniel McCain	Carpenter & Builder (1869)	N/A	N/A
Elm	688	Classic Revival (est)	Cut stone, coursed, sheathed	Unknown	Single detached, L-shaped, single spire on one side, irregular # of storeys, high gable roof	N/A	Frieze on roof trim, stained glass eyebrow and painted windows, spire, buttress, projecting frontispiece, fence, garden	Unknown		N/A	N/A
Elm	795	Classic Revival (est)	Plaster/stucco, nailed frame, sheather	Unknown	Single detached, rectangular, 1 1/2 storeys, medium gable	N/A	Verandah, fence, garden	Mathias Minor	N/A	N/A	N/A
Elm	803	Classic Revival (est)	Stucco, sheathed, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, medium gable roof, bellcast roof	N/A	Stained glass windows, closed porch, balcony, garage, fence, garden, water feature, foundation is flint/cobble, basement is pine beams (originally a school house)	William A. Boneburg	Bricklayer	N/A	N/A
Elm	825		Shingle, sheathed, wood frame	Unknown	Single detached, rectangular, 1 1/2 storeys, pyramidal roof	N/A	Open porch, balcony, double bay window, garage, fence, garden, water feature	Sarah Morningstar	N/A	N/A	N/A
Elm		Italiante (est)	Brick - stretcher bond	Unknown	Single detached, square, 2 storeys, low hip roof	N/A	Belvedere on roof trim, semi-circular windows, open porch, garage, water feature	Elihu Neff	N/A	N/A	Ice cream store
Empire	532		Wood - horizontal plank	Unknown	Single detached, L-shaped, 2 storeys, high gable roof	N/A	Open verandah, garage	N/A		N/A	N/A
Empire	573	Regency (est)	Cut stone, coursed	Unknown	Single detached, L-shaped, 1 1/2 storeys, medium gable roof, centre gable in roof	N/A	Shed dormers, verandah, attached barn/garage, projecting frontispiece, garage, barn, outbuilding, garden	Unknown		N/A	N/A
Empire	731	Classic Revival (est)	Horizontal plank wood	Unknown	Single detached, rectangular, 1 storey, high gable roof	N/A	Spire on extension, painted windows, fence	Possibly Abraham Shesler	N/A	N/A	N/A
Erie	83		Aluminum siding, sheathed, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, medium gable roof, centre gable in roof	N/A	Garage, fence, garden	Unknown		N/A	N/A
Erie	173	Classic Revival (est)	Aluminum siding, sheathed, nailed frame	Unknown	Single detached, rectangular plan, 1 1/2 storeys, high gable roof	N/A	Garage, fence, garden	Unknown		N/A	N/A
Erie	183		Stucco, sheathed, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, medium gable roof	N/A	Outbuilding	John Emerson Niece	N/A	N/A	N/A
Erie	187	Picturesque Revival (est)	Shingle/sheet, sheathed, nailed frame	Unknown	Single detached, rectangular plan, 1 1/2 storeys, medium gable roof, centre gable in roof	N/A	Semi-circular windows, balcony, outbuilding, garden	Leopold Rick	N/A	N/A	N/A
Erie	220		Split weatherboard, sheathed, nailed frame	Unknown	Single detached, rectangular, 1 storey, medium gable roof	N/A	Fence	Unknown		N/A	N/A
Fares	55		Plaster, sheathed, nailed frame	Unknown	Single detached, square, 1 storey, medium gable roof	N/A	Closed porch	Unknown		N/A	N/A
Fares	120		Plaster/stucco, sheathed building, nailed frame	Unknown	Single detached, square, 1 1/2 storeys, high gable roof	N/A	Verandah, outbuilding	Unknown		N/A	N/A
Fares	126		No details	Unknown	L-shaped plan, high gable roof with centre gable, 2 storeys	N/A	Open porch	Possibly R. McClelland	N/A	N/A	N/A
Fares	163		Aluminum siding, sheathed, nailed frame	Unknown	Double semi-detached, row-related, rectangular plan, 1 1/2 storeys, medium gable roof	N/A	Open porch, balcony	Unknown		N/A	N/A
Fares	184	Classic Revival (est)	Stucco	Unknown	L-shaped, high gable roof, 1 1/2 storeys	N/A	Open porch	Unknown		N/A	N/A
Fares	216	Classic Revival on a Regency	Stucco	Unknown	L-shaped, high gable roof, 1 1/2 storeys	N/A	Open porch, garage	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Fares	222	Classic Revival on a Regency	Aluminum siding	Unknown	L-shaped, high gable roof, 1 1/2 storeys	N/A	Closed porch, garage	Unknown		N/A	N/A
Fares	227		Aluminum siding	Unknown	Rectangular plan, flat roof, 2 storeys	N/A	Fence	Unknown		N/A	N/A
Fares	247		Brick	Unknown	T-shaped, 1 storey front, 1 1/2 storey rear, medium gable roof	N/A	N/A	Possibly Thomas White	Innkeeper	N/A	N/A
Fares	257	Classic Revival (est)	Stucco/plaster	Unknown	Rectangular plan, medium gable roof	N/A	N/A	Unknown		N/A	N/A
Fares	272	Classic Revival (est)	Stucco	Unknown	Rectangular, medium gable roof	N/A	Open porch	Unknown		N/A	N/A
Fares	277	Regency (est)	Stucco	Unknown	Rectangular, high gable roof, 1 1/2 storeys front, 1 storey rear	N/A	Open verandah	Unknown		N/A	N/A
Fares	283		Stucco/plaster, sheathed, nailed frame	Unknown	Rectangular plan, 2 storeys, pyramidal roof	N/A	Open porch, garage, garden	Unknown		N/A	N/A
Fares	292		Plaster/stucco, sheathed building, nailed frame	Unknown	Rectangular, 1 1/2 storeys, high gable roof	N/A	Verandah, garage, fence, garden	Unknown		N/A	N/A
Fares	329		Shingle/sheet, sheathed, nailed frame	Unknown	Square, 1 1/2 storeys, medium gable roof	N/A	Verandah, garage, fence, garden	Unknown		N/A	N/A
Fares	344	Regency (est)	Aluminum siding, sheathed, nailed frame	Unknown	Rectangular, 1 1/2 storeys, medium gable roof	N/A	Open porch, garage, garden	Possibly Robert Smith & Wife	N/A	N/A	N/A
Fares	349		Aluminum siding, sheathed, nailed frame	Unknown	Square, 2 storeys, low hip roof	N/A	Eyebrow windows, open porch, balcony, garage, garden	Unknown		N/A	N/A
Fares	367		Horizontal plank wood	Unknown	Single detached, square plan, high gable roof with centre gable, 2 storeys	N/A	Round window in centre gable, closed porch, garage	Unknown		N/A	N/A
Fares	379		Plaster/stucco, sheathed building, nailed frame	Unknown	Single detached, rectangular plan, 1 1/2 storeys, gable/flat roof	N/A	Garage, fence, garden	Unknown		N/A	N/A
Fares	447		Brick	Unknown	Rectangular, 2 storeys, high gable roof	N/A	Open verandah (along side & front of house), fence	Unknown		N/A	N/A
Fares			Brick, sheathed	Unknown	Single detached, rectangular, flat roof, 2 storeys	N/A	N/A	Unknown		N/A	N/A
Fielden	238	Queen Anne Revival (est)	Aluminum siding, sheathed, nailed frame	Unknown	Single detached, rectangular plan, 1 1/2 storeys, gable with overhang	N/A	Balcony, garage, garden	Board of Trustees of Education PC		N/A	N/A
Fielden	252		Plaster/stucco, sheathed building, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, tower	N/A	Main window has alternating voissoirs surrounding head, semi-circular windows, closed porch, attached garage, fence, garden	Lewis Carter	N/A	N/A	N/A
Fielden	296	Italiante (est)	Stretcher bond brick, sheathed, wood frame	Unknown	H-shaped plan, irregular number of storeys, roof has crest gable, tower	N/A	Semi-circular dormers, boxed cornice roof trim with frieze, belvedere on roof, semi-circular and oval windows, curved transom with multiple lights over main entrance, bay window on 2 storeys, projecting frontispiece, garage, fence, garden	Lewis Carter	N/A	N/A	N/A
Fielden	320		Brick	Unknown	3 Storeys, flat roof	N/A	N/A	David Steele	Farmer (189 1/4 acres)	N/A	N/A
Fielden	547		Plaster/stucco, sheathed, wood frame	Unknown	Rectangular plan, 1 1/2 storeys, high gable roof with centre gable	N/A	Verandah, balcony, garage, fence, garden, projecting frontispiece	Municipal Board of Education		N/A	N/A
Fielden	550		Plaster/stucco, sheathed, nailed frame	Unknown	Rectangular, 1 1/2 storeys, medium gable roof	N/A	Fence, garden	Louis Weaver	Farmer	N/A	N/A
Fielden	557	Classic Revival (est)	Aluminum siding, sheathed, nailed frame (originally clapboard)	Unknown	Rectangular, 1 1/2 storeys, medium gable roof	N/A	Eyebrow windows, closed porch, balcony, garage, fence, garden, water feature	Possibly John Thompson	N/A	N/A	N/A
Fielden	583	Regency (est)	Aluminum siding, sheathed, nailed frame	Unknown	Rectangular, 1 1/2 storey, medium gable roof, cross gable in roof	N/A	Monumental pediment, garage	Possibly Louis Weaver	Farmer	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Fielden	592		Vinyl siding, sheathed, wood frame	Unknown	Rectangular, 1 1/2 storeys, medium gable roof with cross gable	N/A	Garage, water feature (old covered up well in back yard)	Joseph Thompson	N/A	N/A	N/A
Fielden	605		Aluminum siding, sheathed, wood frame	Unknown	Square, 1 1/2 storeys, medium gable roof	N/A	N/A	Daniel Neff Sr.	Farmer	N/A	N/A
Fielden	730	Classic Revival (est)	Clapboard, sheathed, wood frame	Unknown	Rectangular, 1 1/2 storeys, high gable roof with cross gable	N/A	Monumental pediment on roof, garage, garden, bay window, verandah, decorative work under bay window	George Hebling	N/A	N/A	N/A
Fielden			Common bond brick, sheathed, nailed frame	Unknown	Rectangular, flat roof	N/A	Corbelled corners, roof trim	Deek Family	N/A	N/A	N/A
Firelane No. 1	1001							Niagara South Board of Education		N/A	N/A
Forkes	3757		Aluminum siding, sheathed, nailed frame	Unknown	Square, 1 1/2 storeys, high gable roof, centre gable	N/A	Garage, barn (1907), outbuilding, fence, garden, water feature				
Forkes	4261		Aluminum siding, sheathed, nailed frame	Unknown	Rectangular, 2 storeys, medium gable	N/A	Barn (1917 - concrete/siding), garage, outbuilding, fence, water feature	Jacob Young	Farmer	N/A	N/A
Fraser	76/80	Classic Revival (est)	Plaster/stucco, sheathed, nailed frame	Unknown	Rectangular, 1 1/2 storeys, gable/flat roof	N/A	Balcony	Possibly George Kreiger	N/A	N/A	N/A
George	33		Plaster/stucco	Unknown	L-shaped, 2 storeys, high gable roof	N/A	Closed porch, garage	Unknown		N/A	N/A
George	34	Classic Revival (est)	Tile, sheathed, foundation - concrete covering random rubble	Unknown	Rectangular, 1 1/2 storeys, high gable roof	N/A	Stained glass window, balcony, garage, outbuilding, fence, garden	Unknown		N/A	N/A
George	41		Plaster/stucco, sheathed, nailed frame	Unknown	Single detached, rectangular, 1 1/2 storeys, offset gable in roof, complicated irregular structure, foundation is random rubble	N/A	Semi-circular windows	Mary Binder	N/A	N/A	N/A
George	62	Classic Revival (est)	Clapboard, not sheathed, foundation is squared rubble	Unknown	Rectangular, 1 1/2 storeys, medium gable roof	N/A	Balcony, garage, outbuilding, fence, garden	Leopold Reek/Rick	N/A	N/A	N/A
Highway #3 East	770		No details	Unknown	No details	N/A	N/A	Fred Hoffmeyer	Teacher	N/A	N/A
Highway #3 East	1097	Regency (est)	Clapboard	Unknown	Rectangular plan, high gable roof	N/A	Open porch, barn, outbuilding	Unknown		N/A	N/A
Highway #3 East	1331		No details	Unknown	Rectangular plan, high gable roof with centre gable	N/A	Open verandah, rounded windows	Unknown		N/A	N/A
Highway #3 East	2309		Aluminum siding	Unknown	Rectangular plan, part gable and part hip roof	N/A	Closed porch	Unknown		N/A	N/A
Highway #3 East	2481	Regency (est)	Stucco - commercial building	Unknown	Rectangular, flat/gable roof	N/A	N/A	Unknown		N/A	N/A
Highway #3 East	2652	Resembles Georgian Tradition	Wood - horizontal plank	Unknown	Rectangular, hip roof with centre gable and dormers	N/A	Garden	Unknown		N/A	N/A
Highway #3 East	2665		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Highway #3 East	2702		Brick	Unknown	Gable roof in front, hip roof in rear	N/A	Open porch	Unknown		N/A	N/A
Highway #3 East	2739		Brick	Unknown	Rectangular, high gable roof with centre gable	N/A	Verandah	Unknown		N/A	N/A
Highway #3 East	2790	Classic Revival & Regency	Stucco	Unknown	L-shaped, medium gable roof	N/A	Verandah, barn	Unknown		N/A	N/A
Highway #3 East	2935	Classic Revival & Regency	Wood	Unknown	L-shaped, high gable roof	N/A	Closed porch, rounded windows with voissoirs	Unknown		N/A	N/A
Highway #3 East	3278		Brick, rubble foundation	Unknown	L-shaped, high gable roof with centre gable	N/A	Open porch, round windows, garage	Unknown		N/A	N/A
Highway #3 East	3436		Stucco	Unknown	Rectangular	N/A	Open porch, garden	Unknown		N/A	N/A
Highway #3 East	3493		Stucco	Unknown	Rectangular, 1 1/2 storeys, high gable roof with centre gable	N/A	Rounded windows, open porch	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Highway #3 East	4109		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
~~Highway #3 East~~	~~4181~~		Material unknown	Unknown	Rectangular, 2 storeys, high gable roof	N/A	Closed porch, garage	Unknown		N/A	N/A
Highway #3 East	5346		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Highway #3 East	1326/9		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Highway #3 West	698		Stone foundation, aluminum siding	Unknown	Irregular design, high gable roof with cross gables	N/A	Closed porch, bay window	Unknown		N/A	N/A
Kent	8-10		Clapboard	Unknown	Saltbox roof (unusual)	N/A	Triangular window, verandah, garage, outbuilding	Unknown		N/A	N/A
Kent	19-21	Regency (est)	Clapboard	Unknown	Gable roof, 1 1/2 storeys	N/A	N/A	Thomas O'Neill	Boots & Shoes Dealer	N/A	O'Neill Hotel
Kent	22	Classic Revival (est)	Asbestos cement sheet	Unknown	1 1/2 storeys, square plan, high gable - cross gables	N/A	Garage, garden	Unknown		N/A	N/A
Kent	44	Regency (est)	Shingle/sheet	Unknown	Rectangular plan, 1 1/2 storeys, high gable roof	N/A	Verandah, old fruit cellar at rear of house has been connected to the house and made into a room	Elizabeth Cramer	N/A	N/A	N/A
Kent	48		Aluminum siding	Unknown	Rectangular, 1 1/2 storeys	N/A	Garage, garden	Henry Cook	N/A	N/A	N/A
Kent	52		Clapboard	Unknown	2 storeys, high gable roof	N/A	Decorative wood carving under porch roof and supports, verandah, garage	Henry Cook	N/A	N/A	N/A
Kent	56		Clapboard	Unknown	High gable roof, gable at back	N/A	Pediment at side door	Henry Cook	N/A	N/A	N/A
Kent	57	Classic Revival (est)	Clapboard	Unknown	Square, 1 1/2 storeys, medium gable roof	N/A	Fence	John Harbison	Labourer	N/A	N/A
Kent	60		Composition shingle or sheet	Unknown	Rectangular, 1 1/2 storeys, medium gable roof	N/A	Eyebrow windows, garage, fence	John E. Elsenhans	Blacksmith	N/A	N/A
Kent	65		Stretch bond brick	Unknown	Rectangular, 1 1/2 storeys, high gable roof with offset & cross gable	N/A	Open porch, balcony, garage, original entrance has been blocked in (Catharine Street)	Mary M. Horning	N/A	N/A	N/A
Kent	66		Stucco/plaster	Unknown	2 storeys, low hip roof - roof is bellcast	N/A	Verandah, outbuilding, fence, garden, water feature	John Gleckner	N/A	N/A	N/A
Kent	77		Clapboard	Unknown	2 1/2 storeys	N/A	Decorative shingle wall design, semi-circular windows, open porch, garage	David McLeod	Hotel owner	N/A	N/A
Kent	93/95	Classic Revival (est)	Stucco/plaster	Unknown	L-shaped, 1 1/2 storeys, cross gable in roof	N/A	Stained glass window, garden	Samuel Hopkins	Dentist & village clerk	N/A	N/A
Kent	94/96		Stucco/plaster, stone foundation	Unknown	Rectangular, 2 storeys, high gable roof	N/A	N/A	Samuel Hopkins	Dentist & village clerk	N/A	N/A
Kent	101		Brick	Unknown	Hip roof	N/A	N/A	Possibly Louis G. Shickluna	N/A	N/A	N/A
Kent	104		Stucco	Unknown	Rectangular, high gable roof with cross gables, 2 1/2 storeys	N/A	Balcony, bay window, garage	Unknown		N/A	N/A
Kent	109		Brick & wood	Unknown	Pyramidal roof with cross gables, 2 1/2 storeys	N/A	Verandah, garage	Maggie Lynden	N/A	N/A	N/A
Kent	110		Stucco	Unknown	Gable roof, 2 1/2 storeys	N/A	Closed porch, bay window, garage	Unknown		N/A	N/A
Kent	114		Brick	Unknown	Rectangular, gable roof with 3 cross gables	N/A	Bay window, verandah, decorated pediment over main entrance	Unknown		N/A	N/A
Kent	115		Stucco	Unknown	Similar to 114 Kent (rectangular, gable roof with 3 cross gables)	N/A	N/A	Unknown		N/A	N/A
Kent	123		Stucco/wood	Unknown	Gable roof, 2 storeys	N/A	Decorated window heads, bay window	Unknown		N/A	N/A
Killaly St East	327		Brick	Unknown	Gable roof	N/A	Bay window, closed porch, garage	Unknown	Once owned by Jacob North	N/A	N/A
Killaly St East	398		Clapboard, stone foundation	Unknown	Rectangular, high gable roof, 2 storeys	N/A	Arched windows, fence	Unknown		N/A	N/A
Killaly St East	741		Aluminum siding	Unknown	L-shaped, medium gable roof with centre gable	N/A	Open porch, outbuilding, building in rear is of stone	Unknown	Owned by an Augustine since 1817	N/A	N/A
Killaly St East	758	Classic Revival (est)	Clapboard	Unknown	L-shaped, high gable roof with centre gable	N/A	Open verandah, fence	Unknown		N/A	N/A
Killaly St East	770	Classic Revival & Regency	Brick	Unknown	Rectangular, high gable roof	N/A	Oval window, open porch	Unknown		N/A	N/A
Killaly St East	791		Clapboard	Unknown	L-shaped, gable roof	N/A	Arched windows	Unknown		N/A	N/A
Killaly St East	1193		Brick	Unknown	L-shaped, medium gable roof with centre gable	N/A	Open porch	Unknown		N/A	N/A
Killaly St East	1379		Clapboard	Unknown	Medium gable roof	N/A	Open porch	Unknown		N/A	N/A
Killaly St East	1627		Clapboard	Unknown	T-shaped, low gable roof	N/A	Stone shed attached	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Killaly St East	1739	Picturesque Revival (est)	Brick - Flemish bond	Unknown	L-shaped, 1 1/2 storeys, high gable roof with offset gable	N/A	Half-round windows, verandah, garage, barn, outbuilding, fence, garden, water feature	Unknown		N/A	N/A
Killaly St West	135		Brick	Unknown	Rectangular plan, 2 1/2 storeys, high gable roof with offset gable	N/A	Round/elliptical/ eyebrow/semi-circular/stained glass windows, balcony	George F. Knoll		N/A	N/A
Killaly St West	149		Cedar siding	Unknown	1 1/2 storeys, gable/flat roof	N/A	Eyebrow windows, open porch, balcony, attached garage, garden	Owen F. Knisley	Farmer	N/A	N/A
Killaly St West	157		Clapboard	Unknown	Gable roof	N/A	Closed porch, bay window	Emanuel Fares	N/A	N/A	N/A
Killaly St West	171	Classic Revival (est)	Brick & brick wall construction, squared rubble foundation	Unknown	2 1/2 storeys, gable roof & addition gable in roof	N/A	Garage (was originally a stable), garden	Unknown		N/A	N/A
Killaly St West	185		Stucco, squared rubble foundation	Unknown	Medium gable roof, cresting on roof trim	N/A	Verandah, balcony, garage, fence	Owen Fares	N/A	N/A	N/A
Killaly St West	211	Regency (est)	Composition shingle or sheet	Unknown	Medium gable roof	N/A	Balcony, garage, garden	Daniel Neff	N/A	N/A	N/A
Killaly St West	269	Classic Revival (est)	Windows 1 ft thick suggest stone wall construction, brick covering	Unknown	Rectangular, medium gable roof	N/A	N/A	Elias Leidy	N/A	N/A	N/A
Killaly St West	29/31		Clapboard	Unknown	Medium gable roof, monumental pediment on roof	N/A	Stained glass window, open porch, balcony, garage, garden, decorative shingles	Reformed Mennonite Church	N/A	N/A	N/A
King	44	Neo-classic (est)	Sawn stone	Unknown	Low gable roof	N/A	Balcony	Possibly Emanuel Fares	N/A	N/A	N/A
King	62	Regency (est)	Plaster/stucco	Unknown	Saltbox roof	N/A	Balcony, garage	William H. Merritt	Promoter of Welland Canal	N/A	N/A
King	86		Plaster/stucco	Unknown	2 storeys, saltbox roof	N/A	Verandah, balcony	Mary Ann Smith	N/A	N/A	N/A
King	87		Plaster/stucco	Unknown	Saltbox roof	N/A	Bay window, closed verandah, outbuilding (converted to home - 89 King St)	Unknown		N/A	N/A
King	101	Neo-classic & Regency (est)	Plaster/stucco	Unknown	Medium gable roof with cross gables	N/A	N/A	John Kingston	N/A	N/A	N/A
King	104	Regency (est)	Clapboard	Unknown	2 storeys, saltbox roof	N/A	Fence	Unknown		N/A	N/A
King	112		Composition shingle or sheet	Unknown	Gable/flat roof, corner bracket roof trim	N/A	Balcony, garage	Hugh Cook	N/A	N/A	N/A
King	123		Brick - stretcher bond with Flemish	Unknown	2 storeys, low gable roof	N/A	Balcony, garage, closed porch	Hugh Cook	N/A	N/A	N/A
King	126		Plaster/stucco, concrete block addition	Unknown	Medium gable roof	N/A	Open porch, balcony, garage, garden, water feature	Peter H. Wintermuke	N/A	N/A	N/A
King	134		Brick	Unknown	Medium gable roof	N/A	Garage, fence	Unknown		N/A	N/A
King	137		Clapboard	Unknown	Hip roof, 2 storeys front, 1 storey rear	N/A	N/A	Henry Cook Sr.	N/A	N/A	N/A
King	138	Regency (est)	Composition shingle or sheet	Unknown	1 1/2 storeys	N/A	Eyebrow windows, closed verandah, garage, garden	Unknown		N/A	N/A
King	143	Classic Revival (est)	Stretcher bond brick	Unknown	2 storeys, high gable roof	N/A	Eyebrow/palladian and stained glass windows, garage	David Steele	Tugman	N/A	Was a barber shop
King	150		Stretch bond brick	Unknown	Rectangular plan, 2 storeys, high hip roof	N/A	Balcony	Salvator Shickluna	Ship carpenter	N/A	N/A
King	164	Classic Revival (est)	Plaster/stucco	Unknown	2 storeys, high gable roof	N/A	Closed verandah, balcony, bay window, fence	James McCoppen	N/A	N/A	N/A
King	172		Plaster/stucco	Unknown	Rectangular, 2 storeys	N/A	Stained glass windows, double bay window, balcony, garage, fence	Jeremiah Barnhart	N/A	N/A	N/A
King	180	Romanesque Revival (est)	Aluminum siding	Unknown	High hip roof with a tower, 2 high gables	N/A	Stained glass windows, spire, double bay window	Alice Hopkins	N/A	N/A	N/A
King	215	Boomtown	Plaster/stucco	Unknown	Square plan, 2 storeys, boomtown front	N/A	N/A	George Hannaford	Evening Shade saloon owner	N/A	N/A
King	239		Brick	Unknown	Flat roof	N/A	N/A	John Smith	Possibly a carpenter	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
King	265		Brick	Unknown	Hip roof, 1 storey	N/A	N/A	Unknown		N/A	N/A
King	280	Georgian	Clapboard with glued/laminated frame	John Williams	Medium gable roof	N/A	Balcony, barn, outbuilding, fence, blacksmith shop, schoolhouse, tearoom, boat	Buffalo & Lake Huron Railway Co.	N/A	N/A	N/A
King	322							John Williams	N/A	N/A	N/A
King	354	Beaux Arts (est)	Brick	Unknown	Irregular plan, high gable roof	N/A	Double bay windows, open verandah, palladian windows				
King	368		Stretcher bond brick	Unknown	Medium gable roof	N/A	Round & oval windows	Possibly Arabella M. Williams	N/A	N/A	N/A
King	380	Romanesque Revival (est)	Brick	Unknown	Flat roof	N/A	N/A	Maria M. Smith	N/A	N/A	N/A
King	293	California Mission Style	Stucco		Flat Roof		One of the earliest remaining examples of a building constructed specically for automobiles	Unknown		N/A	N/A
King	422	Classic Revival (est)	Brick	Unknown	Rectangular, gable roof	N/A	Dormers over windows	Shickluna Family	Carpenter (Owned shipyard)		
King	518		Brick, squared rubble foundation	Unknown	1 1/2 storeys, medium gable roof with offset gable	N/A	Bargeboard roof trim, semi-circular windows, garage, outbuilding, fence	Trustees of McNab Lodge	N/A	N/A	N/A
King	521		Stucco	Unknown	High gable roof	N/A	N/A	Emanuel Fares	N/A	N/A	Office - R. Scott Misener Steamship Lines
King	524		Brick	Unknown	Hip roof with centre & offset gables	N/A	Open verandah, bay window	Unknown		N/A	N/A
King	530		Aluminum siding	Unknown	Gable roof with offset & centre gables	N/A	Bay window, verandah,	Possibly Archibald Sweet	N/A	N/A	N/A
King	537	Regency (est)	Stucco	Unknown	Medium gable roof, monumental pediment	N/A	Verandah, garage, garden	Possibly Anna or Wm. Schneider	N/A	N/A	N/A
King	547		Stucco	Unknown	L-shaped, hip roof with centre gable	N/A	N/A	Michael Heffron	N/A	N/A	N/A
King	561	Boomtown	Brick - stretcher bond	Unknown	2 storeys, boomtown front and roof	N/A	N/A	Unknown		N/A	N/A
King	593		Brick - stretcher bond	Unknown	Medium gable roof with offset gable	N/A	Round and semi-circular windows, old stone fruit cellar in back of house	Unknown		N/A	N/A
King	599	Classic Revival & Regency	Shingle exterior	Unknown	High gable roof with offset gable	N/A	Garage	Emanuel Fares	N/A	N/A	N/A
King	602		Brick	Unknown	Gable roof with decorative trim	N/A	N/A	John Landgroff	N/A	N/A	N/A
King	613	Classic Revival (est)	Clapboard	Unknown	Gable roof	N/A	Garage	Unknown		N/A	N/A
King	620		Stucco	Unknown	Buttress	N/A	N/A	Unknown		N/A	N/A
King	625		Stucco	Unknown	Gable roof	N/A	N/A	Unknown		N/A	N/A
King	626	Classic Revival (est)	Aluminum siding	Unknown	T-shaped, 2 1/2 storeys, pyramidal roof	N/A	Stained glass windows, buttress, balcony, fence, garden	Unknown		N/A	N/A
King	632	Classic Revival (est)	Clapboard	Unknown	Offset gable in roof	Special roof trim along back of home	Garage	Unknown		N/A	N/A
King	640	Queen Anne Revival (est)	Clapboard	Unknown	High gable roof with offset gable	N/A	Garage, garden	John Schneider	N/A	N/A	N/A
King	646	Classic Revival (est)	Plaster/stucco	Unknown	High gable roof	N/A	Verandah, garage, fence	John Thompson	Postmaster, insurance agent	N/A	N/A
King	664	Classic Revival (est)	Aluminum siding	Unknown	Medium gable roof	N/A	Barn, garden	George Freud	N/A	N/A	N/A
King	665	Classic Revival variation	Plaster/stucco	Unknown	Medium gable roof	N/A	Bay window, garage, outbuilding, fence, garden	John Thompson	Postmaster, insurance agent	N/A	N/A
King	675	Classic Revival	Aluminum siding, flint & cobble foundation	Unknown	High gable roof, additional gables	N/A	Outbuilding	John Kinnard	N/A	N/A	N/A
King	681	Classic Revival	Stretcher bond brick, rubble foundation	Unknown	Plynth and endboard wall design	N/A	Stained glass windows, buttress, garage (was probably a barn), garden	Possibly George Whiteman	N/A	Originally a church	N/A
King	688	Classic Revival	Plaster/stucco	Unknown	No details	N/A	Semi-circular windows, garage, fence, garden	George Whiteman	Farmer	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
King	693		Clapboard, squared rubble foundation	Unknown	Plynth and endboard wall design, hipped gambrel roof	N/A	Balcony, garage, fence, garden	Margaret Duff	N/A	N/A	N/A
King	698	Classic Revival	Plaster/stucco	Unknown	Plynth and endboard wall design	N/A	Balcony, garage, fence, garden	John Wright	N/A	N/A	N/A
King	707		No details	Unknown	No details	N/A	N/A	George Morgan	Carpenter	N/A	N/A
King	720		Plaster/stucco	Unknown	No details	N/A	Stained glass windows, balcony, fence, garden	John Wright	N/A	N/A	N/A
King	725		Plaster/stucco	Unknown	Hipped gambrel and gable roof	N/A	N/A	Harriet McCall	N/A	N/A	N/A
King	740		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
King	747	Classic Revival	Clapboard	Unknown	Rectangular, medium gable roof	N/A	N/A	Unknown		N/A	N/A
King	748		Plaster/stucco (originally clapboard), squared limestone rubble foundation	Unknown	High gable roof	N/A	Garage, outbuilding	Unknown		N/A	N/A
King	755		Clapboard	Unknown	Cruciform plan, decorative shingle wall design	N/A	French windows, balcony	William Leiter	N/A	N/A	N/A
King	761	Classic Revival	Stretcher bond brick	Unknown	Low hip roof	N/A	Decorative or painted design on wall (exterior), balcony, garden, water feature	Marion D. Dickinson	N/A	N/A	N/A
King	765	Classic Revival	Plaster/stucco	Unknown	Medium gable roof	N/A	French windows, solid oak beam under house	George Kiehl	N/A	N/A	N/A
King	771		Clapboard, random rubble foundation	Unknown	Pyramidal roof	N/A	Balcony, garage, fence, garden, old wall in rear is random rubble	George Kiehl	N/A	N/A	N/A
King	774		Plaster/stucco	Unknown	Low gable roof, tower/turret	N/A	Inscription on rear wall of building dates 1894, garage (was a barn), outbuilding	John Mosier	N/A	N/A	N/A
King	782	Classic Revival	Aluminum siding	Unknown	Endboard wall design, medium gable roof, arcade	N/A	Garage, fence	Caroline Whiteman	N/A	N/A	N/A
King	783	Classic Revival	Aluminum siding	Unknown	Offset gable in roof	N/A	Garage, fence	Mathew F. Haney	Doctor	N/A	N/A
King	786	Classic Revival	Clapboard	Unknown	Medium gable roof	N/A	Garage	Daniel McCain	Carpenter & builder	N/A	N/A
King	791	Classic Revival	Clapboard	Unknown	Low gable roof	Complex inner structure - low ceilings, low doors	Eyebrow windows, garage	William Knoll	Farmer	N/A	N/A
King	803		Brick	Unknown	Rectangular, gable roof	N/A	Garage (attached)	Andrew Reeb	N/A	N/A	N/A
King	821	Classic Revival	Plaster/stucco	Unknown	Medium gable roof	N/A	Balcony, garage, fence, garden	Unknown		N/A	N/A
King	120/124		Stucco	Unknown	1 storey, square plan, gable roof	N/A	N/A	Michael Reeb	Grocer	N/A	N/A
King	548/550		Plaster/stucco	Unknown	2 1/2 storeys, gablet or gabled hip roof (unusual in the city), roof is truncated	N/A	Semi-circular/french/ stained glass windows, fence, garden	Unknown		N/A	N/A
King	605/607		Plaster/stucco	Unknown	Medium gable roof	N/A	N/A	H.B. Hutton	N/A	N/A	N/A
King		Neo-Gothic	Brick	Unknown	High gable roof	N/A	Round/pointed/stained glass windows, spire in centre façade, decorated parapet on roof trim, buttress and projecting frontispiece	Unknown		N/A	N/A
Lake (Rd)		Georgian Tradition/ Neo-Classic Design	Header bond brick	Unknown	Medium gable roof	N/A	Projecting frontispiece, fence, outbuilding	Roman Catholic Episcopal Corp	N/A	N/A	N/A
Lakeshore	121/123	Classic Revival (est)	Concrete block	Unknown	Cruciform design, high gable roof	N/A	Garage, garden	Jacob North	Brewmaster	N/A	N/A
Lakeshore		Regency variation	Plaster/stucco	Unknown	Cruciform design	N/A	French windows, barn, garden	John Scholfield	N/A	N/A	N/A
Learn			Stretcher bond brick	Unknown	Square plan, low gable roof	N/A	Barn (1860 est)	Christopher Wegnich (?)	N/A	N/A	N/A
Lever	4841		Stucco	Unknown	Medium gable roof	N/A	Attached garage	Unknown		N/A	N/A
Lever	5100		Stucco	Unknown	Rectangular plan	N/A	N/A	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Lever	5245	Classic Revival (est)	Aluminum siding	Unknown	Low gable roof	N/A	Barn (1862 est), garage, outbuilding, fence, garden, water feature	Unknown		N/A	N/A
Lorraine	606		Clapboard	Unknown	Medium gable roof	N/A	N/A	Unknown		N/A	N/A
Lorraine	650		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Lorraine	708		Clapboard	Unknown	T-shaped plan, medium gable roof	N/A	Garage, outbuilding	Unknown		N/A	N/A
Lorraine	773	Regency (est)	Clapboard	Unknown	Rectangular plan, medium gable roof	N/A	Open verandah, fence	Unknown		N/A	N/A
Lorraine	854	Classic Revival (est)	Clapboard	Unknown	Medium gable roof	N/A	N/A	Unknown		N/A	N/A
Main St West	27		Clapboard	Unknown	Decorative shingle, high hip roof	N/A	Bay window, garage, garden	Unknown		N/A	N/A
Main St West	37	Classic Revival	Aluminum siding	Unknown	High gable roof	N/A	Stained glass windows, garage, garden	Horrace Ramey	N/A	N/A	N/A
Main St West	45		Stucco	Unknown	Pyramidal roof	N/A	Dormer in façade, bay window, garage, garden	Horrace Ramey	N/A	N/A	N/A
Main St West	53		Shingle	Unknown	High gable roof	N/A	Bay window, open verandah	Unknown		N/A	N/A
Main St West	56	Classic Revival	Siding	Unknown	Medium gable roof	N/A	Garage, plain boxed cornice roof trim with return	Unknown		N/A	N/A
Main St West	76	Classic Revival	Squared rubble	Latchow	L-shaped plan, decorative/painted design, medium gable roof	N/A	Eyebrow & semi-circular windows, garden	Unknown		N/A	N/A
Main St West	85		Composition shingle or sheet	Unknown	Medium hip roof	N/A	Garage	Town of Humberstone	See designation report for details	N/A	N/A
Main St West	91		Common bond brick	Unknown	Decorative brick, boomtown front roof	N/A	N/A	Cynthia E. Root	N/A	N/A	N/A
Main St West	100		Stretcher bond brick	Unknown	Medium hip roof	N/A	Balcony, garage, fence, garden	Robert Wilde	N/A	N/A	N/A
Main St West	105		Stretcher bond brick	Unknown	Decorative brick, boomtown front roof	N/A	N/A	Franziska Barth	N/A	N/A	N/A
Main St West	106	Classic Revival	Stretcher bond brick	Unknown	Medium gable roof	N/A	Balcony, attractive porch door, garage (originally a barn)	Unknown		N/A	N/A
Main St West	114		Flint/cobble foundation, visible wood beams, stretch bond brick	Unknown	Decorative brick, boomtown roof, truncated roof	N/A	Palladian windows, garage	Franziska Barth	N/A	N/A	N/A
Main St West	115	Italianate (est)	Stucco & brick on sides	Unknown	Entablature wall design, medium hip roof	N/A	Inscription on wall	John Wichman	N/A	N/A	N/A
Main St West	120		Random rubble foundation, stretcher bond brick	Unknown	Flat roof, monumental pediment in roof	N/A	Decorative roof trim, garage, fence, garden, rear & front additions	Thomas White	Innkeeper	N/A	N/A
Main St West	124		Squared rubble foundation, clapboard	Unknown	Decorative shingle, medium hip roof	N/A	Eyebrow & stained glass windows, garage, fence	John Wichman	N/A	N/A	N/A
Main St West	129		No details	Unknown	No details	N/A	N/A	William Mellanby	N/A	N/A	N/A
Main St West	130	Classic Revival	Brick, random rubble foundation	Unknown	Medium gable roof, decorative barge board	N/A	Stained glass windows, garage, water feature	Unknown		N/A	N/A
Main St West	142		Plaster/stucco, nailed pine board frame	Unknown	Low hip roof	N/A	Stained glass windows, bay window, outbuilding, garden, old barn behind (1870 est)	David Kramer	N/A	N/A	Was a hardware store
Main St West	145	Classic Revival variation	Common bond brick	Unknown	Medium gable roof with cross gables, monumental pediment on roof trim	N/A	Garage, garden, fruit cellar in back of house, detailed woodwork around verandah posts	R.H. Appleyard	N/A	N/A	N/A
Main St West	155	Classic Revival	Plaster/stucco	Unknown	Medium gable roof	N/A	Garage, fence	Alvina L. Deterling	N/A	N/A	N/A
Main St West	185	Boomtown	Aluminum siding	Unknown	Boomtown roof	N/A	Garage	Ellen Rose	N/A	N/A	N/A
Main St West	189		Panel/plywood	Unknown	Flat roof	N/A	N/A	Delomma J. Stone	N/A	N/A	N/A
Main St West	196	Classic Revival	Plaster/stucco	Unknown	Medium gable roof	N/A	Garage	Delomma J. Stone	N/A	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Main St West	201	Boomtown	Stretcher bond brick	Unknown	Boomtown roof	N/A	N/A	Unknown		N/A	N/A
Main St West	202		Aluminum siding	Unknown	No details	N/A	Stained glass windows	Unknown		N/A	N/A
Main St West	207	Possibly Classic Revival (behind addition)	Stretcher bond brick, house - stucco	Unknown	Original house is 1 1/2 storeys with high gable roof, addition in front is 1 storey with boomtown roof	N/A	Belvedere on roof	Unknown		N/A	N/A
Main St West	220	Regency Commercial Building	Stretcher bond brick, stucco/plaster	Unknown	Low hip roof	N/A	N/A	John Thompson	Postmaster of Petersburgh, township clerk, conveyancer and secretary/treasurer of Humberstone Flouring & Sawmill Company	N/A	N/A
Main St West	223	Classic Revival (behind), Boomtown (front)	Stretcher bond brick	Unknown	1 1/2 storeys, rectangular plan	N/A	Plain cornice roof trim, garage, fence	C.I.B.C.	Bank	N/A	N/A
Main St West	229		Plaster/stucco	Unknown	Medium hip roof, monumental pediment on roof	N/A	Garage	William Zeiter	N/A	N/A	N/A
Main St West	237	Classic Revival	Plaster/stucco	Unknown	High gable roof	N/A	Plain boxed cornice roof trim, garage, fence, old barn at back	Peter Troup	Proprietor of Steam Flour Mill	N/A	N/A
Main St West	247		Natural stone, original house is brick	Unknown	High hip roof	N/A	Stained glass windows, garage	Frederick Schnell	N/A	N/A	N/A
Main St West	255		Brick, upper half is siding	Unknown	Pyramidal roof	N/A	Double bay window, semi-elliptical windows	Unknown		N/A	N/A
Main St West	256	Classic Revival	Stretcher bond brick	Unknown	High gable roof, monumental pediment roof trim	N/A	Round windows, outbuilding	Unknown		N/A	N/A
Main St West	280	Classic Revival (1/2 building)	Composition shingle or sheet	Unknown	High gable roof with offset gable in façade	N/A	N/A	Frederick Utz	N/A	N/A	N/A
Main St West	296	Regency variation	Plaster/stucco	Unknown	Medium gable roof	N/A	Decorative verandah support, outbuilding, fence, garden	Matilda Cook	N/A	N/A	N/A
Main St West	354		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Main St West	357	1/2 Regency, 1/2 Classic Revival	Clapboard	Unknown	Endboard wall design, high gable roof	N/A	Bay window	Unknown		N/A	N/A
Main St West	360		Clapboard	Unknown	Endboard wall design, high gable roof	N/A	Belvedere/openwalk, garage, garden	George Boneberg	N/A	N/A	N/A
McCain	36		Aluminum siding	Unknown	Medium gable roof with offset gable in façade, additional gable without window	N/A	Decorative woodwork on verandah roof	Johnathon Neff	Proprietor of the Foundary & Machine Shop (Humberstone - 1869)	N/A	N/A
McCain	38	Regency	Plaster/stucco	Unknown	Medium gable roof	N/A	Garage, garden	John Thompson	Postmaster and insurance agent of Humberstone (1869)	N/A	N/A
McCain	46		Aluminum siding	Unknown	Medium gable roof	N/A	Barn, original fruit cellar in back of home	Ephrain Monqua	N/A	N/A	N/A
McCain	62	1/2 Regency, 1/2 Classic Revival	Plaster/stucco	Unknown	Medium gable roof, monumental pediment on roof trim	N/A	N/A	D.W. McCain	Carpenter & builder	N/A	N/A
Mellanby	168		Flint/cobble foundation, plaster/stucco exterior	Unknown	High gable roof	N/A	Stained glass windows, balcony, bargeboard on eaves end, fence, water feature	Mary A. Dewey	N/A	N/A	N/A
Mellanby	226	Regency	Plaster/stucco	Unknown	Saltbox roof	N/A	Garage, garden	Horrace Ramey	N/A	N/A	N/A
Mellanby	231	Classic Revival	Clapboard	Unknown	Medium gable roof	N/A	N/A	Wm. Mellanby	N/A	N/A	N/A
Mellanby	249	Classic Revival variation	Asbestos cement sheet	Unknown	High gable roof	N/A	Bay window, garage	Unknown		N/A	N/A
Michael	507	Regency	Clapboard	Unknown	Medium gable roof	N/A	Garage, barn, outbuilding, fence, garden, water feature	Wm. Mellanby	N/A	N/A	N/A
Michener	5363	Regency	Brick	Unknown	Medium gable roof	N/A	Round windows, attached garage	Unknown		N/A	N/A
Michener	5591		Vertical plank wood	Unknown	No details	N/A	Decorative panel/carving, inscription, balcony, barn	Unknown		N/A	N/A
Miller	1359		Stretcher bond brick	Unknown	Medium gable roof with offset gable in façade	N/A	Round windows, garage, barn, outbuilding, garden, water feature	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Miller	1580	Regency variation	Stretcher bond brick	Unknown	Medium gable roof with offset gable in façade	N/A	Balcony, barn (1869 est), garage, outbuilding, garden	Unknown		N/A	N/A
Miller	1836	Classic Revival variation	Stretcher bond brick	Unknown	High gable roof with offset gable in façade	N/A	Barn, outbuilding, fence, garden	Unknown		N/A	N/A
Miller	2506		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Miller	2575		Clapboard	Unknown	High gable roof with offset gable	N/A	Garage, outbuilding, barn	Unknown		N/A	N/A
Miller	2882		Stucco	Unknown	Medium gable roof with centre gable	N/A	Bay window	Unknown		N/A	N/A
Miller	3104	Picturesque Revival variation	Stucco	Unknown	High gable roof with centre gable in façade	N/A	Fence, garage	Unknown		N/A	N/A
Miller	3603	Regency variation	Clapboard	Unknown	Medium gable roof	N/A	Open verandah, attached garage	Unknown		N/A	N/A
Mitchell	181	Classic Revival	Stucco	Unknown	Medium gable roof with offset gable	N/A	Garage, garden	Unknown		N/A	N/A
Mitchell	209	Neo-Classic variation	Aluminum siding	Unknown	High gable roof	N/A	Garage, garden	Unknown		N/A	N/A
Mitchell	210	Georgian Tradition variation	Stucco	Unknown	Low hip roof	N/A	Outbuilding	Possibly Patrick Cassidy	N/A	N/A	N/A
Mitchell	234		Composition shingle or sheet	Unknown	Flat roof	N/A	N/A	Possibly Wm. Aikens	N/A	N/A	N/A
Mitchell	265	Regency	Stucco	Unknown	Medium gable roof	N/A	Closed verandah	Possibly Neil McTaggart	N/A	N/A	N/A
Mitchell	274		Plaster/stucco	Unknown	Low gable roof	N/A	Fence, garden	Unknown		N/A	N/A
Mitchell	311		Aluminum siding	Unknown	Medium gable roof	N/A	Closed porch, garage, outbuilding, fence, garden	Possibly Matthew Walance (?)	N/A	N/A	N/A
Mitchell	337		Composition shingle or sheet	Unknown	High gable roof	N/A	Balcony, garage	Possibly Polly Clark	N/A	N/A	N/A
Neff	9	Classic Revival variation	Plaster/stucco	Unknown	Medium gable roof	N/A	Garage	Possibly Leo/Geo. Augustine (?)	N/A	N/A	N/A
Neff	27		Plaster/stucco	Unknown	Saltbox roof, 1 1/2 storeys	N/A	N/A	John D. Kinnard	Harness maker	N/A	N/A
Neff	50	Georgian Tradition	Stretcher bond brick, wall construction is stone	Unknown	2 storeys, low hip roof	N/A	Garden, windows are 2 ft. thick	Unknown		N/A	N/A
Neff	58		Brick	Unknown	Pyramidal roof, centre gable in roof	N/A	Closed verandah	Daniel Neff Sr.	N/A	N/A	N/A
Neff	146		Clapboard	Unknown	Medium gable roof	N/A	N/A	Possibly Edward Near	N/A	N/A	N/A
Neff	149		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Neff	164	Classic Revival	Aluminum siding	Unknown	2 1/2 storeys, high gable roof	N/A	Bay window, garden, gazebo	Unknown		N/A	N/A
Neff	165	Picturesque Revival variation	Aluminum siding	Unknown	High gable roof with centre gable in façade, monumental pediment in roof	N/A	Garden, water feature, old covered well in rear	Unknown		N/A	N/A
Neff	86/88		Clapboard	Unknown	U-shaped plan, high gable roof with cross gable in roof	N/A	Decorated cornice roof trim, finial on roof trim, garage (log frame with handmade nails), outbuilding, fence, elliptical & pointed windows, bargeboard	Johnathon Neff	Foundry & machine shop	N/A	N/A
Neff (Rd)	1402		Stucco & brick on addition	Unknown	Medium gable roof with centre gable in façade	N/A	Attached garage	Isaac Misener	N/A	N/A	N/A
Nickel	25		Stucco, concrete block foundation	Unknown	Medium gable roof	N/A	Fence	Unknown		N/A	N/A
Oakwood	111		Flint/cobble foundation, aluminum siding	Unknown	High gable roof	N/A	Stained glass windows, bay window, garage, barn, outbuilding, garden	Unknown		N/A	N/A
Omer	150		Stucco	Unknown	Medium gable roof	N/A	Stained glass windows, bay window, decorative detailed woodwork under bay window	George Neff	Farmer	N/A	N/A
Park	4	Classic Revival	Stucco	Unknown	Medium gable roof	N/A	N/A	Elihu Neff	Farmer	N/A	N/A
Park	16		Brick	Unknown	Mansard roof	N/A	House is a converted barn	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Park	22		Stucco	Unknown	1 1/2 storeys	N/A	Open porch, barn, fence, garden	Unknown		N/A	N/A
Park	26	Classic Revival variation	Stucco	Unknown	Medium gable roof, 1 1/2 storeys	N/A	Garden	Unknown		N/A	N/A
Park	30		Stucco	Unknown	Saltbox roof	N/A	Bay window, garden	Unknown		N/A	N/A
Park	34		Stucco	Unknown	Medium gable roof	N/A	N/A	Possible Thomas Parke	N/A	N/A	N/A
Park	44	Classic Revival variation	Stucco	Unknown	High gable roof	N/A	Triangular windows, garage	Unknown		N/A	N/A
Pine	34		Stucco	Unknown	Medium gable roof	N/A	Open verandah, garage	John Lynson	N/A	N/A	N/A
Pine	35		Brick	Unknown	Pyramidal roof	N/A	Bay window, closed porch	Unknown		N/A	N/A
Pine	41	Regency variation	Aluminum siding	Unknown	High gable roof	N/A	Garage, outbuilding	Unknown		N/A	N/A
Pine	42	Classsic Revival	Stucco	Unknown	Medium gable roof	N/A	Garden	Marlin Schmitt	N/A	N/A	N/A
Pine	57	Picturesque Revival variation	Vinyl siding	Unknown	Endboard wall design, medium gable roof, monumental pediment on roof trim, embrasure	N/A	Garage, garden	Unknown		N/A	N/A
Pinecrest	663		No details	Unknown	No details	N/A	N/A	John Thompson	Postmaster & insurance agent (Humberstone)	N/A	N/A
Pinecrest	736		Clapboard	Unknown	Endboard wall design, medium gable roof, centre gable in façade	N/A	Oval windows, old barn, garage, outbuilding, fence, garden, water feature	Unknown		N/A	N/A
Pleasant Beach	484		Stucco	Unknown	Medium gable roof	N/A	Fence	Unknown		N/A	N/A
Pleasant Beach	566		Stone/clapboard	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Pleasant Beach	591		Stucco	Unknown	Centre gable in façade, medium gable roof	N/A	Stone pillar property markers	Unknown		N/A	N/A
Pleasant Beach	666	Regency	Stucco/clapboard	Unknown	Medium gable roof	N/A	Open verandah with decorative supports, garden	Unknown		N/A	N/A
Pleasant Beach			No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Ramey	34		Clapboard	Unknown	Hip roof	N/A	Dormer in façade, palladian window, garage	Unknown		N/A	N/A
Ramey	72		Plaster/stucco	Unknown	High gable roof, double gable in façade, additional gable in roof	N/A	Garage	Unknown		N/A	N/A
Ramey	76		Stucco	Unknown	High gable roof with double gable, addition gable with windows	N/A	Bow window with decorative carving	John Duffill	N/A	N/A	N/A
Rodney	83		Stucco	Unknown	High gable roof	N/A	N/A	R.H. Appleyard	N/A	N/A	N/A
Second Concession	3288		Composition shingle or sheet	Unknown	Medium gable roof	N/A	Balcony, garage, barn, outbuilding, porch - Century Farm (1867-1967)	Unknown		N/A	N/A
Second Concession	3930		Aluminum siding	Unknown	2 storeys, medium hip roof	N/A	Garage, barn, outbuilding, fence, garden, water feature	Unknown		N/A	N/A
Second Concession	5167		No details	Unknown	Centre gable in roof (façade)	N/A	Garage, fence	Unknown		N/A	N/A
Second Concession	5222		Stretcher bond brick	Unknown	Low gable roof	N/A	Garage, outbuilding, barn (1860 est), fence, garden	Unknown		N/A	N/A
Second Concession	5625		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Sherk	1271		Clapboard	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Sherkston	4250		Stretcher bond brick	Unknown	High gable roof	N/A	Barn, outbuilding, garden, water feature	Unknown		N/A	N/A
Sherkston	4838	Georgian Tradition	Sawn stone, sheathed	Unknown	2 storeys, low gable roof	N/A	Semi-circular windows, boxed cornice roof trim with frieze and brackets	Unknown		N/A	N/A
Sherkston	5031		Composition shingle or sheet	Unknown	Gable/flat roof	N/A	Diamond shaped windows, balcony, barn, fence	Possibly Thomas Sherk	N/A	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Sherkston	5065		No details	Unknown	No details	N/A	N/A	Possibly Daniel Sherk	N/A	N/A	N/A
Sherkston	5080		Stucco	Unknown	Medium gable roof with centre gable in façade	N/A	Garden	Unknown		N/A	N/A
Sherkston	5212		Composition shingle or sheet	Unknown	Medium gable roof, centre gable in roof	N/A	Semi-circular windows	Unknown		N/A	N/A
Sherkston	5306		Aluminum siding	Unknown	High gable roof with centre gable	N/A	Garage, garden	Possibly Samuel Sherk	N/A	N/A	N/A
Sherkston	5420	Regency	Clapboard	Unknown	Low gable roof	N/A	Open verandah with decorative supports	Unknown		N/A	N/A
Sherkston	5446		Aluminum siding	Unknown	Medium gable roof, centre gable in roof	N/A	Rounded verandah with stone supports, fence, garden, garage	Unknown		N/A	N/A
Sherkston	5488		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Sherkston	5966	Georgian Tradition variation	Wood - horizontal plank	Unknown	Low gable roof	N/A	Dormer over front door entrance, garage, garden, barn (used for nursery purposes)	Unknown		N/A	N/A
Silver	86		Stucco	Unknown	Medium gable roof with offset gable in roof, additional gable without window	N/A	Plain boxed cornice roof trim, semi-circular windows	Unknown		N/A	N/A
St. Arnaud	79		Stucco	Unknown	Medium gable roof	N/A	Fence	Charly Schooley	N/A	N/A	N/A
St. Arnaud	110	Classic Revival	Stucco	Unknown	Medium gable roof	N/A	Semi-circular windows, garage, garden	Unknown		N/A	N/A
Steele	20		Stucco	Unknown	No details	N/A	Transom in main window, bay window on both storeys, garage, fence, garden	Unknown		N/A	N/A
Steele	34	Picturesque Revival variation	Stucco	Unknown	No details	N/A	Elliptical & semi-circular windows, garage, garden	David Steele Jr.	Farmer	N/A	N/A
Steele	64	Classic Revival variation	Stucco	Unknown	High gable roof	N/A	Transom in main window, garage, garden	Possibly Jefferson Steele	N/A	N/A	Belongs to Humberstone Summer Resort Co.
Steele	178		Rock-faced stone	Unknown	Mansard roof, truncated roof	N/A	Garage, garden, looks like converted barn	Charles Steele	N/A	N/A	N/A
Steele	210		Brick	Unknown	Low hip roof, pediment without window in façade	N/A	Decorative pillar supports over main entrance	Charles Steele	N/A	N/A	N/A
Steele	228		Stretcher bond brick	Unknown	Cross gable in roof	N/A	Plain boxed cornice with return roof trim, round, bay, and semi-circular windows, garage, fence, garden	Niagara South Board of Education		N/A	N/A
Steele	246		Brick	Unknown	Pyramidal roof, gable in façade	N/A	Bay window in both storeys, round windows, garage	David Steele	N/A	N/A	N/A
Sugarloaf	21		Stucco	Unknown	Medium gable roof, additional gable without window	N/A	Plain boxed cornice roof trim, bay window, steeple, balcony, triangular windows	Unknown		N/A	N/A
Sugarloaf	25		Composition shingle or sheet	Unknown	Hipped gable roof, monumental pediment in roof	N/A	Decorative wall shingles, round, bay and stained glass windows, garage under house, balcony, bay window on more than one storey, verandahs on 2nd & 3rd floors and at side of house	Joseph Shickluna	Ship carpenter	N/A	N/A
Sugarloaf	51	Georgian Tradition	Siding	Unknown	Medium gable roof	N/A	Dormer over main entrance, garden	Richard S. King	N/A	N/A	N/A
Sugarloaf	65		Plaster/stucco	Unknown	High hip roof	N/A	Decorative brick, spire, balcony, bay window on both storeys, garage, fence	Unknown		N/A	N/A
Sugarloaf	77		Stucco	Unknown	High gable roof	N/A	Decorated design on walls, stained glass windows, balcony	Ann Jenkinson	N/A	N/A	N/A
Sugarloaf	86		No details	Unknown	No details	N/A	N/A	John Matthews	Owner of canal towing teams	N/A	N/A
Sugarloaf	87		Stucco	Unknown	Entablature wall design, saltbox roof	N/A	N/A	Unknown		N/A	N/A
Sugarloaf	90		Stucco	Unknown	High gable roof	N/A	Fence, hitching post	Kingston	N/A	N/A	N/A
Sugarloaf	100		Brick, concrete block foundation	Unknown	Pyramidal roof	N/A	Open verandah, garden, garage	Carter	N/A	N/A	N/A
Sugarloaf	108		Plaster/stucco	Unknown	High gable roof	N/A	Bay window, balcony, garage, fence, water feature (pool) - old farm house	Unknown		N/A	N/A
Sugarloaf	117		Composition shingle or sheet	Unknown	Low gable roof, cross gable in roof	N/A	Garage	Mary C. Scholfield	N/A	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Sugarloaf	334							William H. Merritt Jr.	N/A	N/A	N/A
Tennessee	3										
Tennessee	19		Stucco	Unknown	Hipped gambrel roof	N/A	French windows, buttress, attached barn, garden, water feature				
Tennessee	33		Clapboard	Unknown	Hipped gambrel roof	N/A	Bay window on more than one storey, garden, water feature	Alice Kock	N/A	N/A	In 1912 the Casino was built as part of the Humberstone Summer Resort Club
Tennessee	34	Regency variation	Clapboard	Unknown	Cross gable in roof	N/A	Balcony, garage, fence, garden	Unknown		N/A	Humberstone Summer Resort Club
Tennessee	49		Clapboard	Unknown	Medium gable roof	N/A	Plain boxed cornice with decorated frieze roof trim, elliptical, bay windows, attached garage, garden, water feature	Unknown		N/A	Humberstone Summer Resort Club
Tennessee	59		Plaster/stucco	Unknown	Cross gable in roof	N/A	Decorative shingle wall design, half-round windows, projecting frontispiece, attached garage, garden, water feature	Possibly J.P. Jordan	N/A	N/A	Humberstone Summer Resort Club
Tennessee	83		Split weather board	Unknown	Truncated roof	N/A	Bay window, balcony, attached garage, garden, water feature	Possibly David Steele Jr.	N/A	N/A	Humberstone Summer Resort Club
Tennessee	89		Plaster/stucco	Unknown	No details	N/A	Bay window on both storeys, open porch, balcony, garden, water feature	Humberstone Summer Resort Co. - Jefferson Steele	N/A	N/A	N/A
Tennessee	91		Aluminum siding	Unknown	No details	N/A	Eyebrow & bay windows, attached garage, garden, water feature	Jefferson Steele	N/A	N/A	Humberstone Summer Resort Club
Tennessee	101		Clapboard	Unknown	Cross gable in roof	N/A	Spire/steeple, attached barn, garden, water feature	Jefferson Steele	N/A	N/A	Humberstone Summer Resort Club
Tennessee	105		Plaster/stucco	Unknown	Gable/flat roof	N/A	Attached garage, garden, water feature	Jefferson Steele	N/A	N/A	Humberstone Summer Resort Club
Tennessee	109		Clapboard	Unknown	Butterfly roof	N/A	Open porch, attached garage, garden, water feature	Humberstone Summer Resort Co. - Jefferson Steele	N/A	N/A	Humberstone Summer Resort Club
Tennessee	113		Plaster/stucco	Unknown	High gable roof, parapet with entablature roof trim	N/A	Projecting frontispiece, water feature, garden	Humberstone Summer Resort Co. - Jefferson Steele	N/A	N/A	Humberstone Summer Resort Club
Tennessee	119		Aluminum siding	Unknown	Gambrel roof	N/A	French windows, projecting frontispiece, garden, water feature	Humberstone Summer Resort Co. - Jefferson Steele	N/A	N/A	Humberstone Summer Resort Club
Tennessee	125		Clapboard	Unknown	No details	N/A	Triangular dormer, french windows, closed porch, water feature	Jefferson Steele	N/A	N/A	N/A
Tennessee	133		Wood	Unknown	Low gable roof	N/A	Garden, water feature	Humberstone Summer Resort Co. - Jefferson Steele	N/A	N/A	Humberstone Summer Resort Club
Third Concession	1598		Clapboard	Unknown	Medium gable roof, gable in façade	N/A	N/A	Humberstone Summer Resort Co.	N/A	N/A	N/A
Third Concession	1724	Classic Revival	Plaster/stucco	Unknown	High gable roof	N/A	N/A	Unknown		N/A	N/A
Third Concession	1795		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Third Concession	1870	Picturesque Revival variation	Clapboard	Unknown	Medium gable roof with centre & offset gables in roof	N/A	Semi-circular windows, barn, garage, outbuilding, woodshed (1865 est), fence, garden, water feature	Unknown		N/A	N/A
Third Concession	2148		Clapboard	Unknown	Medium gable roof	N/A	N/A	David Kramer Sr.	Farmer	N/A	N/A
Third Concession	2352		Stucco	Unknown	Garage is original house	N/A	N/A	Jacob Doan	N/A	N/A	N/A
Third Concession	2437		Clapboard	Unknown	Medium gable roof	N/A	Garage, garden	Christian Weis - original 1840 house, John White - 1906 house	N/A	N/A	N/A
Third Concession	2562		Aluminum siding	Unknown	Low gable roof	N/A	Quarter round windows	Unknown		N/A	N/A
Third Concession	2784		Clapboard	Unknown	High gable roof	N/A	N/A	Christopher Schleffel	N/A	N/A	N/A
Troup	1152		Wood	Unknown	No details	N/A	Fence, shed	Unknown		N/A	N/A
Troup	1170		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Union	43		Aluminum siding	Unknown	High gable roof	N/A	Plain boxed cornice roof trim, verandah	Unknown		N/A	N/A
Victoria	26		Clapboard	Unknown	High gable roof with offset & cross gables in roof, monumental pediment on roof trim	N/A	Garage, fence, unusual window design on 2nd floor main façade, balcony	Fred Woods	Teacher	N/A	N/A
Victoria	49		Plaster/stucco	Unknown	Low gable roof	N/A	N/A	Fred Woods	Owner of ship chandling firm (??)	N/A	N/A
Victoria	50	Regency variation	Composition shingle or sheet	Unknown	Medium hip roof with centre gable in roof	N/A	Balcony, two-storey verandah at rear, garage	Thomas Waldron	N/A	N/A	Old farmhouse of the area
Victoria	59		Plaster/stucco	Unknown	High gable roof	N/A	Verandah	Robert Cook	N/A	N/A	N/A
Victoria	60		No details	Unknown	No details	N/A	N/A	Eliza Ellen Yokom	N/A	N/A	N/A
Victoria	64	Classic Revival variation	Plaster/stucco	Unknown	Medium gable roof, cross gable	N/A	Garage	Unknown		N/A	N/A
Victoria	86	Classic Revival variation	Shingle	Unknown	High gable roof	N/A	Decorative boxed cornice roof trim, semi-circular windows, garage, fence, garden	John Fleming	N/A	N/A	N/A
Victoria	90		Shingle	Unknown	Gable/flat roof	N/A	Garage, fence, garden	MaryAnn Wilcox	N/A	N/A	N/A
Victoria	94		Plaster/stucco	Unknown	No details	N/A	Garage, garden	Unknown		N/A	N/A
Victoria	95	Classic Revival variation	Stucco	Unknown	High gable roof	N/A	Open verandah, fence	John Gordon	N/A	N/A	N/A
Victoria	108		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Victoria	113		Stucco	Unknown	Saltbox roof	N/A	Garage	Unknown		N/A	N/A
Victoria	117		Stucco	Unknown	Saltbox roof	N/A	Garage, garden	Possibly Eliza Mills	N/A	N/A	N/A
Victoria	118		Stucco	Unknown	No details	N/A	Garage, fence, garden	Unknown		N/A	N/A
Wallace	18		Stucco	Unknown	Medium gable roof	N/A	Plain boxed cornice roof trim, embrasure	Unknown		N/A	N/A
Walnut	12		Clapboard	Unknown	No details	N/A	Attached garage, garden	Mathew T. Haney	N/A	N/A	N/A
Weaver	736		Clapboard	Unknown	Gambrel roof	N/A	Open verandah, fence, garden	Unknown		N/A	N/A
Weaver	856		Wood	Unknown	Medium gable roof	N/A	Plain boxed cornice roof trim, verandah, garage, barn, outbuilding, fence, garden, water feature	Unknown		N/A	N/A
Welland	43		Plaster/stucco	Unknown	Medium gable roof	N/A	Closed porch, garage, fence, garden	Samuel Weaver	N/A	N/A	N/A
Welland	49		Stucco	Unknown	High gable roof	N/A	Decorative trim on porch roof	Patrick Neelon	N/A	N/A	N/A
Welland	63		Stucco	Unknown	High gable roof	N/A	N/A	Unknown		N/A	N/A
Welland	77		Plaster/stucco	Unknown	High gable roof	N/A	Open porch, outbuilding	Unknown		N/A	N/A
Welland	83		Plaster/stucco	Unknown	High gable roof	N/A	Triangular windows, open porch, outbuilding	Unknown		N/A	N/A
Welland	89		Plaster/stucco	Unknown	Medium gable roof	N/A	Verandah, water feature	Daniel Brown	N/A	N/A	N/A
Welland	95		Plaster/stucco	Unknown	Medium gable roof	N/A	Water feature	Unknown		N/A	N/A
Welland	155		Plaster/stucco	Unknown	Medium gable roof	N/A	N/A	William Brown	N/A	N/A	N/A
Welland	165		Plaster/stucco	Unknown	Medium gable roof	N/A	Balcony, garage, fence, garden	Unknown		N/A	N/A
Welland	173		Plaster/stucco	Unknown	Medium gable roof	N/A	Plain boxed cornice roof trim, garage	Kate McAllister	N/A	N/A	N/A
Welland	177	Regency variation	Plaster/stucco	Unknown	Low gable roof	N/A	Closed verandah	Robert Richardson	Carpenter	N/A	N/A
Welland	185	Boomtown	Common bond brick	Unknown	Low gable roof	N/A	N/A	Matthew Richardson	Engineer	N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
Welland	203		Stretcher bond brick	Unknown	High gable roof	N/A	Cornia with fascia roof trim, palladian windows, garage, fence, garden	Possibly Henry Spratt	N/A	N/A	N/A
Welland	247		Brick, stucco, aluminum siding	Unknown	Flat/gable roof	N/A	N/A	Margaret Ramey	N/A	N/A	N/A
Welland	281	Classic Revival variation	Aluminum siding	Unknown	Medium gable roof, offset gable in roof	N/A	Outbuilding, fence	Unknown		N/A	N/A
Welland	289	Classic Revival	Plaster/stucco	Unknown	Medium gable roof	N/A	Roof trim with projecting eaves and frieze, balcony, outbuilding	Henry Cronmiller	Brewery bought from Jacob North	N/A	N/A
Welland	293		Aluminum siding	Unknown	Low gable roof	N/A	Plain boxed cornice roof trim, fence	Henry Cronmiller	Brewery bought from Jacob North	N/A	N/A
Welland	323	Boomtown	Plaster/stucco	Unknown	Gable/flat roof	N/A	Plain boxed cornice roof trim, balcony, outbuilding	Henry Cronmiller		N/A	N/A
Welland	327		Aluminum siding	Unknown	High gable roof with offset gable in roof	N/A	Plain boxed cornice roof trim, garage, fence, garden	William Hamilton Merritt Jr.	N/A	N/A	N/A
Welland	331		Clapboard	Unknown	Gable/flat roof	N/A	Balcony, fence	William Hamilton Merritt Jr.	N/A	N/A	N/A
West	56		Plaster/stucco, poured concrete wall construction	Unknown	High hip roof, gable in roof	N/A	Plain boxed cornice with decorated frieze roof trim, bay, palladian, semi-circular, oval windows, spire/steeple, garage	William Hamilton Merritt Jr.	N/A	N/A	N/A
West	62		Composition shingle or sheet	Unknown	Low gable roof	N/A	Elliptical, bay, stained glass windows, outbuilding	Charles S. Carter	Tug proprietor	N/A	N/A
West	70		Aluminum siding	Unknown	High gable roof, cross gable in roof	N/A	Bay window	Unknown		N/A	Lakeview Hotel
West	84		No details	Unknown	No details	N/A	N/A	James Hamilton	N/A	N/A	N/A
West	136		Plaster/stucco	Unknown	High gable roof	N/A	Unusual front door, corbelling wall design, decorative brick & shingle, corner bracket roof trim, bay, french, and stained glass windows	Alexander Stuart	N/A	N/A	N/A
West	140		Aluminum siding	Unknown	Hipped gable roof, cross gable in roof	N/A	Plain boxed cornice roof trim, garage, bay and stained glass windows, balcony	John A. Ramsden	N/A	N/A	N/A
West	144		Clapboard	Unknown	Flat roof	N/A	Entablature wall design	Mary Mahaffey	N/A	N/A	N/A
West	146	Classic Revival	Aluminum siding	Unknown	High gable roof	N/A	N/A	Frank C. Mahaffey	N/A	N/A	N/A
West	148	Boomtown	Brick	Unknown	No details	N/A	Semi-circular windows	Samuel Cook	Grocer	N/A	N/A
West	152	Classic Revival	Plaster/stucco	Unknown	Low gable roof, six rectangular gables in roof	N/A	N/A	Unknown		N/A	N/A
West	158		Plaster/stucco	Unknown	Flat roof	N/A	Boxed cornice with frieze roof trim	Robert Smith	Dry goods, groceries dealer	N/A	N/A
West	162		No details	Unknown	No details	N/A	N/A	James Twohey (?)	N/A	N/A	N/A
West	176		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
West	182		Plaster/stucco	Unknown	Gable/flat roof	N/A	Plain boxed cornice roof trim	Unknown		N/A	N/A
West	192		Stretcher bond brick	Unknown	Flat roof	N/A	Balcony, plain boxed cornice and plain frieze roof trim	Jeremiah Johnson	N/A	N/A	N/A
West	196		No details	Unknown	No details	N/A	N/A	Thomas Scholfield	N/A	N/A	N/A
West	256		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A

		ARCHITECTURE						PROPERTY HISTORY			
STREET/ROAD	BUILDING NO.	STYLE	CONSTRUCTION	ARCHITECT	DESIGN	INTERIOR FEATURES	PROPERTY FEATURES	ORIGINAL OWNER	OCCUPATION	EVENT	CONTEXT
West	260		Stretcher bond brick	Unknown	No details	N/A	Entablature wall design, tie rod anchors wall design, decorative brick	Unknown		N/A	N/A
West	266		No details	Unknown	No details	N/A	N/A	Donald Stewart	N/A	N/A	N/A
West	172/174	Boomtown	Stretcher bond brick	Unknown	Boomtown roof	N/A	Decorative brick, attached garage	Unknown		N/A	N/A
West	212/214							John & Eugene Reeb	N/A	N/A	N/A
West	188/190		Plaster/stucco	Unknown	Saltbox roof	N/A	Decorated boxed cornice roof trim				
West	262/264		No details	Unknown	No details	N/A	N/A	Thomas Greenwood	Butcher	N/A	N/A
Westside	46	Picturesque Revival	Clapboard	Unknown	Medium gable roof, centre gable in roof	N/A	Semi-circular windows, outbuilding	Unknown		N/A	N/A
White	1715		Clapboard	Unknown	High gable roof	N/A	N/A	Emanuel G. Neff	N/A	N/A	N/A
White	1866		Clapboard	Unknown	No details	N/A	Barn	Unknown		N/A	N/A
White	2207		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
White	2464		Clapboard	Unknown	Medium gable roof, gable in centre	N/A	N/A	Unknown		N/A	N/A
White	2577		Clapboard	Unknown	Mansard roof	N/A	N/A	Unknown		N/A	N/A
Wilhelm	3980		Stretcher bond brick	Unknown	Low gable roof with offset gable in roof	N/A	Garage, barn (1870), outbuilding, fence, water feature	Unknown		N/A	N/A
Wyldewood	895		No details	Unknown	No details	N/A	N/A	Jacob Scheil Jr.	N/A	N/A	N/A
Yager	3247		Clapboard	Unknown	High gable roof with offset gable in roof	N/A	Buttress, balcony, garage, barn (1880 est), outbuilding, fence, garden, water feature	Unknown		N/A	N/A
Yager	3670		No details	Unknown	No details	N/A	N/A	Unknown		N/A	N/A
Zavitz	3499		Stretcher bond brick	Unknown	Medium gable roof	N/A	Garage, barn (1884 est), outbuilding, fence, garden, water feature	William T. Kramer	N/A	N/A	N/A
								Unknown		N/A	N/A

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Adelaide	21	N/A	N/A	N/A	Original	Windows, doors, roof, chimney, porch/stairs		Good	See Parks Canada Survey for further info
Adelaide	27	N/A	N/A	N/A	Original	Windows, doors, roof, porch, addition		Good	See Parks Canada Survey for further info
Adelaide	55	N/A	N/A	N/A	Original	Windows, roof, stair, addition		Good	See Parks Canada Survey for further info
Adelaide	66	N/A	N/A	N/A	Original	Wall, window, doors, roof, chimney		Good	See Parks Canada Survey for further info
Adelaide	67	N/A	N/A	N/A	Original	Wall, back door, roof, chimney, porch stairs	Good	Good	See Parks Canada Survey for further info
Adelaide	79	N/A	N/A	N/A	Original	Wall, windows, doors, roof, chimney		Good	See Parks Canada Survey for further info
Adelaide	87	N/A	N/A	N/A	Original	Windows, doors, porch		Good	See Parks Canada Survey for further info
Adelaide	109	N/A	N/A	N/A	Original	Windows, doors		Good	See Parks Canada Survey for further info
Adelaide	115	N/A	N/A	N/A	Original			Good	See Parks Canada Survey for further info
Ash	167	N/A	N/A	N/A	Original	Windows, doors		Good	See Parks Canada Survey for further info
Barrick	264	N/A	N/A	N/A				Good	See Parks Canada Survey for further info
Barrick	315	N/A	N/A	N/A	Unknown			Good	See Parks Canada Survey for further info
Beach	14	N/A	N/A	N/A	Unknown			Good	See Parks Canada Survey for further info
Beach	25	N/A	N/A	N/A	Original	Windows, addition		Good	See Parks Canada Survey for further info
Beach (Road)	5251	N/A	N/A	N/A	Unknown			Good	No Canada Parks Survey
Bell	146	N/A	N/A	N/A	Unknown			Good	No Canada Parks Survey
Bell	160	N/A	N/A	N/A	Unknown	Addition (rear), porch (front)		Good	No Canada Parks Survey
Bell	206	N/A	N/A	N/A	Original	Walls, windows, doors, addition		Good	See Parks Canada Survey for further info
Bell	245	N/A	N/A	N/A		Windows		Good	No Canada Parks Survey
Borden	1	N/A	N/A	N/A	Unknown			Good	No Canada Parks Survey
Borden	133	N/A	N/A	N/A	Original	Walls, windows, doors, porch, addition		Good	See Parks Canada Survey for further info
Borden	183	N/A	N/A	N/A	Original	Addition		Good	See Parks Canada Survey for further info
Brookfield	1623	N/A	N/A	N/A	Original	Walls, windows, doors, roof, porch, addition		Good	See Parks Canada Survey for further info
Brookfield	3986	N/A	N/A	N/A	Original	Wall, windows, roof, chimney, addition		Good	See Parks Canada Survey for further info
Canal Bank	25	N/A	N/A	N/A	Original	Windows, addition, doors, roof, chimney, porch, storey		Good	See Parks Canada Survey for further info
Canal Bank	35	N/A	N/A	N/A	Original	Chimney		Good	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Canal Bank	37	N/A	N/A	N/A	Original	Addition, windows		Good	No Canada Parks Survey
Canal Bank	45	N/A	N/A	N/A	Unknown	Wall, windows, roof, addition		House renovated - 1979	See Parks Canada Survey for further info
Catharine	13	N/A	N/A	N/A	Unknown	Wall, windows, doors, roof, chimney, addition			See Parks Canada Survey for further info
Catharine	14	N/A	N/A	N/A	Original	Windows, doors, roof, porch		Good	See Parks Canada Survey for further info
Catharine	28	N/A	House is very unusual and attractive	N/A	Original	None	Poor	Good	See Parks Canada Survey for further info
Catharine	29	N/A	Very attractive house	N/A	Unknown	Addition, windows, roof		Good	See Parks Canada Survey for further info
Catharine	90	N/A	N/A	N/A	Unknown	Addition, windows		Good	No Canada Parks Survey
Catharine	96	N/A	N/A	N/A	Original	Doors, porch		Good	See Parks Canada Survey for further info
Catharine	133	N/A	N/A	N/A	Original	Windows, doors, porch, addition		Good	See Parks Canada Survey for further info
Catharine	136	N/A	N/A	N/A	Original	Doors, roof, chimney, porch		Good	See Parks Canada Survey for further info
Catharine	140	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Catharine	172	N/A	N/A	N/A	Original	Doors, porch, addition		Good	See Parks Canada Survey for further info
Catharine	206	N/A	N/A	N/A	Unknown	Windows		Good	See Parks Canada Survey for further info
Catharine	254	N/A	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Catharine	262	N/A	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Catharine	304	N/A	N/A	N/A	Original	Doors, porch, addition		Good	See Parks Canada Survey for further info
Catharine	310	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Catharine	326	N/A	N/A	N/A	Original	Wall, roof, addition		Good	See Parks Canada Survey for further info
Catharine	346	N/A	Very attractive house, unusual	N/A	Unknown	Unknown		Very good	No Canada Parks Survey
Catharine	358	N/A	N/A	N/A	Original	Wall, doors, porch		Unknown	See Parks Canada Survey for further info
Cedar Bay (Road)	621	N/A	N/A	N/A	Unknown	Porch		Good	No Canada Parks Survey
Cedar Bay (Road)	666	N/A	N/A	N/A	Original	Windows, doors, chimney, porch		Good	See Parks Canada Survey for further info
Charles	42	N/A	N/A	N/A	Original	Windows, doors, addition		Good	See Parks Canada Survey for further info
Charles	44	N/A	N/A	N/A	Original	Windows, doors, addition		Good	See Parks Canada Survey for further info
Charles	66	N/A	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Charlotte	17	N/A	N/A	N/A	Original	Unknown		Good	See Parks Canada Survey for further info
Charlotte	20	See Comment	N/A	N/A	Unknown	False front added, windows, door, roof, addition		Good	See Parks Canada Survey for further info
Charlotte	21	See Comment	N/A	N/A	Unknown	Windows, doors, store front		Good	No Canada Parks Survey

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Charlotte	50	See Comment	N/A	N/A	Original	Wall, window, door, chimney		Good	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Charlotte	54	See Comment	N/A	N/A	Original	Windows, doors, addition, 1st floor changed		Good	See Parks Canada Survey for further info
Charlotte	55	N/A	N/A	N/A	Original	Window, door, addition		Good	See Parks Canada Survey for further info
Charlotte	56	YES	YES, Very attractive	Yes, it's a visual landmark	Original	Unknown		Good	No Canada Parks Survey
Charlotte	72	N/A	N/A	N/A	N/A	Unknown		BUILDING HAS BEEN DEMOLISHED	
Charlotte	112	N/A	N/A	N/A	Original	Unknown		Good	See Parks Canada Survey for further info
Charlotte	119	N/A	N/A	N/A	Original	Windows, doors, addition		Good	See Parks Canada Survey for further info
Charlotte	122	N/A	N/A	N/A	Original	Door, porch/stair		Good	See Parks Canada Survey for further info
Charlotte	169	N/A	N/A	N/A	Original	Doors		Satisfactory	See Parks Canada Survey for further info
Charlotte	2/12/14	N/A	N/A	N/A	Original	Windows, doors, porch, storey added, addition			See Parks Canada Survey for further info
Charlotte	29-33	See Comment	N/A	N/A	Unknown	Windows		Good	No Canada Parks Survey
Charlotte	32-34	See Comment	N/A	N/A	Original	Walls, windows, doors		Good	See Parks Canada Survey for further info
Chippawa (Road)	153	See Comment	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Chippawa (Road)	205	N/A	N/A	N/A	Unknown	Porch, windows		Good	No Canada Parks Survey
Chippawa (Road)	352	N/A	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Chippawa (Road)	572	N/A	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Chippawa (Road)	975	N/A	N/A	N/A	Unknown	Unknown		Good	See Parks Canada Survey for further info
Chippawa (Road)	998	N/A	N/A	N/A	Unknown	Unknown		Good	See Parks Canada Survey for further info
Chippawa (Road)	1024	N/A	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Chippawa (Road)	1245	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, chimney, addition		Good	See Parks Canada Survey for further info
Chippawa (Road)	1246	N/A	N/A	N/A	Unknown	Wall, window, roof, porch, addition		Good	See Parks Canada Survey for further info
Chippawa (Road)	1445	N/A	N/A	N/A	Unknown	Unknown		Unknown	See Parks Canada Survey for further info
Chippawa (Road)	2703					Addition to west of existing building			
Chippawa (Road)	2831	N/A	N/A	N/A	Unknown	Chimney		Good	See Parks Canada Survey for further info
Chippawa (Road)	2950	N/A	N/A	N/A	Unknown	Unknown		Unknown	See Parks Canada Survey for further info
Church	24	N/A	N/A	N/A	Unknown	Unknown		Unknown	See Parks Canada Survey for further info
Church	28	N/A	N/A	N/A	Original	Addition		Good	See Parks Canada Survey for further info
Clarence	1	N/A	N/A	N/A	Unknown	Unknown		Good	See Parks Canada Survey for further info
Clarence	67	See Comment	N/A	N/A		Windows, roof, storefront		Good	No Canada Parks Survey
Clarence	78	N/A	N/A	N/A	Original	Unknown		Good	No Canada Parks Survey
Clarence	170	N/A	N/A	N/A	Original	Wall, roof, chimney, added storey, addition		Good	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Clarence	178	N/A	N/A	N/A	Unknown	Unknown		Okay	No Canada Parks Survey
Clarence	216	N/A	N/A	N/A	Original	Wall, 1st floor changed		Good	See Parks Canada Survey for further info
Clarence	217	N/A	N/A	N/A	Original	None		Good	See Parks Canada Survey for further info
Clarence	232	N/A	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Clarence	264	N/A	N/A	N/A	Unknown	Unknown		Good	No Canada Parks Survey
Clarence	208/210	N/A	N/A	N/A	Original	Porch		Good	See Parks Canada Survey for further info
Clarence	302/304	N/A	N/A	N/A	Original	Wall		Good	See Parks Canada Survey for further info
Clark (Road)	1152	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Colborne	75	N/A	N/A	See comment	Original	Chimney, addition		Good	See Parks Canada Survey for further info
David	15	N/A	N/A	N/A	Original	Wall, addition		Good	See Parks Canada Survey for further info
Davis	128	N/A	N/A	N/A	Unknown	Windows, porch, front of building		Good	No Canada Parks Survey
Davis	346	N/A	N/A	N/A	Unknown	Additions		Good	No Canada Parks Survey
Davis	413	N/A	N/A	N/A	See Comment	N/A		Good	No Canada Parks Survey
Davis	473	N/A	N/A	N/A	See Comment	N/A		Good	No Canada Parks Survey
Delhi	57	N/A	N/A	N/A	Unknown	Door, porch		Good	No Canada Parks Survey
Division	252	N/A	N/A	N/A	Unknown	N/A		Good	Building permit states 1897, but lot not built up until 1899, See Canada Parks Survey
Durham	93	N/A	N/A	N/A	Original	Addition		Good	See Parks Canada Survey for further info
Durham	101	N/A	N/A	N/A	Original	Wall, addition		Good	See Parks Canada Survey for further info
Durham	129	N/A	N/A	N/A	Original	Wall, windows, roof, addition		Good	See Parks Canada Survey for further info
Durham	133	N/A	N/A	N/A	N/A	Windows		Good	No Canada Parks Survey
Durham	159	N/A	N/A	N/A	Original	Doors, addition		Good	See Parks Canada Survey for further info
Elgin	63	N/A	N/A	N/A	N/A	Porch/stairs		Good	No Canada Parks Survey
Elgin	69	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Elgin		N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Elm	56	N/A	N/A	Only highschool on west side	Original	Windows, doors, wall, addition		Good	No Canada Parks Survey
Elm	78	N/A	N/A	N/A	Original	Addition		Good	See Parks Canada Survey for further info
Elm	82	N/A	N/A	N/A	Original	Doors, stair porch		Good	See Parks Canada Survey for further info
Elm	102	N/A	N/A	N/A	Original	Door		Good	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Elm	114	N/A	N/A	N/A	N/A	Windows, doors, porch, aluminum siding		Good	No Canada Parks Survey
Elm	262	N/A	N/A	N/A	Original	Door, addition		Paint peeling - some work needed (1979)	See Parks Canada Survey for further info
Elm	610	N/A	N/A	N/A	Original	Roof, porch, addition		Good	See Parks Canada Survey for further info
Elm	625	N/A	N/A	N/A	Original	Wall, window, doors, additional storey		N/A	See Parks Canada Survey for further info
Elm	688	N/A	N/A	N/A	Unknown	Porch, windows		Good	No Canada Parks Survey
Elm	795	N/A	N/A	Factory	Original	Walls, windows, doors, roof, addition		Good	See Parks Canada Survey for further info
Elm	803	N/A	N/A	N/A	Unknown	Wall, window, door, roof, addition		Good	See Parks Canada Survey for further info
Elm	825	N/A	N/A	Originally old school house	N/A	Remodelled 1922, walls, windows, roof, addition		N/A	See Parks Canada Survey for further info
Elm		N/A	N/A	Early ice cream store (since been remodelled)	Moved	Wall, windows, roof, chimney, addition (house moved when canal built)		Good	See Parks Canada Survey for further info
Empire	532	N/A	N/A	N/A	N/A	N/A		N/A	No Canada Parks Survey
Empire	573	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Empire	731	N/A	N/A	N/A	Original	Added storey		Good	See Parks Canada Survey for further info
Erie	83	N/A	N/A	N/A	Unknown	N/A		Good	See Parks Canada Survey for further info
Erie	173	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, addition		N/A	See Parks Canada Survey for further info
Erie	183	N/A	N/A	N/A	Unknown	Wall, roof, addition (renovated)		Good	See Parks Canada Survey for further info
Erie	187	N/A	N/A	N/A	Unknown	Walls, windows, doors, first floor changed		Good	See Parks Canada Survey for further info
Erie	220	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, chimney, porch, addition		N/A	See Parks Canada Survey for further info
Fares	55	N/A	N/A	N/A	Original	Wall, doors, roof, chimney, recently renovated, original covering unknown, only original windows remain inside of building		Good	See Parks Canada Survey for further info
Fares	120	N/A	N/A	N/A	Original	Walls, windows, doors		Good	See Parks Canada Survey for further info
Fares	126	N/A	N/A	N/A	Original	Windows, roof, chimney		Good	See Parks Canada Survey for further info
Fares	163	N/A	N/A	N/A	Unknown	Porch		Good	No Canada Parks Survey
Fares	184	N/A	N/A	N/A	Original	Windows, porch		Good	See Parks Canada Survey for further info
Fares	216	N/A	N/A	N/A	Unknown	Windows		Good	No Canada Parks Survey

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Fares	222	N/A	N/A	N/A	Unknown	Roof		Good	No Canada Parks Survey
Fares	227	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Fares	247	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Fares	257	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Fares	272	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Fares	277	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Fares	283	N/A	N/A	N/A	Unknown	Addition, doors		Good	No Canada Parks Survey
Fares	292	N/A	N/A	N/A	Original	None		Good	See Parks Canada Survey for further info
Fares	329	N/A	N/A	N/A	Original	Addition		Good	See Parks Canada Survey for further info
Fares	344	N/A	N/A	N/A	Original	Walls, windows		Good	See Parks Canada Survey for further info
Fares	349	N/A	N/A	N/A	Original	Walls, windows, doors, addition		Good	See Parks Canada Survey for further info
Fares	367	N/A	N/A	N/A	Original	Walls, windows, doors, chimney		Good	See Parks Canada Survey for further info
Fares	379	N/A	N/A	N/A	Unknown	Windows		Good	No Canada Parks Survey
Fares	447	N/A	N/A	N/A	Original	Walls, windows, doors, addition		Good	See Parks Canada Survey for further info
Fares		N/A	N/A	N/A	Unknown	N/A		Satisfactory	No Canada Parks Survey
Fielden	238	N/A	N/A	Elementary school named after DeWitt Carter	Original	Windows, doors, roof, etc		Good	No Canada Parks Survey
Fielden	252	N/A	N/A	N/A	Original	Windows, doors, roof, addition		Good	See Parks Canada Survey for further info
Fielden	296	N/A	N/A	N/A	Original	Doors, porch		Good	See Parks Canada Survey for further info
Fielden	320	N/A	YES	Yes, very attractive, unique house	Original	Walls, roof, addition		Good	See Parks Canada Survey for further info
Fielden	547	N/A	N/A	School	Original	Windows, doors, addition		Good	No Canada Parks Survey
Fielden	550	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, addition		Good	See Parks Canada Survey for further info
Fielden	557	N/A	N/A	N/A	Unknown	Walls, windows, doors, addition, roof		Good	See Parks Canada Survey for further info
Fielden	583	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, addition		Good	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Fielden	592	N/A	N/A	N/A	Original	Addition		Good	See Parks Canada Survey for further info
Fielden	605	N/A	N/A	N/A	Original	Windows, doors, chimney		Good	See Parks Canada Survey for further info
Fielden	730	N/A	N/A	N/A	Original	N/A		Good	See Parks Canada Survey for further info
Fielden		N/A	N/A	N/A	Original	Chimney, addition		Good	See Parks Canada Survey for further info
Firelane No. 1	1001	N/A	N/A	School	Original	Walls, windows		Good	See Parks Canada Survey for further info
Forkes	3757								
Forkes	4261	N/A	N/A	N/A	N/A	Wall, window, door, roof, chimney, addition (house rebuilt 1920)		Good	See Parks Canada Survey for further info
Fraser	76/80	N/A	N/A	N/A	Unknown	Wall, chimney, addition		Good	See Parks Canada Survey for further info
George	33	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
George	34	N/A	N/A	N/A	N/A	Windows		Good	No Canada Parks Survey
George	41	N/A	N/A	N/A	Unknown	Wall, roof, porch, addition		Well-maintained	See Parks Canada Survey for further info
George	62	N/A	N/A	N/A	Original	Wall, roof, chimney, additional storey		Well-maintained	See Parks Canada Survey for further info
Highway #3 East	770	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, addition		Maintained	See Parks Canada Survey for further info
Highway #3 East	1097	N/A	N/A	N/A	N/A	N/A		N/A	See Parks Canada Survey for further info
Highway #3 East	1331	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Highway #3 East	2309	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Highway #3 East	2481	N/A	N/A	N/A	Unknown	Windows, doors		Well-maintained	No Canada Parks Survey
Highway #3 East	2652	N/A	N/A	N/A	Unknown	Remodelled		Maintained	No Canada Parks Survey
Highway #3 East	2665	N/A	N/A	N/A	N/A	Windows		Well-maintained	No Canada Parks Survey
Highway #3 East	2702	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Highway #3 East	2739	N/A	N/A	N/A	Unknown	Addition, windows		Well-maintained	No Canada Parks Survey
Highway #3 East	2790	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Highway #3 East	2935	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Highway #3 East	3278	N/A	N/A	N/A	Unknown	Roof		Maintained	No Canada Parks Survey
Highway #3 East	3436	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Highway #3 East	3493	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Highway #3 East	4109	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
~~Highway #3 East~~	~~4181~~	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Highway #3 East	5346	N/A	N/A	N/A	N/A	Addition, porch		Well-maintained	No Canada Parks Survey
Highway #3 East	1326/9	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Highway #3 West	698	N/A	N/A	N/A	Unknown	N/A		N/A	See Parks Canada Survey for further info
Kent	8-10	N/A	N/A	N/A	N/A	Windows		Well-maintained	No Canada Parks Survey
Kent	19-21	N/A	N/A	N/A	Moved	Changed to duplex		Maintained	See Parks Canada Survey for further info
Kent	22	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Kent	44	N/A	N/A	N/A	Original	N/A		Good	See Parks Canada Survey for further info
Kent	48	N/A	N/A	N/A	Original	Roof, addition		Maintained	See Parks Canada Survey for further info
Kent	52	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
Kent	56	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
Kent	57	N/A	N/A	N/A	Original	Windows, doors		Maintained	See Parks Canada Survey for further info
Kent	60	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney		Maintained	See Parks Canada Survey for further info
Kent	65	N/A	N/A	N/A	Original	Porch/stairs		Maintained	See Parks Canada Survey for further info
Kent	66	N/A	N/A	N/A	Original	Walls, windows, doors, roof, stair/porch		Good	See Parks Canada Survey for further info
Kent	77	N/A	N/A	N/A	Original	Wall, windows, door, chimney		Maintained	See Parks Canada Survey for further info
Kent	93/95	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info
Kent	94/96	N/A	N/A	N/A	Original	Windows, doors, porch, addition		Maintained	See Parks Canada Survey for further info
Kent	101	N/A	N/A	N/A	Original	N/A		Maintained	No Canada Parks Survey
Kent	104	N/A	N/A	N/A	Unknown	Addition		Well-maintained	No Canada Parks Survey
Kent	109	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Kent	110	N/A	Attractive house	N/A	Unknown	Addition		Well-maintained	No Canada Parks Survey
Kent	114	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Kent	115	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Kent	123	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Killaly St East	327	N/A	N/A	N/A	Unknown	Porch		Well-maintained	No Canada Parks Survey
Killaly St East	398	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Killaly St East	741	N/A	N/A	N/A	Unknown	Windows, porch, addition		Well-maintained	No Canada Parks Survey
Killaly St East	758	N/A	N/A	N/A	Unknown	Windows		Maintained	No Canada Parks Survey
Killaly St East	770	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Killaly St East	791	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Killaly St East	1193	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Killaly St East	1379	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
Killaly St East	1627	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Killaly St East	1739	N/A	N/A	N/A	Unknown	N/A		Satisfactory	No Canada Parks Survey
Killaly St West	135	N/A	N/A	N/A	Original	Walls, windows, doors, addition		Good	See Parks Canada Survey for further info
Killaly St West	149	Corner Building	Attractive house	N/A	Unknown	Doors, roof, porch, addition		Maintained	See Parks Canada Survey for further info
Killaly St West	157	N/A	N/A	N/A	Original	Began as a 2-room cabin, a guest house for 135 Killaly - completely remodelled		Well-maintained	See Parks Canada Survey for further info
Killaly St West	171	N/A	N/A	N/A	N/A	Addition		Well-maintained	No Canada Parks Survey
Killaly St West	185	N/A	N/A	N/A	Original	Roof, porch, addition		Well-maintained	See Parks Canada Survey for further info
Killaly St West	211	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, addition		Well-maintained	See Parks Canada Survey for further info
Killaly St West	269	N/A	N/A	N/A	Unknown	Completed renovated		Well-maintained	See Parks Canada Survey for further info
Killaly St West	29/31	N/A	N/A	Old church	Original	Remodelled		Well-maintained	See Parks Canada Survey for further info
King	44	N/A	N/A	N/A	Moved from King St in 1920s	Roof, addition		Maintained	See Parks Canada Survey for further info
King	62	N/A	N/A	N/A	Original	Doors, porch, addition		Maintained	See Parks Canada Survey for further info
King	86	N/A	N/A	N/A	Original	Doors, roof, chimney, porch		Maintained	See Parks Canada Survey for further info
King	87	N/A	N/A	N/A	Moved (this lot was not built up prior to 1899)	Windows, roof, porch, addition		Maintained	See Parks Canada Survey for further info
King	101	N/A	N/A	N/A	Original	Walls, windows, doors, roof, porch, addition		Maintained	See Parks Canada Survey for further info
King	104	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney		Maintained	See Parks Canada Survey for further info
King	112	N/A	N/A	N/A	Original	Windows, roof, chimney, addition		N/A	See Parks Canada Survey for further info
King	123	N/A	N/A	N/A	Original	Walls, roof, chimney, addition		Maintained	See Parks Canada Survey for further info
King	126	N/A	Attractive house	Rectory of old church	Original	Roof, chimney, porch, addition		Well-maintained	See Parks Canada Survey for further info
King	134	N/A	N/A	N/A	Unknown	Wall, roof, addition		Well-maintained	See Parks Canada Survey for further info
King	137	N/A	N/A	N/A	Original	Wall, doors, roof, chimney, addition		Maintained	See Parks Canada Survey for further info
King	138	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
King	143	N/A	N/A	N/A	Original	Walls, windows, doors, roof, porch, addition		N/A	See Parks Canada Survey for further info
King	150	N/A	N/A	N/A	Original	Roof, porch, addition		Maintained	See Parks Canada Survey for further info
King	164	N/A	Attractive house	N/A	Original	Roof		Well-maintained	See Parks Canada Survey for further info
King	172	N/A	N/A	N/A	Original	Wall, windows, doors, roof, chimney, porch, addition		Maintained	See Parks Canada Survey for further info
King	180	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney, porch		Maintained	See Parks Canada Survey for further info
King	215	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney, addition		Maintained	See Parks Canada Survey for further info
King	239	Part of downtown area	N/A	N/A	Original	Windows, doors, porch, addition, storey		Well-maintained	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
King	265	Part of downtown area	N/A	City Hall	Unknown	Remodelled		Well-maintained	No Canada Parks Survey
King	280	N/A	Very attractive with flowers, etc	Only train station	Original	Roof		Good	See Parks Canada Survey for further info
King	322	Corner lot	Attractive & well-kept	Only museum	Original	None		Well-maintained	See Parks Canada Survey for further info
King	354								
King	368	N/A	Attractive large house	N/A	Unknown	Unknown - presently being remodelled (1982)		Maintained	No Canada Parks Survey
King	380	N/A	N/A	N/A	Original	Walls, porch, addition		Okay condition	See Parks Canada Survey for further info
King	293	N/A	N/A	N/A	Unknown	Walls		Well-maintained	No Canada Parks Survey
King	422				Original			Okay condition	Designated Federial historical Site
King	518	N/A	N/A	N/A	Original	N/A		Well-maintained	No Canada Parks Survey
King	521	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, porch, chimney, addition (building in process of being restored to original form)		Maintained	See Parks Canada Survey for further info
King	524	N/A	N/A	N/A	Unknown	Windows		Well-maintained	No Canada Parks Survey
King	530	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
King	537	N/A	N/A	N/A	Unknown	N/A		Well-maintained	See Parks Canada Survey for further info
King	547	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info
King	561	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
King	593	N/A	N/A	N/A	Original	N/A		Good	See Parks Canada Survey for further info
King	599	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
King	602	N/A	N/A	N/A	Original	Chimney, addition		Maintained	See Parks Canada Survey for further info
King	613	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
King	620	N/A	N/A	N/A	Unknown	N/A		Good	No Canada Parks Survey
King	625	N/A	N/A	N/A	Unknown	Completely renovated (no remnants of original building)		Maintained	See Parks Canada Survey for further info
King	626	N/A	N/A	N/A	Unknown	Addition, windows		Maintained	No Canada Parks Survey
King	632	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, addition		Maintained	See Parks Canada Survey for further info
King	640	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info
King	646	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
King	664	N/A	N/A	N/A	Unknown	Walls, windows, addition (good example of old architectural style - not many alterations)		Maintained	See Parks Canada Survey for further info
King	665	N/A	N/A	N/A	Original	Roof, addition		Maintained	See Parks Canada Survey for further info
King	675	N/A	N/A	N/A	N/A	Walls, windows, roof, porch, addition (house was originally clapboard, storeroom was a guest house)		Maintained	See Parks Canada Survey for further info
King	681	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, chimney, addition (most remnants of old building gone - used to have a steeple, stained glass windows)		Maintained	See Parks Canada Survey for further info
King	688	N/A	N/A	N/A	Unknown	Windows, roof, chimney, addition		Maintained	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
King	693	N/A	N/A	N/A	Unknown	Wall, window, chimney, roof, addition		Maintained	See Parks Canada Survey for further info
King	698	N/A	N/A	N/A	Unknown	Walls, addition		Okay condition	See Parks Canada Survey for further info
King	707	N/A	N/A	N/A	Unknown	Windows, walls, door, chimney, porch, addition		Maintained	See Parks Canada Survey for further info
King	720	N/A	N/A	N/A	Unknown	N/A		BUILDING HAS BEEN DEMOLISHED	
King	725	N/A	N/A	N/A	Unknown	Walls, roof, chimney, porch, addition		Good	See Parks Canada Survey for further info
King	740	N/A	N/A	N/A	Unknown	N/A		Maintained	See Parks Canada Survey for further info
King	747	N/A	N/A	N/A	Unknown	BUILDING REPLACED		BUILDING HAS BEEN DEMOLISHED	See Parks Canada Survey for further info
King	748	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
King	755	N/A	N/A	N/A	Unknown	Wall, roof, addition		Maintained	See Parks Canada Survey for further info
King	761	N/A	N/A	N/A	Unknown	Wall, first floor changed (house was once attached to factory behind)		Maintained	See Parks Canada Survey for further info
King	765	N/A	N/A	N/A	Original	Walls, windows, porch, addition		Maintained	See Parks Canada Survey for further info
King	771	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney (south side of house was originally the front - it was turned around to make room to build 761 King St)		Maintained	See Parks Canada Survey for further info
King	774	N/A	N/A	N/A	Original	Wall, doors, addition, first floor changed		Maintained	See Parks Canada Survey for further info
King	782	N/A	N/A	N/A	Original	Doors, roof, porch, added storey, addition		Maintained	See Parks Canada Survey for further info
King	783	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney, addition (recently renovated)		Maintained	See Parks Canada Survey for further info
King	786	N/A	N/A	N/A	Original	Completely renovated		Well-maintained	See Parks Canada Survey for further info
King	791	N/A	N/A	N/A	Original	Walls, doors, addition		Satisfactory	See Parks Canada Survey for further info
King	803	N/A	N/A	N/A	Original	Windows, addition, chimney		Satisfactory	See Parks Canada Survey for further info
King	821	N/A	N/A	N/A	Unknown	Front of building, doors		Well-maintained	See Parks Canada Survey for further info
King	120/124	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, chimney, addition		Well-maintained	See Parks Canada Survey for further info
King	548/550	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
King	605/607	N/A	Attractive house	N/A	Unknown	Walls, roof, addition		Well-maintained	See Parks Canada Survey for further info
King		N/A	N/A	N/A	Original	Windows, doors, roof		Maintained	See Parks Canada Survey for further info
Lake (Rd)		N/A	Attractive church	One of oldest churches	Original	Porch, addition		Well-maintained	See Parks Canada Survey for further info
Lakeshore	121/123	N/A	N/A	Obsolete brewery	Original	Addition		Satisfactory	See Parks Canada Survey for further info
Lakeshore		N/A	N/A	N/A	N/A	Windows, doors, addition		Well-maintained	See Parks Canada Survey for further info
Learn		N/A	N/A	N/A	Unknown	Addition		Well-maintained	See Parks Canada Survey for further info
Lever	4841	N/A	N/A	N/A	Original	Wall, windows, chimney, addition		Maintained	See Parks Canada Survey for further info
Lever	5100	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Lever	5245	N/A	N/A	N/A	Unknown	Addition		Well-maintained	No Canada Parks Survey
Lorraine	606	N/A	N/A	N/A	Unknown	Walls, windows, doors, addition		Well-maintained	See Parks Canada Survey for further info
Lorraine	650	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Lorraine	708	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Lorraine	773	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Lorraine	854	N/A	N/A	N/A	N/A	N/A		Maintained	No Canada Parks Survey
Main St West	27	N/A	N/A	N/A	Unknown	Addition		Well-maintained	No Canada Parks Survey
Main St West	37	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
Main St West	45	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
Main St West	53	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Main St West	56	N/A	N/A	N/A	Unknown	Addition		Satisfactory	No Canada Parks Survey
Main St West	76	N/A	N/A	N/A	Unknown	Windows		Satisfactory	No Canada Parks Survey
Main St West	85	N/A	Attractive, old town hall	Yes, old town hall	Original	Walls, windows, roof, chimney, addition, 1st floor changed - building is designated		Well-maintained	See Parks Canada Survey for further info
Main St West	91	N/A	N/A	N/A	Original	Addition		Well-maintained	See Parks Canada Survey for further info
Main St West	100	N/A	Attractive commercial building	N/A	Original	Windows, doors, porch, addition		Well-maintained	See Parks Canada Survey for further info
Main St West	105	N/A	N/A	N/A	Unknown	Extensive renovation		Maintained	See Parks Canada Survey for further info
Main St West	106	N/A	N/A	N/A	Unknown	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
Main St West	114	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, addition		Maintained	See Parks Canada Survey for further info
Main St West	115	N/A	N/A	N/A	Unknown	Renovated completely, originally was a funeral parlour		Well-maintained	See Parks Canada Survey for further info
Main St West	120	N/A	N/A	Site of one of oldest inns	Original	Windows, doors, addition		Well-maintained	See Parks Canada Survey for further info
Main St West	124	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, additions		Maintained	See Parks Canada Survey for further info
Main St West	129	N/A	N/A	N/A	Unknown	Generally few alterations		Satisfactory	See Parks Canada Survey for further info
Main St West	130	N/A	N/A	N/A	N/A	N/A		BUILDING HAS BEEN DEMOLISHED	Parks Canada Study not complete
Main St West	142	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, addition		Maintained	See Parks Canada Survey for further info
Main St West	145	N/A	N/A	N/A	Original	Walls, roof, chimney, addition			See Parks Canada Survey for further info
Main St West	155	N/A	N/A	N/A	Original	Recently remodelled		Maintained	See Parks Canada Survey for further info
Main St West	185	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney		Well-maintained	See Parks Canada Survey for further info
Main St West	189	N/A	N/A	N/A	Original	Walls, windows, doors, addition		Maintained	See Parks Canada Survey for further info
Main St West	196	N/A	N/A	N/A	Original	Walls, windows, addition		Satisfactory	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Main St West	201	N/A	N/A	N/A	Original	Addition		Satisfactory	See Parks Canada Survey for further info
Main St West	202	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
Main St West	207	N/A	N/A	N/A	Original	Windows, doors, roof, addition, 1st floor changed		Maintained	See Parks Canada Survey for further info
Main St West	220	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney, porch, addition		Satisfactory	See Parks Canada Survey for further info
Main St West	223	Corner building (major intersection)	N/A	N/A	Original	Windows, doors, roof		Well-maintained	See Parks Canada Survey for further info
Main St West	229	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
Main St West	237	N/A	N/A	N/A	Original	Windows, doors		Maintained	See Parks Canada Survey for further info
Main St West	247	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
Main St West	255	N/A	N/A	N/A	Original	Windows, doors, 1st floor changed		Well-maintained	See Parks Canada Survey for further info
Main St West	256	N/A	N/A	N/A	Unknown	Unknown		Well-maintained	No Canada Parks Survey
Main St West	280	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
Main St West	296	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
Main St West	354	N/A	N/A	N/A	Unknown	Walls, windows, doors, chimney, addition		Maintained	See Parks Canada Survey for further info
Main St West	357	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Main St West	360	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
McCain	36	N/A	N/A	N/A	Original	Porch, addition		Maintained	See Parks Canada Survey for further info
McCain	38	N/A	N/A	N/A	Original	Doors, addition		Well-maintained	See Parks Canada Survey for further info
McCain	46	N/A	N/A	N/A	Original	Addition		Well-maintained	See Parks Canada Survey for further info
McCain	62	N/A	N/A	N/A	Original	Windows, doors, addition, original window shapes covered over with aluminum siding		Well-maintained	See Parks Canada Survey for further info
Mellanby	168	N/A	N/A	N/A	Original	Doors, addition		Maintained	See Parks Canada Survey for further info
Mellanby	226	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, chimney, addition		Maintained	See Parks Canada Survey for further info
Mellanby	231	N/A	N/A	N/A	Original	Windows, doors, roof, addition		Maintained	See Parks Canada Survey for further info
Mellanby	249	N/A	N/A	N/A	Unknown	Unknown		Satisfactory	No Canada Parks Survey
Michael	507	N/A	N/A	N/A	Original	Addition		Well-maintained	See Parks Canada Survey for further info
Michener	5363	N/A	N/A	N/A	Original	Chimney, addition		Maintained	See Parks Canada Survey for further info
Michener	5591	N/A	N/A	N/A	Unknown	Unknown		Maintained	No Canada Parks Survey
Miller	1359	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Miller	1580	N/A	N/A	N/A	Original	Doors, chimney, addition		Maintained	See Parks Canada Survey for further info
Miller	1836	N/A	N/A	N/A	Original	Chimney, addition		Maintained	See Parks Canada Survey for further info
Miller	2506	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Miller	2575	N/A	N/A	N/A	N/A	N/A		N/A	See Parks Canada Survey for further info
Miller	2882	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Miller	3104	N/A	N/A	N/A	Unknown	Porch		Maintained	No Canada Parks Survey
Miller	3603	N/A	N/A	N/A	Unknown	Windows		Maintained	No Canada Parks Survey
Mitchell	181	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Mitchell	209	N/A	N/A	N/A	N/A	Addition		Maintained	No Canada Parks Survey
Mitchell	210	N/A	N/A	N/A	Original	Wall, addition		Maintained	See Parks Canada Survey for further info
Mitchell	234	N/A	N/A	N/A	Original	Doors, addition		Maintained	See Parks Canada Survey for further info
Mitchell	265	N/A	N/A	N/A	Moved	Walls		Maintained	See Parks Canada Survey for further info
Mitchell	274	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Mitchell	311	N/A	N/A	N/A	Moved	None		Satisfactory	See Parks Canada Survey for further info
Mitchell	337	N/A	N/A	N/A	Original	Walls, windows, doors, porch, addition		Maintained	See Parks Canada Survey for further info
Neff	9	N/A	N/A	N/A	Original	Walls, windows, doors, addition		Satisfactory	See Parks Canada Survey for further info
Neff	27	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info
Neff	50	N/A	N/A	N/A	Unknown	Doors		Maintained	See Parks Canada Survey for further info
Neff	58	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, additions		Maintained	See Parks Canada Survey for further info
Neff	146	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Neff	149	N/A	N/A	N/A	Unknown	N/A		Maintained	See Parks Canada Survey for further info
Neff	164	N/A	N/A	N/A	Unknown	N/A		N/A	See Parks Canada Survey for further info
Neff	165	N/A	N/A	N/A	Unknown	Addition		Well-maintained	No Canada Parks Survey
Neff	86/88	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
Neff (Rd)	1402	N/A	N/A	N/A	Original	Walls, roof, 1st floor changed		Maintained	See Parks Canada Survey for further info
Nickel	25	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Oakwood	111	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Omer	150	N/A	N/A	N/A	Unknown	Walls, windows, doors, roof, chimney, addition		Well-maintained	See Parks Canada Survey for further info
Park	4	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
Park	16	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Park	22	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Park	26	N/A	N/A	N/A	Original	Doors, porch		Maintained	See Parks Canada Survey for further info
Park	30	N/A	N/A	N/A	Original	Door, porch		Maintained	See Parks Canada Survey for further info
Park	34	N/A	N/A	N/A	Original	Doors, chimney, porch		Well-maintained	See Parks Canada Survey for further info
Park	44	N/A	N/A	N/A	Unknown	N/A		Well-maintained	See Parks Canada Survey for further info
Pine	34	N/A	N/A	N/A	Original	Windows, doors		Maintained	See Parks Canada Survey for further info
Pine	35	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Pine	41	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Pine	42	N/A	N/A	N/A	Original	Windows, doors, roof, addition		Well-maintained	See Parks Canada Survey for further info
Pine	57	N/A	N/A	N/A	Unknown	Windows, porch		Well-maintained	No Canada Parks Survey
Pinecrest	663	N/A	N/A	N/A	Original	Doors, roof, addition		Well-maintained	See Parks Canada Survey for further info
Pinecrest	736	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Pleasant Beach	484	N/A	N/A	N/A	Unknown	Windows		Maintained	No Canada Parks Survey
Pleasant Beach	566	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Pleasant Beach	591	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Pleasant Beach	666	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Pleasant Beach		N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Ramey	34	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Ramey	72	N/A	N/A	N/A	Unknown	N/A		Satisfactory	No Canada Parks Survey
Ramey	76	N/A	N/A	N/A	Original	Roof, addition		Well-maintained	See Parks Canada Survey for further info
Rodney	83	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
Second Concession	3288	N/A	N/A	N/A	Unknown	N/A		Satisfactory	No Canada Parks Survey
Second Concession	3930	N/A	N/A	N/A	Unknown	N/A		Satisfactory	No Canada Parks Survey
Second Concession	5167	N/A	N/A	N/A	N/A	Walls, windows, doors, chimney, porch, addition		Well-maintained	See Parks Canada Survey for further info
Second Concession	5222	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Second Concession	5625	N/A	N/A	N/A	Original	Chimney, addition		Maintained	See Parks Canada Survey for further info
Sherk	1271	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Sherkston	4250	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Sherkston	4838	N/A	N/A	N/A	Original	Addition		Maintained	See Parks Canada Survey for further info
Sherkston	5031	N/A	N/A	N/A	Original	None		House was condemned in 1972 when present owner acquired it	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Sherkston	5065	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info
Sherkston	5080	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Sherkston	5212	N/A	N/A	N/A	Unknown	Unknown		Maintained	No Canada Parks Survey
Sherkston	5306	N/A	N/A	N/A	Original	None		Satisfactory	See Parks Canada Survey for further info
Sherkston	5420	N/A	N/A	N/A	Unknown	Roof, windows		Well-maintained	No Canada Parks Survey
Sherkston	5446	N/A	N/A	N/A	Unknown	N/A		Satisfactory	No Canada Parks Survey
Sherkston	5488	N/A	N/A	N/A	Unknown	Addition		Well-maintained	No Canada Parks Survey
Sherkston	5966	N/A	N/A	N/A	Unknown	N/A		Recent fire (1982) ?	No Canada Parks Survey
Silver	86	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
St. Arnaud	79	N/A	N/A	N/A	Original	addition		Maintained	See Parks Canada Survey for further info
St. Arnaud	110	N/A	N/A	N/A	Unknown	Windows		Maintained	No Canada Parks Survey
Steele	20	N/A	N/A	N/A	Original	Wall, addition		Maintained	See Parks Canada Survey for further info
Steele	34	N/A	N/A	N/A	Original	Doors		Well-maintained	See Parks Canada Survey for further info
Steele	64	N/A	N/A	N/A	Original	None		N/A	See Parks Canada Survey for further info
Steele	178	N/A	N/A	N/A	Original	Windows, doors, addition		Well-maintained	See Parks Canada Survey for further info
Steele	210	N/A	N/A	N/A	Original	N/A		Well-maintained	No Canada Parks Survey
Steele	228	N/A	N/A	N/A	Original	N/A		Well-maintained	No Canada Parks Survey
Steele	246	N/A	N/A	N/A	Original	Roof, porch		Maintained	See Parks Canada Survey for further info
Sugarloaf	21	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Sugarloaf	25	N/A	N/A	N/A	Original	Roof, porch, addition		Maintained	See Parks Canada Survey for further info
Sugarloaf	51	N/A	N/A	N/A	Original	N/A		Maintained	See Parks Canada Survey for further info
Sugarloaf	65	N/A	N/A	N/A	Unknown	Addition		Well-maintained	No Canada Parks Survey
Sugarloaf	77	N/A	N/A	N/A	Original	Roof, porch		Well-maintained	See Parks Canada Survey for further info
Sugarloaf	86	N/A	N/A	N/A	Original	Walls, windows, roof, porch, addition		Well-maintained	See Parks Canada Survey for further info
Sugarloaf	87	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Sugarloaf	90	N/A	N/A	N/A	Original	Walls, windows, doors, porch		Maintained	See Parks Canada Survey for further info
Sugarloaf	100	N/A	N/A	N/A	Original	Roof, chimney, porch, addition		Maintained	See Parks Canada Survey for further info
Sugarloaf	108	N/A	N/A	N/A	Unknown	Addition		Well-maintained	No Canada Parks Survey
Sugarloaf	117	N/A	N/A	N/A	N/A	Walls, roof, addition		Well-maintained	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Sugarloaf	334	N/A	N/A	N/A	Original	Remodelled		Maintained	See Parks Canada Survey for further info
Tennessee	3								
Tennessee	19								
Tennessee	33	N/A	N/A	N/A	Original	Doors, addition		Well-maintained	See Parks Canada Survey for further info
Tennessee	34	N/A	N/A	N/A	Original	Doors		Well-maintained	See Parks Canada Survey for further info
Tennessee	49	N/A	N/A	N/A	N/A	Doors, addition		Well-maintained	See Parks Canada Survey for further info
Tennessee	59	N/A	N/A	N/A	Original	Windows, doors, chimney		Well-maintained	See Parks Canada Survey for further info
Tennessee	83	N/A	N/A	N/A	Original	Walls, windows, doors, porch		Well-maintained	See Parks Canada Survey for further info
Tennessee	89	N/A	N/A	N/A	Original	Walls, doors, chimney		Well-maintained	See Parks Canada Survey for further info
Tennessee	91	N/A	N/A	N/A	Original	Chimney, porch		Well-maintained	See Parks Canada Survey for further info
Tennessee	101	N/A	N/A	N/A	Original	Doors, fence, garden, addition		Well-maintained	See Parks Canada Survey for further info
Tennessee	105	N/A	N/A	N/A	Original	Windows, doors, stair/porch		Well-maintained	See Parks Canada Survey for further info
Tennessee	109	N/A	N/A	N/A	Original	Windows, doors, porch		N/A	See Parks Canada Survey for further info
Tennessee	113	N/A	N/A	N/A	Original	Windows, doors, roof, chimney		N/A	See Parks Canada Survey for further info
Tennessee	119	N/A	N/A	N/A	Original	Windows, doors, porch, addition		Well-maintained	See Parks Canada Survey for further info
Tennessee	125	N/A	N/A	N/A	Original	Addition		Well-maintained	See Parks Canada Survey for further info
Tennessee	133	N/A	N/A	N/A	Original	Addition		Well-maintained	See Parks Canada Survey for further info
Third Concession	1598	N/A	N/A	N/A	Original	N/A		Well-maintained	No Canada Parks Survey
Third Concession	1724	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Third Concession	1795	N/A	N/A	N/A	Original	Doors, addition		Maintained	See Parks Canada Survey for further info
Third Concession	1870	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Third Concession	2148	N/A	N/A	N/A	Unknown	Chimney, addition		Maintained	See Parks Canada Survey for further info
Third Concession	2352	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Third Concession	2437	N/A	N/A	N/A	Unknown	N/A		Maintained	See Parks Canada Survey for further info
Third Concession	2562	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Third Concession	2784	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney, addition		Maintained	See Parks Canada Survey for further info
Troup	1152	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Troup	1170	N/A	N/A	N/A	Unknown	Addition		Satisfactory	No Canada Parks Survey

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Union	43	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Victoria	26	N/A	N/A	N/A	Original	Walls, windows, roof, chimney, addition		Satisfactory	See Parks Canada Survey for further info
Victoria	49	N/A	N/A	N/A	Original	Roof, chimney, addition		Satisfactory	See Parks Canada Survey for further info
Victoria	50	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney, addition		Maintained	See Parks Canada Survey for further info
Victoria	59	N/A	N/A	N/A	Original	Wall, roof, porch		Maintained	See Parks Canada Survey for further info
Victoria	60	N/A	N/A	N/A	Moved	Doors, roof, porch, addition - house moved from back of lot to front		Maintained	See Parks Canada Survey for further info
Victoria	64	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
Victoria	86	N/A	N/A	N/A	N/A	Wall, door, roof, chimney, porch, addition		Maintained	See Parks Canada Survey for further info
Victoria	90	N/A	N/A	N/A	Original	Windows, doors, chimney		Maintained	See Parks Canada Survey for further info
Victoria	94	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
Victoria	95	N/A	N/A	N/A	Original	Windows, doors, addition		Maintained	See Parks Canada Survey for further info
Victoria	108	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Victoria	113	N/A	N/A	N/A	Unknown	N/A		N/A	See Parks Canada Survey for further info
Victoria	117	N/A	N/A	N/A	Unknown	N/A		Maintained	See Parks Canada Survey for further info
Victoria	118	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Wallace	18	N/A	N/A	N/A	Original	Window, doors		Maintained	See Parks Canada Survey for further info
Walnut	12	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info
Weaver	736	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Weaver	856	N/A	N/A	N/A	Unknown	N/A		Well-maintained	No Canada Parks Survey
Welland	43	N/A	N/A	N/A	Unknown	Wall, door, window, roof, chimney, addition		Maintained	See Parks Canada Survey for further info
Welland	49	N/A	N/A	N/A	Original	Walls, windows, chimney, addition		Maintained	See Parks Canada Survey for further info
Welland	63	N/A	N/A	N/A	Unknown	N/A		Satisfactory	No Canada Parks Survey
Welland	77	N/A	N/A	N/A	Unknown	Addition		Satisfactory	No Canada Parks Survey
Welland	83	N/A	N/A	N/A	Original	Chimney		Maintained	See Parks Canada Survey for further info
Welland	89	N/A	N/A	N/A	Original	Porch, addition		Maintained	See Parks Canada Survey for further info
Welland	95	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info
Welland	155	N/A	N/A	N/A	Original	Windows, porch, addition		Satisfactory	See Parks Canada Survey for further info
Welland	165	N/A	N/A	N/A	Original	Wall, window, porch, addition		Maintained	See Parks Canada Survey for further info
Welland	173	N/A	N/A	N/A	Original	Walls, windows, doors, porch, addition		Maintained	See Parks Canada Survey for further info
Welland	177	N/A	N/A	N/A	Original	Walls, windows		N/A	See Parks Canada Survey for further info
Welland	185	N/A	N/A	N/A	Original	Windows, porch, addition		Maintained	See Parks Canada Survey for further info

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
Welland	203	N/A	N/A	N/A	Original	Windows, addition		Maintained	See Parks Canada Survey for further info
Welland	247	N/A	N/A	N/A	Original	Walls, addition		Maintained	See Parks Canada Survey for further info
Welland	281	N/A	N/A	N/A	Unknown	Addition		Maintained	No Canada Parks Survey
Welland	289	N/A	N/A	N/A	Original	Walls, windows, doors, chimney, porch		Maintained	See Parks Canada Survey for further info
Welland	293	N/A	N/A	N/A	Original	Walls, doors, porch, addition		Maintained	See Parks Canada Survey for further info
Welland	323	N/A	N/A	N/A	Original	Walls, windows, doors, chimney, addition		Maintained	See Parks Canada Survey for further info
Welland	327	N/A	N/A	N/A	Original	Walls, windows, doors, addition		Maintained	See Parks Canada Survey for further info
Welland	331	N/A	N/A	N/A	Original	Walls, windows		Satisfactory	See Parks Canada Survey for further info
West	56	N/A	N/A	N/A	Original	Windows		Satisfactory	See Parks Canada Survey for further info
West	62	N/A	N/A	N/A	Original	Doors, roof		Maintained	See Parks Canada Survey for further info
West	70	N/A	N/A	N/A	Moved	Wall, roof, chimney, porch - Mr. Carter moved building to this site and converted to home		Satisfactory	See Parks Canada Survey for further info
West	84	N/A	N/A	N/A	Original	Walls, windows, doors, roof, chimney, addition		Maintained	See Parks Canada Survey for further info
West	136	N/A	N/A	N/A	Original	Remodelled		Maintained	See Parks Canada Survey for further info
West	140	N/A	N/A	N/A	Original	Walls, roof, chimney		Maintained	See Parks Canada Survey for further info
West	144	N/A	N/A	N/A	Original	Walls, roof, porch, addition		Maintained	See Parks Canada Survey for further info
West	146	N/A	N/A	N/A	Original	Wall, doors, chimney		Maintained	See Parks Canada Survey for further info
West	148	N/A	N/A	N/A	Original	Walls, windows, porch, addition		Maintained	See Parks Canada Survey for further info
West	152	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
West	158	N/A	N/A	N/A	Original	Doors, porch, 1st floor changed		Maintained	See Parks Canada Survey for further info
West	162	N/A	N/A	N/A	Original	Walls, doors		Maintained	See Parks Canada Survey for further info
West	176	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
West	182	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
West	192	N/A	N/A	N/A	Original	Remodelled		Maintained	See Parks Canada Survey for further info
West	196	N/A	N/A	N/A	Original	Walls, windows, doors, porch, addition		Maintained	See Parks Canada Survey for further info
West	256	N/A	N/A	N/A	N/A	N/A		N/A	No Canada Parks Survey

		ENVIRONMENT & INTEGRITY							
STREET/ROAD	BUILDING NO.	CONTINUITY	SETTING	LANDMARK	SITE	ALTERATIONS	CURRENT CONDITION	CONDITION (Survey 1982)	COMMENTS/ SKETCHES
West	260	N/A	N/A	N/A	N/A	N/A		N/A	No Canada Parks Survey
West	266	N/A	N/A	N/A	Original	Walls, windows, doors		Maintained	See Parks Canada Survey for further info
West	172/174	N/A	N/A	N/A	N/A	N/A		N/A	No Canada Parks Survey
West	212/214	N/A	N/A	N/A	N/A	Walls, windows, doors		Maintained	See Parks Canada Survey for further info
West	188/190								
West	262/264	N/A	N/A	N/A	Original	Walls, windows, doors, roof, porch, addition		Maintained	See Parks Canada Survey for further info
Westside	46	N/A	N/A	N/A	Unknown	N/A		N/A	No Canada Parks Survey
White	1715	N/A	N/A	N/A	Unknown	Addition		Satisfactory	See Parks Canada Survey for further info
White	1866	N/A	N/A	N/A	Unknown	N/A		N/A	See Parks Canada Survey for further info
White	2207	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
White	2464	N/A	N/A	N/A	Unknown	N/A		N/A	See Parks Canada Survey for further info
White	2577	N/A	N/A	N/A	Unknown	N/A		Maintained	No Canada Parks Survey
Wilhelm	3980	N/A	N/A	N/A	Unknown	N/A		N/A	See Parks Canada Survey for further info
Wyldewood	895	N/A	N/A	N/A	N/A	Walls, windows, doors, addition		N/A	See Parks Canada Survey for further info
Yager	3247	N/A	N/A	N/A	Unknown	N/A		N/A	See Parks Canada Survey for further info
Yager	3670	N/A	N/A	N/A	Original	Doors, addition		Maintained	See Parks Canada Survey for further info
Zavitz	3499	N/A	N/A	N/A	Original	None		Maintained	See Parks Canada Survey for further info
		N/A	N/A	N/A	N/A	Walls, chimney, addition		Maintained	See Parks Canada Survey for further info



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APPENDIX D: CULTURAL HERITAGE REPORT (PREPARED BY GOLDER ASSOCIATES)

REPORT

Cultural Heritage Existing Conditions and Preliminary Impact Assessment Report

Eastside Sewage Pumping Station Forcemain Replacement Class Environmental Assessment, City of Port Colborne, Regional Municipality of Niagara, Ontario

Submitted to:

Niagara Region
1815 Sir Isaac Brock Way
P.O. Box 1042
Thorold, Ontario
L2V 4T7

Submitted by:

Golder Associates Ltd.
100 Scotia Court, Whitby, Ontario, L1N 8Y6, Canada

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March 2021

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Executive Summary

The Executive Summary highlights key points from the report only; for complete information and findings, as well as the limitations, the reader should examine the complete report.

In August 2020, Niagara Region (the Client) retained Golder Associates Ltd. (Golder) to conduct a Cultural Heritage Existing Conditions and Preliminary Impact Assessment to support a Municipal Class Environmental Assessment (MCEA) to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain in the City of Port Colborne (the Project). The Cultural Heritage Existing Conditions and Preliminary Impact Assessment evaluates four alternative routes generally bound by Barrick Road to the north, Highway 140/Elizabeth Street to the east, Kent Street and Lakeshore Road East to the south and Fielden Avenue to the west.

The four alternative route options are:

- **Alternative Route 1 (Do Nothing) / Alternative Route 4 (Rehabilitation)**: both routes are aligned with the existing forcemain route extending west from the Eastside SPS (53 Killaly Street East) to Fraser Street, south along Fraser Street, crossing the Welland Canal north of Clarence Street. The forcemain extends north along the west side of the canal to the Seaway Wastewater Treatment Plant, located at 30 Prosperity Avenue.
- **Alternative Route 2A (Barrick Road Crossing – ROW):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, it crosses The Welland Canal north of The Island to Barrick Road, east to Elm Street, south to 975 Elm Street and 59 Prosperity Avenue, and east to the Seaway Wastewater Treatment Plant.
- **Alternative Route 2B (Barrick Road Crossing – Seaway):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses The Welland Canal north of The Island to Barrick Road, southwest through 2 Sherwood Forest Lane, and west to the Seaway Wastewater Treatment Plant.
- **Alternative Route 3 (North Island Crossing):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the northern tip of The Island north of Main Street East/West, and northwest to the Seaway Wastewater Treatment Plant.

The preferred alignment is expected to be completed through a combination of open-cut construction and tunnelling operations.

The Cultural Heritage Existing Conditions and Preliminary Impact Assessment will assess a 30 m buffer (15 m either side of the centre line) around the alternative route options (the study area). As Alternative Route 1 involves a ‘do nothing’ approach this alternative was not carried forward for impact assessment, or consideration of mitigation.

The study area is located within Lots 27 and 28, Concession 1; Lots 26 to 28, Concession 2; and Lots 27 and 28, Concession 3, in the Geographic Township of Humberstone, former County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

Following guidelines provided by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), municipal documents such as the Regional Municipality of Niagara and City of Port Colborne official plans, as well as recognized conservation manuals such as Canada's Historic Places *Standards and Guidelines for the Conservation of Historic Places in Canada* (2010), this Cultural Heritage Existing Conditions and Preliminary Impact Assessment identifies the applicable heritage policies, summarizes the study area's geography and history, identifies known and potential built heritage resources and cultural heritage landscapes, and evaluates properties identified to have potential built heritage resources and cultural heritage landscapes using *Ontario Regulation 9/06 Criteria for Determining Cultural Heritage Value or Interest*. Subsequently, identified built heritage resources and cultural heritage landscapes will be assessed for impacts, and based on the impacts identified, conservation or mitigation strategies to avoid or reduce adverse effects to the identified built heritage resources and cultural heritage landscapes will be recommended.

This Cultural Heritage Existing Conditions and Preliminary Impact Assessment identified:

- One (1) National Historic Event under *Historic Sites and Monuments Act* (R.S.C., 1985, c. H-4);
- One (1) property listed (not designated) on the City of Port Colborne's Heritage Property Registry; and
- Four (4) properties of potential cultural heritage value or interest (CHVI).

Recommendations to avoid or reduce adverse impacts to the identified known and potential cultural heritage resources are summarized below. Note that these recommendations are based on Golder's current understanding of the Project and may need to be revisited if components are revised.

Alternative Route 2A (Barrick Road Crossing ROW)	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
National Historic Event (designated under *Historic Sites and Monuments Act* [R.S.C., 1985, c. H-4]): ■ Welland Canal	**No conservation or mitigation is recommended.**
Property of potential CHVI: ■ 72 Killaly Street East	■ Indirect impacts from vibration during construction works associated with the alignment which runs approximately 30 m from the identified built heritage resource. **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during ground disturbance associated with the construction of the forcemain route.

Alternative Route 2B (Barrick Road Crossing Seaway)	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
National Historic Event (designated under *Historic Sites and* Monuments Act [R.S.C., 1985, c. H-4]): ■ Welland Canal	**No conservation or mitigation is recommended.**
Property of potential CHVI: ■ 72 Killaly Street East	■ Indirect impacts from vibration during construction works associated with the alignment which runs approximately 30 m from the identified built heritage resource. **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during disturbance associated with the construction of the forcemain route.
Property of potential CHVI: ■ 2 Sherwood Forest Lane: former Robin Hood Flour Plant	■ The proposed route passes along the north western edge of the property line, approximately 30 – 60 m from the identified built heritage resource at 2 Sherwood Forest Lane. ■ Any disturbance (i.e., opencut tunneling) would induce vibration effects in the vicinity. Any potential vibration impacts would result in indirect, minor, site specific impacts to the physical heritage attributes of the flour plant at Robin Hood Lane. ■ No impact to the setting of the potential heritage resource is predicted since the visual attributes of the resource relate to its canal side frontage and the vistas between the property and The Island / Welland Canal (i.e., the south eastern side of the flour plant). **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during disturbance associated with the construction of the forcemain route.

Alternative Route 3 North Island Crossing	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
National Historic Event (designated under Historic Sites and Monuments Act [R.S.C., 1985, c. H-4]): ■ Welland Canal	**No conservation or mitigation is recommended.**
Property of potential CHVI: ■ 72 Killaly Street East	■ Indirect impacts from vibration during construction works associated with the alignment which runs approximately 30 m from the identified built heritage resource. **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during disturbance associated with the construction of the forcemain route.
Property of potential CHVI: ■ 401 Weir Road - Derek Point Memorial Garden	■ Disturbance (opencut tunneling) would occur in the vicinity of the park. These works would have a temporary, site specific, minor impact on setting (within the park), and its recreational and aesthetic values. ■ No impact on the wider setting is predicted, with the vistas between the garden, the canal and the flour mill site unaffected. **Recommendation**: ■ To reduce the temporary impacts on setting, any vegetation clearance required should be limited to reduce any impacts on the visual context, setting and the heritage attributes of the memorial garden. Where vegetation removal is unavoidable, incorporate into the detailed design a strategy for replacement planting.

Alternative Route 4 (Rehabilitation)	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
National Historic Event (designated under *Historic Sites and Monuments Act* [R.S.C., 1985, c. H-4]): ■ Welland Canal	**No conservation or mitigation is recommended.**
Property listed on City of Port of Colborne's Heritage Property Registry: ■ 110 Saint Arnaud Street	■ Indirect impacts from vibration during sub-surface rehabilitation works associated with the existing alignment which runs 30 – 50 m from the identified built heritage resource. **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during disturbance associated with the rehabilitation of the existing forcemain route.
Property of potential CHVI: ■ 183 Main Street West	■ Indirect impacts from vibration during sub-surface rehabilitation works associated with the existing alignment which runs approximately 15 m from the identified built heritage resource. **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during disturbance associated with the rehabilitation of the existing forcemain route.

Study Limitations

Golder Associates Ltd. has prepared this report in a manner consistent with the guidelines developed by the Ontario Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), the Regional Municipality of Niagara, the City of Port Colborne, and Canada's Historic Places *Standards and Guidelines for the Conservation of Historic Places* subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied, is made.

This report has been prepared for the specific site, design objective, developments and purpose described to Golder Associates Ltd., by Niagara Region (the Client). The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder Associates Ltd.'s express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the Client, Golder Associates Ltd. may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder Associates Ltd. The report, all plans, data, drawings and other documents as well as electronic media prepared by Golder Associates Ltd. are considered its professional work product and shall remain the copyright property of Golder Associates Ltd., who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder Associates Ltd. The Client acknowledges the electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder Associates Ltd.'s report or other work products.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project.

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APPENDIX A
Properties with buildings or structures 40 years old or more evaluated not to have potential CHVI

1.0 INTRODUCTION

In August 2020, Niagara Region (the Client) retained Golder Associates Ltd. (Golder) to conduct a Cultural Heritage Existing Conditions and Preliminary Impact Assessment to support a Municipal Class Environmental Assessment (MCEA) to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain in the City of Port Colborne (the Project). The Cultural Heritage Existing Conditions and Preliminary Impact Assessment will evaluate four alternative routes generally bound by Barrick Road to the north, Highway 140/Elizabeth Street to the east, Kent Street and Lakeshore Road East to the south and Fielden Avenue to the west (Figure 1).

The four alternative route options are:

- **Alternative Route 1 (Do Nothing**) **/ Alternative Route 4 (Rehabilitation**): both routes are aligned with the existing forcemain route extending west from the Eastside SPS (53 Killaly Street East) to Fraser Street, south along Fraser Street, crossing the Welland Canal north of Clarence Street. The forcemain extends north along the west side of the canal to the Seaway Wastewater Treatment Plant, located at 30 Prosperity Avenue.
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- **Alternative Route 2B (Barrick Road Crossing – SEAWAY):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, it crosses The Welland Canal north of The Island to Barrick Road, southwest through 2 Sherwood Forest Lane, and west to the Seaway Wastewater Treatment Plant.
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The preferred alignment is expected to be completed through a combination of open-cut construction and tunnelling operations.

The Cultural Heritage Existing Conditions and Preliminary Impact Assessment will assess a 30 m buffer (15 m either side of the centre line) around the alternative route options (the study area) as illustrated on Figure 1. As alternative Route 1 involves a ‘do nothing’ approach this alternative was not carried forward for impact assessment, or consideration of mitigation.

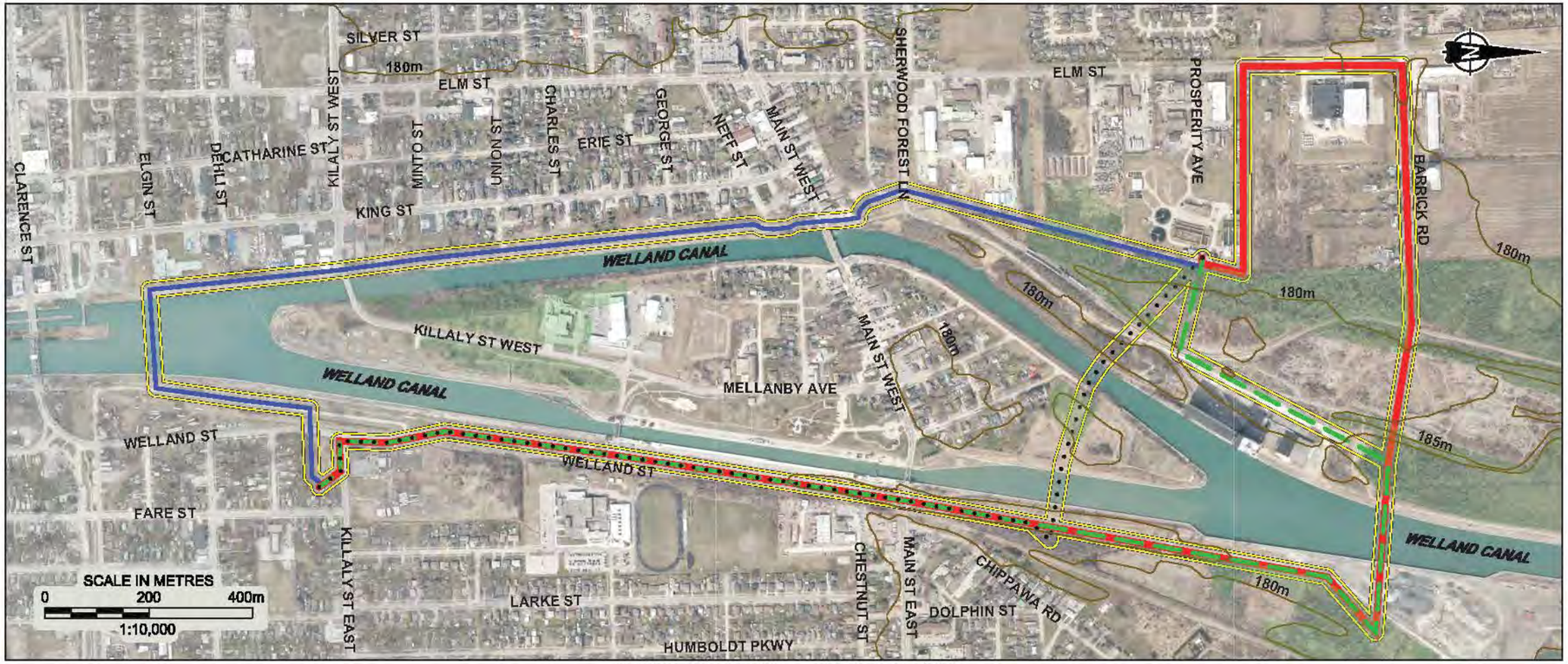
The study area is located within Lots 27 and 28, Concession 1; Lots 26 to 28, Concession 2; and Lots 27 and 28, Concession 3, in the Geographic Township of Humberstone, former County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

Following guidelines provided by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), municipal documents such as the Regional Municipality of Niagara and City of Port Colborne official plans, as well as recognized conservation manuals such as Canada’s Historic Places *Standards and Guidelines for the Conservation of Historic Places in Canada* (2010), this Cultural Heritage Existing Conditions and Preliminary Impact Assessment identifies the applicable heritage policies, summarizes the study area’s geography and

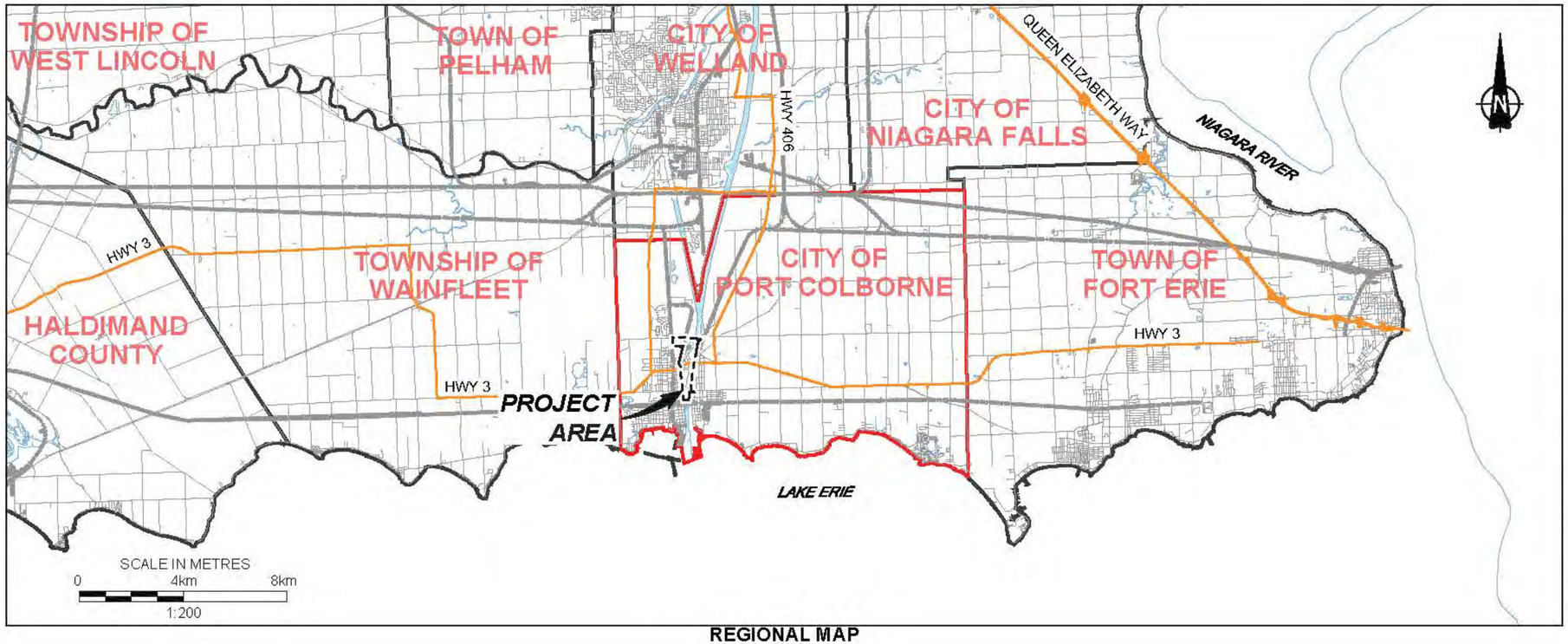
history, identifies known and potential built heritage resources and cultural heritage landscapes, and evaluates properties identified to have potential built heritage resources and cultural heritage landscapes using *Ontario Regulation 9/06 Criteria for Determining Cultural Heritage Value or Interest*. Subsequently, identified built heritage resources and cultural heritage landscapes will be assessed for impacts, and based on the impacts recommends conservation or mitigation strategies to avoid or reduce adverse effects to the identified built heritage resources and cultural heritage landscapes. This Cultural Heritage Existing Conditions and Preliminary Impact Assessment therefore, includes:

- an overview of heritage legislation and policies in Ontario, and an outline of the methods that were used to investigate and evaluate cultural heritage resources in the study area;
- an overview of the study area's historical development and existing conditions;
- an inventory of cultural heritage resources in the study area, including known properties of cultural heritage value or interest (CHVI) and those screened to have potential CHVI;
- a description of the proposed development options and an assessment of their predicted impacts on known or newly identified cultural heritage resources in the study area; and
- recommendations for cultural heritage mitigation or further studies where necessary.

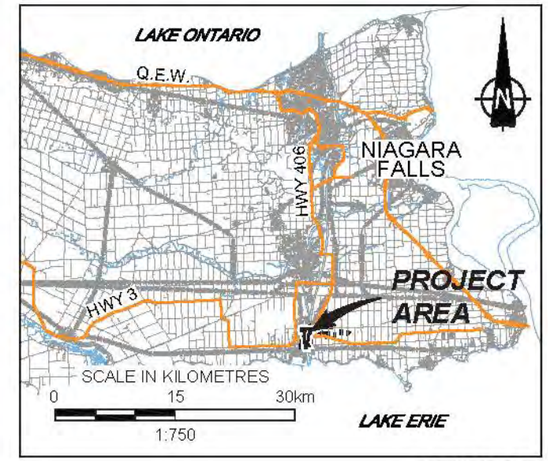
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AERIAL IMAGERY and OBM MAPPING



REGIONAL MAP



KEY PLAN

LEGEND

15m BUFFER FROM ALTERNATIVES (APPROXIMATE PROJECT AREA)

ROUTE ALTERNATIVES
- 1 - DO NOTHING / 4 - REHAB
- 2A - BARRICK ROAD CROSSING - ROW
- 2B - BARRICK ROAD CROSSING - SEAWAY
- 3 - NORTH ISLAND CROSSING

REGIONAL MAP
- APPROXIMATE PROJECT AREA
- CITY OF PORT COLBORNE BOUNDARY
- TOWNSHIP/MUNICIPALITY BOUNDARY
- WELLAND — TOWNSHIP/MUNICIPALITY

REFERENCE

DRAWING BASED ON MNR LIO, OBTAINED 2020, PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020; AERIAL IMAGERY AND PARCEL DATA PROVIDED BY THE REGION OF NIAGARA; AND ROUTE ALTERNATIVES PROVIDED BY GM BLUEPLAN, SEPTEMBER 29 - 2020.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
CULTURAL HERITAGE EXISTING CONDITIONS AND PRELIMINARY IMPACT ASSESSMENT REPORT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE
PROJECT AREA

GOLDER

PROJECT No.			20139291	FILE No. 20139291-2000-R01001
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2.0 SCOPE AND METHODS

The scope of this study was defined by guidance outlined in the MHSTCI *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes: A Checklist for the Non-Specialist* (2016; the MSTCI Checklist) and *Ontario Heritage Tool Kit: Heritage Resources in the Land Use Planning Process* (MHSTCI 2006). The MHSTCI Checklist provides a screening tool to identify all known or recognized cultural heritage resources in the study area, as well as commemorative plaques, cemeteries, Canadian Heritage River watersheds, properties with buildings or structures 40 or more years old, or potential cultural heritage landscapes.

With this scope, Golder completed the following tasks:

- researched archival and published sources relevant to the historical and geographic context of the study area;
- reviewed federal, provincial, and municipal heritage registers, inventories and databases to identify known cultural heritage resources in the study area, including:
  - Canadian Register of Historic Places (www.historicplaces.ca)
  - Parks Canada Directory of Federal Heritage Designations (http://www.pc.gc.ca/apps/dfhd/search-recherche_eng.aspx)
  - Ontario Heritage Trust Online Plaque Guide (http://www.heritagetrust.on.ca/en/index.php/online-plaque-guide) and Ontario Places of Worship Inventory (http://www.heritagetrust.on.ca/Ontario-s-Places-of-Worship/Inventory) and List of Easement Properties (http://www.heritagetrust.on.ca/en/property-types/easement-properties)
  - Ontarioplaques.com (data correlated with the Ontario Heritage Foundation Online Plaque Guide)
  - Canadian Heritage River System list of designated heritage river systems (http://chrs.ca/)
  - City of Port Colborne's *Heritage Property Registry*
  - Historical Topographic Map Digitization Project (Ontario Council of University Libraries, main page: https://ocul.on.ca/topomaps/collection/)
- engaged with heritage planning staff at the City of Port Colborne;
- conducted a field investigation from the public right-of-way (ROW) to record all known and potential built heritage resources and cultural heritage landscape crossed by and adjacent to the study area and to understand the wider built heritage and cultural landscape context;
- completed screening-level evaluations of properties with buildings or structures 40 or more years old and evaluated their potential CHVI using the criteria prescribed in *Ontario Regulation 9/06;*
- assessed the risk of impact to properties of known and potential CHVI; and,
- where necessary, recommended mitigation and conservation measures using MHSTCI and other guidance.

Field investigations were conducted by Cultural Heritage Specialist Ragavan Nithiyanantham in August 2020. This included photographing streetscapes and properties in the study area from the public ROW.

Descriptions of architectural styles and elements used in this Cultural Heritage Existing Conditions and Preliminary Impact Assessment employ terms provided in Blumenson (1990), Ricketts et al. (2004), Hubka (2013), and the Canadian Inventory of Historic Buildings (Parks Canada 1980). Landscape analysis and landform and vegetation description relies on terms and concepts presented in the Historic Scotland Historic Landuse Assessment (1999) and Australian Soil and Land Survey Field Handbook, Third Edition (2017).

The approach and terms for impact assessment and mitigation measures follow the MHSTCI *Ontario Heritage Tool Kit: Heritage Resources in the Land Use Planning Process*, supplemented with other recognized international guidance such as the *Guidelines for Landscape and Visual Impact Assessment, Third Edition* (Landscape Institute 2013) and *Standards and Guidelines for the Conservation of Historic Places in Canada* (Canada's Historic Places 2010).

2.1 Record of Engagement

Table 1 summarizes the results of engagement conducted for this Cultural Heritage Existing Conditions and Preliminary Impact Assessment.

Table 1: Results of Engagement

Contact	Date of Email and Inquiry	Response
David Schulz, Planner, City of Port Colborne	Email sent on March 31, 2020. Requested a list of designated and listed heritage resources for the City, and if the City had any specific concerns that we should be aware of in the study area.	Email received on March 31, 2020. Provided an Excel document containing Port Colborne's Heritage Property Registry, revised September 2016. Advised that there are few designated properties with most being listed. No specific concerns regarding the Project identified.
David Schulz, Planner, City of Port Colborne	Email received on August 18, 2020 following Golder's request for clarification regarding the number of designated properties within the study area.	No municipally designated sites were identified within the study area buffer, though seven sites are located in proximity.

2.2 Archaeology

Golder conducted a Stage 1 archaeological investigation of the study area under PIF# P390-0342-2020. This study recommended a Stage 2 archaeological assessment in areas of archaeological potential that will be impacted by this development. The field work for this study had not been initiated at the time of producing this assessment. The results of the Stage 2 will be provided to the MHSTCI in a separate report.

3.0 PLANNING, LEGAL AND REGULATORY CONTEXT

Management of cultural heritage is guided by provincial and municipal legislation and planning policy regimes, as well as advice developed at the federal and international levels. These policies have varying levels of authority at the local level, though generally all are considered when making decisions about heritage assets.

3.1 International & Federal Heritage Policies

Canada's Historic Places *Standards and Guidelines for the Conservation of Historic Places in Canada* (Canada's Historic Places, 2010) defines three conservation "treatments" — preservation, rehabilitation, and restoration— and outlines the process, and required and recommended actions, to meet the objectives for each treatment for a range of built heritage resources and cultural heritage landscapes.

Conservation of Historic Places in Canada was drafted in response to international and national agreements such as the 1964 *International Charter for the Conservation and Restoration of Monuments and Sites* (*Venice Charter*), 1979 Australia ICOMOS Charter for Places of Cultural Significance (*Burra Charter*, updated 2013), and 1983 Canadian *Appleton Charter for the Protection and Enhancement of the Built Environment*. The International Council on Monuments and Sites (ICOMOS) has also developed guidance on heritage impact assessments for world heritage properties, which also provide "best practice" approaches for all historic assets (ICOMOS 2011).

There is one federal designation within the study area, in relation to the Welland Canal watercourse which flows through the centre of the study area, linking Lake Erie - Lake Ontario. The canal, completed in 1833, is recognised as a National Historic Event. An interpretive plaque commemorating the canal is situated at Allenburg, Thorold, approximately 18 km north of the study area.

3.2 Provincial Heritage Policies

3.2.1 Environmental Assessment Act and Municipal Class Environmental Assessments

The Environmental Assessment Act (EAA) was legislated to ensure that Ontario's environment is protected, conserved, and wisely managed. Under the EAA, "environment" includes not only natural elements such as air, land, water and plant and animal life, but also the "social, economic and cultural conditions that influence the life of humans or a community", and "any building, structure, machine or other device or thing made by humans". To determine the potential environmental effects of new development, the Environmental Assessment (EA) process was created to standardize decision-making. For the municipal road, water, and wastewater projects this decision-making is streamlined in the Class EA process, which divides routine activities with predictable environmental effects into four "schedules" (Government of Ontario 2014; MEA 2015). This EA falls under the Schedule B process.

The phases (up to five) and associated actions required for each of these schedules are outlined in the Ontario Municipal Engineers Association (MEA) Manual. Avoidance of cultural heritage resources is the primary mitigation suggested in the manual, although other options suggested include: "employing necessary steps to decrease harmful environmental impacts such as vibration, alterations of water table, etc." and "record or salvage of information on features to be lost" (Appendix 2 of MEA 2015). In all cases, the "effects should be minimized where possible, and every effort made to mitigate adverse impacts, in accordance with provincial and municipal policies and procedures."

3.2.2 Planning Act and Provincial Policy Statement

The Ontario *Planning Act* (1990) and associated *Provincial Policy Statement* 2020 (PPS 2020) mandate heritage conservation in land use planning. Under the *Planning Act*, conservation of "features of significant architectural, cultural, historical, archaeological or scientific interest" are a "matter of provincial interest" and integrates this at the provincial and municipal levels through the PPS 2020. Issued under Section 3 of the *Planning Act*, PPS 2020 recognizes that cultural heritage and archaeological resources "provide important environmental, economic, and social benefits", and that "encouraging a sense of place, by promoting well-designed built form and cultural planning, and by conserving features that help define character, including *built heritage resources* and *cultural heritage landscapes*" supports long-term economic prosperity (PPS 2020:6,22).

The importance of identifying and evaluating built heritage and cultural heritage landscapes is recognized in two policies of PPS 2020:

- Section 2.6.1 – Significant built heritage resources and significant heritage landscapes shall be conserved
- Section 2.6.3 – Planning authorities shall not permit development and site alteration on adjacent lands to protected heritage property except where the proposed development and site alteration has been evaluated and it has been demonstrated that the heritage attributes of the protected heritage property will be conserved

Each of the italicised terms is defined in Section 6.0 of PPS 2020, with those relevant to this report provided below:

- ***Adjacent lands*****:** for the purposes of policy 2.6.3, those lands contiguous to a *protected heritage property* or as otherwise defined in the municipal official plan.
- ***Built heritage resource:*** means a building, structure, monument, installation or any manufactured or constructed part or remnant that contributes to a property's CHVI as identified by a community, including an Indigenous community. *Built heritage resources* are located on property that may be designated under Parts IV or V of the *Ontario Heritage Act (OHA)*, or that may be included on local, provincial, federal and/or international registers.
- ***Conserved*****:** means the identification, protection, management and use of built heritage resources, cultural heritage landscapes and archaeological resources in a manner that ensures their CHVI is retained. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment, and/or heritage impact assessment that has been approved, accepted or adopted by the relevant planning authority and/or decision-maker. Mitigative measures and/or alternative development approaches can be included in these plans and assessments.
- ***Cultural heritage landscape:*** means a defined geographical area that may have been modified by human activity and is identified as having CHVI by a community, including an Indigenous community. The area may include features such as buildings, structures, spaces, views, archaeological sites, or natural elements that are valued together for their interrelationship, meaning or association. Cultural heritage landscapes may be properties that have been determined to have CHVI under the *OHA*; or have been included in federal and/or international registers, and/or protected through official plan, zoning by-law, or other land use planning mechanisms.
- ***Development*****:** means the creation of a new lot, a change in land use, or the construction of buildings and structures requiring approval under the Ontario *Planning Act*.

- ***Heritage attributes:*** the principal features or elements that contribute to a protected heritage property's CHVI, and may include the property's built, constructed, or manufactured elements, as well as natural landforms, vegetation, water features, and its visual setting (e.g., significant views or vistas to or from a protected heritage property).
- ***Protected heritage property:*** property designated under Parts IV, V, or VI of the *OHA*; property subject to a heritage conservation easement under Parts II or IV of the *OHA*; property identified by the Province and prescribed public bodies as provincial heritage property under the Standards and Guidelines for Conservation of Provincial Heritage Properties; property protected under federal legislation, and UNESCO World Heritage Sites.
- ***Significant*****:** means, in regard to cultural heritage and archaeology, resources that have been determined to have CHVI. Processes and criteria for determining CHVI are established by the Province under the authority of the *OHA*.

The definition for *significant* includes a caveat that "while some significant resources may already be identified and inventoried by official sources, the significance of others can only be determined after evaluation." The criteria for significance established by the Province as well as the need for evaluation is outlined in the following section. Municipalities implement PPS 2020 through an official plan, which may outline further heritage policies (see Section 3.3.2).

3.2.3 Ontario Heritage Act and Ontario Regulation 9/06

The Province and municipalities are enabled to conserve significant individual properties and areas through the *OHA*. For municipalities, Part IV and Part V of the *OHA* enables councils to "designate" individual properties (Part IV), or properties within a heritage conservation district (HCD) (Part V) as being of CHVI. Evaluation for CHVI under the *OHA* is guided by *Ontario Regulation 9/06*, which prescribes the "criteria for determining cultural heritage value or interest". The criteria are as follows:

1) The property has ***design value or physical value*** because it:
    i) Is a rare, unique, representative or early example of a style, type, expression, material or construction method;
    ii) Displays a high degree of craftsmanship or artistic merit; or
    iii) Demonstrates a high degree of technical or scientific achievement.
2) The property has ***historic value or associative value*** because it:
    i) Has direct associations with a theme, event, belief, person, activity, organization, or institution that is significant to a community;
    ii) Yields, or has the potential to yield information that contributes to an understanding of a community or culture; or
    iii) Demonstrates or reflects the work or ideas of an architect, artist, builder, designer, or theorist who is significant to a community.

3) The property has ***contextual value*** because it:

   i) Is important in defining, maintaining or supporting the character of an area;

   ii) Is physically, functionally, visually or historically linked to its surroundings; or

   iii) Is a landmark.

A property needs to meet only one criterion of *O. Reg. 9/06* to be considered for designation under Part IV of the *OHA*. If found to meet one or more criterion, the property's CHVI is then described with a Statement of Cultural Heritage Value or Interest (SCHVI) that includes a brief property description, a succinct statement of the property's cultural heritage significance, and a list of its heritage attributes. In the *OHA* heritage attributes are defined slightly differently to the PPS 2020 and directly linked to real property[1]; therefore, in most cases a property's CHVI applies to the entire land parcel, not just individual buildings or structures.

Once a municipal council decides to designate a property, it is recognized through by-law and added to a ''Register'' maintained by the municipal clerk. A municipality may also ''list'' a property on the Register to indicate it as having potential cultural heritage value or interest.

3.2.4 Provincial Heritage Guidance

To advise municipalities, organizations, and individuals on heritage protection and conservation, the Province, through the MHSTCI, has developed a series of guidance products. One used primarily for EAs is the MHSTCI *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes: A Checklist for the Non-Specialist* (2016; the MHSTCI *Checklist*). The MHSTCI *Checklist* provides a screening tool for a Study Area to identify all the known or recognized cultural heritage resources, commemorative plaques, cemeteries, Canadian Heritage River watersheds, properties with structures 40 or more years old, or potential cultural heritage landscapes. If known or potential cultural heritage resources are identified, the MHSTCI *Checklist* then advises whether further investigation as part of a Cultural Heritage Evaluation Report (CHER) or Heritage Impact Assessment (HIA) is necessary.

Further guidance on identifying, evaluating and assessing impacts to built heritage resources and cultural heritage landscapes is provided in the *Ontario Heritage Tool Kit* series. Of these, *Heritage Property Evaluation* (MHSTCI 2006a) describes in detail the *O. Reg. 9/06* criteria and methods for researching and evaluating potential cultural resources, while the *Heritage Resources in the Land Use Planning Process* (MHSTCI 2006b) provides an outline for the contents of an HIA, which it defines as:

> "a study to determine if any cultural resources (including those previously identified and those found as part of the site assessment) are impacted by a specific proposed development or site alteration. It can also demonstrate how the cultural resource will be conserved in the context of redevelopment or site alteration. Mitigative or avoidance measures or alternative development or site alteration approaches may be recommended."

[1] The OHA definition ''heritage attributes mean, in relation to real property, and to the buildings and structures on the real property, the attributes of the property, buildings and structures that contribute to their cultural heritage value or interest.''

For large study areas, a Cultural Heritage Existing Conditions and Preliminary Impact Assessment combines CHER and HIA studies to evaluate potential cultural resource and assess the impacts of new development.

For EAs, the *Ontario Heritage Tool Kit* partially, but not entirely, supersedes earlier MHSTCI advice. Criteria to identify cultural landscapes is detailed in the *Guidelines on the Man-Made Heritage Component of Environmental Assessments* (1980:7) and recording and documentation procedures are outlined in the *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (1992:3-7). The latter document also stresses the importance of identifying and gauging the cumulative effects of a Class EA development (MHSTCI 1992:8).

For provincial properties, heritage conservation must comply with the MHSTCI *Standards and Guidelines for the Conservation of Provincial Heritage Properties*. Supporting documents include the *Standards and Guidelines for the Conservation of Provincial Heritage Properties – Heritage Identification & Evaluation Process* (MHSTCI 2014) —which provides detailed explanations of the *O. Reg. 9/06* and *10/06* criteria and its application— and *Information Bulletin 3: Heritage Impact Assessments for Provincial Heritage Properties*, which describes how to organize the sections of an HIA and the range of possible impacts and mitigation measures. Although compliance with the MHSTCI *Standards and Guidelines* is only required for provincial properties, they inform “best practice” approaches for conserving cultural heritage resources not under provincial jurisdiction.

3.3 Municipal Heritage Policies

3.3.1 Regional Municipality of Niagara Regional Official Plan

The Regional Municipality of Niagara Regional Official Plan implements the Niagara Growth Management Strategy (Niagara 2031) and was developed to align with the Provincial Growth Plan for the Greater Golden Horseshoe (2006) and the Greenbelt Plan (2005). Section 4.G.1 of the Official Plan identifies Niagara’s Urban Community Objectives, with Objective 4.G.1.7 listing the goal to promote the preservation and enhancement of cultural heritage resources.

Section 10.C.2.1 describes policies as it relates to Built Heritage Resources, Cultural Heritage Landscapes and Archaeological Resources. Policy 10.C.2.1.5 states that where a development, site alteration or a public works project is proposed on or adjacent to a significant built heritage resource or cultural heritage landscapes, a heritage impact assessment will be required. The findings of the assessment must include recommendations for design alternatives and satisfactory measures to mitigate any negative impacts on identified significant heritage resources (Niagara Region 2014:10-7).

3.3.2 City of Port Colborne Official Plan

The City of Port Colborne’s Official Plan was approved in 2013 and consolidated in 2017 with the intent to reflect new policy and regulatory initiatives, address emerging issues and guide the land use of the City for the next 20 years.

Section 7 contains policies addressing the protection and enhancement of heritage features within the City. In terms of historic structures and heritage conservation districts, Section 7.1 states:

a) The designation of historic buildings, structures and land under the *Ontario Heritage Act* is encouraged.

b) The use of conservation *easements* registered on title to the property is encouraged if designation under the *Ontario Heritage Act* is not appropriate.

c) Where a historic building, structure or feature is incorporated into a development proposal and the feature is not being dedicated to the City, the requirement for a conservation *easement* will be included as a condition of approval.

d) To ensure that heritage properties remain in their original context, the relocation of heritage buildings or structures is not permitted.

e) The City may establish heritage conservation districts pursuant to the *Ontario Heritage Act* to control the erection, demolition or alteration of buildings. The following criteria shall be used to guide the establishment of a heritage conservation district:

   i) Buildings, structures, and/or streetscapes are representative of a certain historic era;

   ii) Buildings and/or structures are of a particular architectural style or have unique architectural features; and/or

   iii) Buildings, structures and/or streetscapes are related to a unique local event or period that shaped the *development* of a neighbourhood/community.

f) The City supports the protection and enhancement of cultural and heritage assets which include the establishment of a Heritage Character Area and Urban Design Guidelines that can preserve and guide *new development* or re-development and is supported by rebate and incentive programs that encourage property owners to protect, preserve and enhance these assets.

g) Alterations to a designated heritage property may be permitted where the impacts of the proposed alterations have been evaluated and it has been demonstrated that the heritage attributes of the protected property will be *conserved.* This policy would require a Heritage Impact Assessment by a qualified person to properly identify and evaluate the CHVI of a property and recommend appropriate alternative approaches and mitigative measures.

h) All new development permitted by the land-use policies and designations of this Plan shall conserve cultural heritage resources and shall incorporate these resources into any new development plans. In addition, all new development will be planned in a manner which preserves and enhances the context in which cultural heritage resources are situated. Cultural heritage resources include but are not limited to, buildings, structures, landmarks, trees, tree lines, hedge lines, or fence lines.

i) Development and *site alteration* may be permitted on *adjacent lands* to a protected heritage property where the proposed development and *site alteration* has been evaluated and it has been demonstrated that the heritage attributes of the protected heritage property will be *conserved.* Mitigative measures and/or alternative development approaches may be required in order to conserve the heritage attributes of the protected heritage property affected by the adjacent development or *site alteration.*

The subsequent subsections in Section 7 of the City of Port Colborne's Official Plan include policies related to the Municipal Heritage Committee, Archaeological Resources and Marine Archaeological Resources.

4.0 GEOGRAPHICAL AND HISTORICAL CONTEXT

4.1 Geographic Context

The study area is located in the City of Port Colborne, approximately 1 km north of Lake Erie, Niagara Region, Southern Ontario. The study area is within the Haldimand Clay Plain physiographic region of Southern Ontario, characterised by a series of parallel belts, lying between the Niagara Escarpment and Lake Erie. The northern portion of the study area is at an elevation of approximately 184 m above sea level (asl), the southern portion is at approximately 175 m asl.

According to the reviewed geotechnical studies, the general geologic stratigraphy of the Port Colborne area is characterized by topsoil/natural silty clay soils overlying a shallow bedrock, ranging in depths from 0.9 m to 3.4 m based on some of the drilled boreholes (GM BluePlan Engineering, 2019). With some exceptions, the bedrock elevation becomes progressively shallower further south in Port Colborne towards Lake Erie (*ibid*).

The Welland Canal is a dominating feature of the study area, formed through the gradual realignment of the Welland River in the 1800s, it bisects the central portion, flowing from north to south (Figure 1) over gently undulating topography. The water sources present in the wider area (i.e., the Welland watercourse and Lake Erie) provide an indicator of favourable conditions for early human settlement and archaeological site potential.

4.2 Historical Context

4.2.1 Pre-Contact Indigenous Period

The general culture and tool tradition history of the Indigenous pre-contact period of southern Ontario is summarised briefly in Table 2 and is based largely on Ellis and Ferris (1990).

Table 2: Overview of Pre-Contact Cultural Chronology of Southern Ontario

Period		Time Period BP (Before Present)	Characteristics
Paleo	Early	10,950 – 10,350 BP	Gainey, Barnes and Crowfield traditions; small bands; mobile hunters and gatherers; utilization of seasonal resources and large territories; fluted projectiles
	Late	10,350 – 9,950 BP	Holcombe, Hi-Lo and Lanceolate biface traditions; continuing mobility; campsite/way-station sites; smaller territories are utilized; non-fluted projectiles
Archaic	Early	9,950 – 7,950 BP	Side-notched, Corner-notched (Nettling, Thebes) and Bifurcate Base traditions; growing diversity of stone tool types; heavy woodworking tools appear (e.g., ground stone axes and chisels)
	Middle	7,950 – 4,450 BP	Stemmed (Kirk, Stanly/Neville), Brewerton side- and corner-notched traditions; reliance on

Period		Time Period BP (Before Present)	Characteristics
			local resources; populations increasing; more ritual activities; fully ground and polished tools; net-sinkers common; earliest copper tools
	Late	4,450 – 2,900 BP	Narrow Point (Lamoka), Broad Point (Genesee) and Small Point (Crawford Knoll) traditions; less mobility; use of fish-weirs; formal cemeteries appear; stone pipes emerge; long-distance trade (marine shells and galena)
Woodland	Early	2,900 – 2,350 BP	Meadowood tradition; cord-roughened ceramics emerge; Meadowood cache blades and side-notched points; bands of up to 35 people
	Middle	2,350 – 1,400 BP	Saugeen tradition; stamped ceramics appear; Saugeen projectile points; cobble spall scrapers; Seasonal settlements and resource utilization; post holes, hearths, middens, cemeteries and rectangular structures identified
	Transitional	1,400 – 1,050 BP	Princess Point tradition; cord roughening, impressed lines, and punctate designs on pottery; adoption of maize horticulture at the western end of Lake Ontario; oval houses and ‘incipient’ longhouses; first palisades; villages with up to 75 people
	Late	1,050 – 650 BP	Early – Glen Meyer tradition; settled village-life based on agriculture; small villages (0.4 ha) with 75–200 people and 4–5 longhouses; semi-permanent settlements
		650 – 550 BP	Middle – Uren and Middleport traditions; classic longhouses emerge; larger villages (1.2 ha) with up to 600 people; more permanent settlements (30 years)
		550 – 350 BP	Late – Larger villages (1.7 ha); examples up to 5 ha with 2,500 people; extensive croplands; also, hamlets, cabins, camps and cemeteries; potential tribal units; fur trade begins ca. 1580; European trade goods appear

4.2.1.1 Paleo Period

The occupation of southern Ontario became possible just after the end of the Wisconsin Glacial Period. Although there were a complex series of ice retreats and advances which played a large role in shaping the local topography, south-central Ontario was finally free of ice by 12,500 BP. The first human settlement can be traced back 11,000 years, when this area was settled by Indigenous groups that had been living south of the Great Lakes. The period of these early Indigenous inhabitants is known as the Paleo Period (Ellis and Deller 1990). The Paleo period marks the beginning of human settlement in southern Ontario. It is characterized by small bands of nomadic hunter-gatherers who largely depended on the communal hunting of big game such as caribou, and possible mammoth and/or mastodon. This early period of occupation is divided into early and late phases, which span from ca. 10,950 – 9,950 BP (Ellis and Deller 1990) and from circa (*ca*.) 10,350 - 9,950 BP (Jackson 2004), respectively.

Our current understanding of settlement patterns of Early Paleo peoples suggests that small bands, consisting of probably no more than 25 to 35 individuals, followed a pattern of seasonal mobility extending over large territories (Ellis and Deller 1990). Early Paleo sites tend to be located in elevated locations on well-drained loamy soils. Many of the known sites were located on former beach ridges associated with glacial lakes. There are a few extremely large Early Paleo sites, such as one located close to Parkhill, Ontario, which covered as much as six hectares. It appears that these sites were formed when the same general locations were occupied for short periods of time over the course of many years. Given their placement in locations conducive to the interception of migratory mammals such as caribou, it has been suggested that they may represent communal hunting camps. There are also smaller Early Paleo camps scattered throughout the interior of southwestern and south-central Ontario, usually situated adjacent to wetlands.

The most recent research suggests that population densities were very low during the Early Paleo Period (Ellis and Deller 1990:54). Archaeological examples of Early Paleo sites are rare.

The Late Paleo Period (10,350 – 9,950 BP) has been less researched and is consequently more poorly understood. By this time, the environment of south-central Ontario was coming to be dominated by closed coniferous forests with some minor deciduous elements. It seems that many of the large game species that had been hunted in the early part of the Paleo Period had either moved further north, or as in the case of the mastodons and mammoths, become extinct.

Like the early Paleo peoples, late Paleo-peoples covered large territories as they moved about in response to seasonal resource fluctuations. On a province-wide basis, Late Paleo projectile points are far more common than Early Paleo materials, suggesting a relative increase in population.

The end of the Late Paleo Period was heralded by numerous technological and cultural innovations that appeared throughout the Archaic Period. These innovations may be best explained in relation to the dynamic nature of the post-glacial environment and region-wide population increases.

4.2.1.2 Archaic Period

During the Early Archaic Period (9, 950 – 7,950 BP) (8000 – 6000 Before Christ [B.C.]), the jack and red pine forests that characterized the Late Paleo environment were replaced by forests dominated by white pine with some associated deciduous trees (Ellis et al. 1990:68-69). One of the more notable changes in the Early Archaic Period is the appearance of side and corner-notched projectile points.

Other significant innovations include the introduction of ground stone tools such as celts and axes, suggesting the beginnings of a simple woodworking industry. The presence of these often large and not easily portable tools suggests there may have been some reduction in the degree of seasonal movement, although it is still suspected that population densities were quite low, and band territories large.

During the Middle Archaic Period (7,950 – 4,450 BP) (6000 – 2500 B.C.) the trend to more diverse toolkits continued, as the presence of netsinkers suggest that fishing was becoming an important aspect of the subsistence economy. It was also at this time that "bannerstones" were first manufactured.

Bannerstones are carefully crafted ground stone devices that served as a counterbalance for atlatls or spear throwers. Another characteristic of the Middle Archaic Period is an increased reliance on local, often poorer quality, chert resources for the manufacturing of projectile points and other stone tools. It seems that during earlier periods, when groups occupied large territories, it was possible for them to visit a primary outcrop of high-quality chert at least once during their seasonal round. However, during the Middle Archaic Period, groups inhabited smaller territories that often did not encompass a source of high-quality raw material. In these instances, lower quality materials which had been deposited by the glaciers in the local till and river gravels were utilized.

This reduction in territory size was probably the result of gradual region-wide population growth which led to the infilling of the landscape. This process forced a reorganization of Indigenous subsistence practices, as more people had to be supported from the resources of a smaller area. During the latter part of the Middle Archaic Period, technological innovations such as fish weirs have been documented as well as stone tools especially designed for the preparation of wild plant foods.

It is also during the latter part of the Middle Archaic Period that long distance trade routes began to develop, spanning the northeastern part of the continent. In particular, native copper tools manufactured from a source located northwest of Lake Superior were being widely traded (Ellis et al. 1990:66). By 3500 B.C. the local environment had stabilized and began to reflect the more modern landscape (Ellis et al. 1990:69).

During the Late Archaic Period (4,450 – 2,900 BP) (2500 – 950 B.C.) the trend towards decreased territory size and a broadening subsistence strategy continued. Late Archaic sites are far more numerous than either Early or Middle Archaic sites, and it seems that the local population had expanded. It is during the Late Archaic Period that more formal cemeteries appear. Before this time individuals were interred close to the location where they died. During the Late Archaic Period, if an individual died while his or her group happened to be at some distance from their group cemetery, the bones would be kept until they could be placed in the cemetery. Consequently, it is not unusual to find disarticulated skeletons, or even skeletons lacking minor elements such as fingers, toes, or ribs, in Late Archaic burial pits.

The appearance of cemeteries during the Late Archaic Period has been interpreted as a response to increased population densities and competition between local groups for access to resources. It is argued that cemeteries would have provided strong symbolic claims over a local territory and its resources. These cemeteries are often located on heights of well-drained sandy/gravel soils adjacent to major watercourses.

This suggestion of increased territoriality is also consistent with the regionalized variation present in Late Archaic Period projectile point styles. It was during the Late Archaic Period that distinct local styles of projectile points appear. Also, it was during the Late Archaic Period that trade networks which had been established during the Middle Archaic Period continued to flourish. Native copper from northern Ontario and marine shell artifacts from as far away as the Mid-Atlantic coast are frequently encountered as grave goods at Southern Ontario sites.

Other artifacts such as polished stone pipes and banded slate gorgets also appear on Late Archaic sites in Southern Ontario. One of the more unusual and interesting of the Late Archaic Period artifacts is the birdstone, which are small, bird-like effigies usually manufactured from green banded slate.

4.2.1.3 Woodland Period

The Early Woodland Period (2,900 – 2,350 BP) (950 – 400 B.C.) is distinguished from the Late Archaic Period primarily by the addition of ceramic technology. While the introduction of pottery provides a useful demarcation point for archaeologists, it may have made less difference in the lives of the Early Woodland peoples. The first pots were thick walled and are often friable when found archaeologically. It has been suggested that they were used in the processing of nut oils by boiling crushed nut fragments in water and skimming off the oil. These vessels were not easily portable, and individual pots likely did not have a long use life. There have also been numerous Early Woodland sites located at which no pottery was found, suggesting that these poorly constructed undecorated vessels had yet to assume a central position in the day-to-day lives of Early Woodland peoples.

Other than the introduction of this limited ceramic technology, the life ways of Early Woodland peoples show a great deal of continuity with the preceding Late Archaic Period. For instance, birdstones continue to be manufactured, although the Early Woodland varieties have "pop-eyes" which protrude from the sides of their heads.

Likewise, the thin, well-made projectile points which were produced during the terminal part of the Archaic Period continue in use. However, the Early Woodland Period variants were side-notched rather than corner-notched, giving them a slightly altered and distinctive appearance.

The trade networks which were established in the Middle and Late Archaic Periods also continued to function, although there does not appear to have been as much trade in marine shell during the Early Woodland Period. During the last 200 years of the Early Woodland Period, projectile points manufactured from high quality raw materials from the American Midwest begin to appear on sites in southwestern Ontario.

In terms of settlement and subsistence patterns, the Middle Woodland Period (2,350 – 1,400 BP) (400 B.C. – 500 Anno Domini [A.D.]) provides a major point of departure from the Archaic and Early Woodland Periods. While Middle Woodland peoples still relied on hunting and gathering to meet their subsistence requirements, fish were becoming an even more important part of the diet.

In addition, Middle Woodland peoples relied much more extensively on ceramic technology. Middle Woodland vessels are often heavily decorated with hastily impressed designs covering the entire exterior surface and upper portion of the vessel interior. Consequently, even very small fragments of Middle Woodland vessels are easily identifiable.

It is also at the beginning of the Middle Woodland Period that rich, densely occupied sites appear along the margins of major rivers and lakes. While these areas had been utilized by earlier peoples, Middle Woodland sites are significantly different in that the same location was occupied off and on for as long as several hundred years and large deposits of artifacts often accumulated. Unlike earlier seasonally utilized locations, these Middle Woodland sites appear to have functioned as base camps, occupied off and on over the course of the year. There are also numerous small upland Middle Woodland sites, many of which can be interpreted as special purpose camps from which localized resource patches were exploited. This shift towards a greater degree of sedentism continues the trend witnessed from at least Middle Archaic times and provides a prelude to the developments that follow during the Late Woodland Period.

The Late Woodland began with a shift in settlement and subsistence patterns involving an increasing reliance on corn horticulture (Fox 1990:185; Smith 1990; Williamson 1990:312). Corn may have been introduced into southwestern Ontario from the American Midwest as early as 600 A.D. or a few centuries before. Corn did not become a dietary staple, however, until at least three to four hundred years later, when the cultivation of corn gradually spread into south-central and southeastern Ontario.

During the Transitional Woodland Period, particularly within the Princess Point Complex (circa 1,450 -900 BP) (*ca* AD 500-1050), a number of archaeological material changes have been noted including the appearance of triangular projectile point styles, first seen during this period beginning with the Levanna form; cord-wrapped stick decorated ceramics using the paddle and anvil forming technique evolving from the mainly coil-manufactured and dentate stamped and pseudo-scallop shell impressed ceramics; and if not appearance, increasing use of maize (*Zea mays*) as a food source (e.g., Bursey 1995; Crawford et al. 1997; Ferris and Spence 1995:103; Martin 2004 [2007]; Ritchie 1971:31-32; Spence et al. 1990; Williamson 1990:299).

The Late Woodland Period is widely accepted as the beginning of agricultural life ways in southern Ontario. Researchers have suggested that a warming trend during this time may have encouraged the spread of maize into southern Ontario, providing a greater number of frost-free days (Stothers and Yarnell 1977). Further, shifts in the location of sites have also been identified with an emphasis on riverine, lacustrine and wetland occupations set against a more diffuse use of the landscape during the Middle Woodland (Dieterman 2001).

One such site, located on the Grand River near Cayuga, Ontario is the Grand Banks site (AfGx-3). As of 1997, 40 maize kernels and 29 cupules had been recovered at this site (Crawford et al. 1997). The earliest AMS radiocarbon assay run on maize from paleosol II produced a date of approximately AD 500 (Crawford et al. 1997:116). This site is interpreted as a long-term basecamp that may have been used year-round or nearly year-round (Crawford and Smith 1996:785). This growing sedentism is seen as a departure from Middle Woodland hunting and gathering and may reflect growing investment in the care of garden plots of maize (Smith 1997:15). The riverine location of Grand Banks (AfGx-3) may have also provided light, nutrient-rich soil for agriculture (Crawford et al. 1997). While Levanna projectile points are formal tools, Princess Point Complex toolkits are predominantly characterized by informal or expedient flake tools and ground stone and bone artifacts are rare (Ferris and Spence 1995:103; Shen 2000). At Grand Banks, experimental archaeology suggests that chert flakes were put to a variety of useful tasks, from butchering to bone-working to wood-working to plant-working. Formal bifaces and projectile points had less evidence of use-wear (Shen 2000). Local cherts appear to have been used, although Onondaga, albeit also a local resource, was preferred at Grand Banks (AfGx-3) (Shen 1997).

The first agricultural villages in southern Ontario date to the 10th century A.D. Unlike the riverine base camps of the Middle Woodland Period, these sites are located in the uplands, on well-drained sandy soils.

Village sites dating between 1,050 – 650 BP (900 and 1300 A.D.). share many attributes with the historically reported early Late Woodland sites, including the presence of longhouses and sometimes palisades. However, these early longhouses were actually not all that large, averaging only 12.4 metres in length (Dodd et al. 1990:349; Williamson 1990:304-305). It is also quite common to find the outlines of overlapping house structures, suggesting that these villages were occupied long enough to necessitate re-building.

The Jesuits reported that the Huron moved their villages once every 10 – 15 years, when the nearby soils had been depleted by farming and conveniently collected firewood grew scarce (Pearce 2010). It seems likely that early Late Woodland people occupied their villages for considerably longer, as they relied less heavily on corn than did later groups, and their villages were much smaller, placing less demand on nearby resources.

Judging by the presence of carbonized corn kernels and cob fragments recovered from sub-floor storage pits, agriculture was becoming a vital part of the early Late Woodland economy. However, it had not reached the level of importance it would in the middle and late Woodland Periods. There is ample evidence to suggest that more traditional resources continued to be exploited and comprised a large part of the subsistence economy. Seasonally occupied special purpose sites relating to deer procurement, nut collection, and fishing activities, have all been identified. While beans are known to have been cultivated later in the Late Woodland Period, they have yet to be identified on early Late Woodland Period sites.

The middle Late Woodland Period (650 – 550 BP) witnessed several interesting developments in terms of settlement patterns and artifact assemblages. Changes in ceramic styles have been carefully documented, allowing the placement of sites in the first or second half of this 100-year period. Moreover, villages, which averaged approximately 0.6 hectares in extent during the early Late Woodland Period, now consistently range between one and two hectares in size.

House lengths also change dramatically, more than doubling to an average of 30 metres, while houses of up to 45 metres (m) have been documented. This increase in longhouse length has been variously interpreted. The simplest possibility is that increased house length is the result of a gradual, natural increase in population (Dodd et al. 1990:323, 350, 357; Smith 1990). However, this does not account for the sudden shift in longhouse lengths around 1300 A.D. Other possible explanations involve changes in economic and socio-political organization (Dodd et al. 1990:357). One suggestion is that during the middle Late Woodland Period small villages were amalgamating to form larger communities for mutual defence (Dodd et al. 1990:357). If this was the case, the more successful military leaders may have been able to absorb some of the smaller family groups into their households, thereby requiring longer structures. This hypothesis draws support from the fact that some sites had up to seven rows of palisades, indicating at least an occasional need for strong defensive measures. There are, however, other middle Late Woodland villages which had no palisades present (Dodd et al. 1990). More research is required to evaluate these competing interpretations.

The lay-out of houses within villages also changes dramatically by 650 BP. During the early Late Woodland Period villages were haphazardly planned, with houses oriented in various directions. During the middle Late Woodland Period villages are organized into two or more discrete groups of tightly spaced, parallel aligned, longhouses. It has been suggested that this change in village organization may indicate the initial development of the clans which were a characteristic of the historically known Late Woodland peoples (Dodd et al. 1990:358).

During the late Late Woodland period, the Iroquoian-speaking linguistic and cultural groups developed. Prior to European Contact, neighbouring Iroquois-speaking communities united to form several confederacies known as the Huron (Huron-Wendat), Neutral (called Attiewandaron by the Wendat), Petun (Tionnontaté or Khionontateronon) in Ontario, and the Five Nations (later Six Nations) of the Iroquois (Haudenosaunee) of upper New York State (Birch 2010:31; Warrick 2013:71). These groups are located primarily in south and central Ontario. Each group was distinct but shared a similar pattern of life already established by the 16th century (Trigger 1994:42).

Prior to European contact, the geographic distribution of pre-contact Late Woodland sites describes two major groups east and west of the Niagara Escarpment: the ancestral Attiewandaron to the west, and the ancestral Huron-Wendat to the east (Warrick 2000:446).

Ancestral Huron-Wendat villages have been located as far east as the Trent River watershed, where “concentrations of sites occur in the areas of the Humber River valley, the Rouge and Duffin Creek valleys, the

lower Trent valley, Lake Scugog, the upper Trent River and Simcoe County" (Ramsden 1990:363). These concentrations are distributed in a triangular area along the north shore of Lake Ontario and northward bounded by the Trent River system and the Niagara Escarpment (Ramsden 1990:363).

Settlement types included longhouses, house sizes depended on the size of the extended family that inhabited it; however, archaeological evidence suggests that the average longhouse was 25 feet by 100 feet, with heights about the same as widths (Heidenreich 1978:366). Village size gradually enlarged as horticulture began to take on a more central importance in subsistence patterns, particularly the farming of maize, squash, and beans, supplemented by fishing, hunting, and gathering. Sites were chosen for their proximity to sources of "water, arable soils, available firewood, [and] a young secondary forest, [as well as] a defendable position" (Heidenreich 1978:375). Later villages consisted of up to 100 longhouses clustered closely together, and only the largest villages on the frontier were fortified (Heidenreich 1978:377).

Subsistence patterns reflect a horticultural diet that was supplemented with fish rather than red meat (Heidenreich 1978:377). 'Slash-and-burn' farming was used to quickly and efficiently clear trees and brushwood for flour and flint corn fields (Heidenreich 1978:380). These were consistently cultivated until no longer productive, at which point the village was abandoned, an event that took place about every 8 to 12 years (Heidenreich 1978:381). Consequently, as horticulture became the primary mode of subsistence, pre-contact Indigenous groups gradually relocated from the northern shores of Lake Ontario to further inland, likely as a result of depleting resources and growing tension between Indigenous communities.

4.2.2 Contact Period

The Huron-Wendat and Haudenosaunee called those within the territory of the Niagara Peninsula the "Attiewandaron" (also spelled Attiwondaronks and Atiquandaronk) (Brown 2009: 26). According to Samuel de Champlain, who first referred to the Attiewandaron as *la Nation neutre,* the Attiewandaron inhabited forty villages and could field 4,000 warriors (Jury 1974: 4; White 1978: 410; Warrick 2008: 80). It is speculated that prior to the great epidemics of the 1630s, the Attiewandaron Confederacy numbered approximately 35,000 to 40,000 individuals (White 1978: 409; Warrick 2008: 86).

Their territory at the western end of Lake Ontario and along the north shore of Lake Erie was favourably located for easy trade with the Erie, Haudenosaunee, Tionnontaté, and Huron-Wendat (Trigger 1994: 47). The interior lands occupied by the Attiewandaron contained rapidly running streams, large rivers, and portage routes. A significant trail beginning at Lake Simcoe, following the Nottawasaga River to the Pine River to the source of the Irvine River and into the Grand River and banks of Lake Erie, formed an Indigenous portage route favoured for travel and trade between Huron-Wendat and Attiewandaron territorial lands (Bricker 1934: 58).

From 1649 to 1650, the Haudenosaunee engaged in warfare with the Huron-Wendat Confederacy, destroying several Huron-Wendat villages throughout Southern Ontario (Trigger 1994: 53). The small groups that remained of the Huron-Wendat Confederacy became widely dispersed throughout the Great Lakes region, ultimately resettling in Quebec (Schmalz 1991: 17). Many Huron-Wendat groups sought refuge and protection within the Attiewandaron, until the Haudenosaunee attacked in the 1650s (Trigger 1994: 56; Warrick 2008: 208). Many were captured and incorporated into the Haudenosaunee or sought refuge within other tribes (Lennox and Fitzgerald 1990: 410; Trigger 1994: 57). The last mention of the Attiewandaron in French writing was in 1671 (Noble 2012).

After the 1660s, the Haudenosaunee controlled most of Southern Ontario. Although their homeland was located south of the lower Great Lakes, they occupied at "least half a dozen villages along the north shore of Lake Ontario and into the interior" (Schmalz 1991: 17; Williamson 2013: 60). The Haudenosaunee established "settlements at

strategic locations along the trade routes inland from the north shore of Lake Ontario. Their settlements were on canoe-and-portage routes that linked Lake Ontario to Georgian Bay and the upper Great Lakes" (Williamson 2013: 60). The Haudenosaunee had established a village at the Rouge River, the Humber River, and at the Niagara River (Robinson 1965: 15-16; Schmalz 1991: 29).

At this time, several Algonquin-speaking linguistic and cultural groups within the Anishinaabeg (or Anishinaabe) began to challenge the Haudenosaunee dominance in the region (Johnston 2004: 9-10; Gibson 2006: 36). Before contact with the Europeans, the Anishinaabeg were primarily in Northern Ontario, with the Ojibwa territorial homeland inland from the north shore of Lake Huron (MNCFN [date unknown]: 3). The English referred to those Algonquin-speaking linguistic and cultural groups that settled in the area bounded by Lakes Ontario, Erie, and Huron as Chippewas or Ojibwas (Smith 2002: 107). In 1640, the Jesuit fathers had recorded the name "*oumisagai*, or Mississaugas, as the name of an Algonquin group near the Mississagi River on the northwestern shore of Lake Huron. The French, and later the English applied this same designation to all Algonquian [-speaking groups] settling on the north shore of Lake Ontario" (Smith 2002: 107; Smith 2013: 19-20). "The term 'Mississauga' perplexed the Algonquins, or Ojibwas, on the north shore of Lake Ontario, who knew themselves as the Anishinaabeg" (Smith 2013: 20).

Following a major smallpox epidemic, combined with the capture of New Netherland by the English, access to guns and powder became increasingly restricted for the Haudenosaunee. After a series of successful attacks against the Haudenosaunee by groups within the Anishinaabeg, the Haudenosaunee dominance in the region began to fail. By the 1690s, Haudenosaunee settlements along the northern shores of Lake Ontario were abandoned, and in 1701, the Haudenosaunee were defeated. After these battles, the Anishinaabeg replaced the Haudenosaunee in Southern Ontario (Coyne 1895: 28; Schmalz 1991: 20, 27, 29; Gibson 2006: 37; Warrick 2008: 242; Williamson 2013: 60).

4.2.1 Post-Contact Period

Although their territory was located south of the lower Great Lakes, the Haudenosaunee controlled most of southern Ontario after the 1660s, occupying at "least half a dozen villages along the north shore of Lake Ontario and into the interior" (Schmalz 1991:17; Williamson 2013:60). The Haudenosaunee established "settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario. Their settlements were on canoe-and-portage routes that linked Lake Ontario to Georgian Bay and the upper Great Lakes" (Williamson 2013:60). The Haudenosaunee had established a village named Ganatsekwyagon at the mouth of the Rouge River, and Teiaiagon at a bend near the mouth of the Humber River to exploit both branches of the Toronto Carrying Place Trail (Robinson 1965:15-16; Schmalz 1991:29). Because of the French being allies of the Huron-Wendat, the Haudenosaunee prevented French explorers and missionaries from utilizing the St. Lawrence River and traveling within their territory north of Lake Ontario (Lajeunesse 1960:xxix).

At this time, several Algonquin-speaking linguistic and cultural groups within the Anishinaabeg (or Anishinaabe) began to challenge the Haudenosaunee dominance in the region (Johnston 2004:9-10; Gibson 2006:36). The Anishinaabeg were originally located primarily in northern Ontario. Before contact with the Europeans, the Ojibwa territorial homeland was situated inland from the north shore of Lake Huron (MNCFN nd:3). The English referred to those Algonquin-speaking linguistic and cultural groups that settled in the area bounded by Lakes Ontario, Erie, and Huron as Chippewas or Ojibwas (Smith 2002:107). In 1640, the Jesuit fathers had recorded the name "oumisagai, or Mississaugas, as the name of an Algonquin group near the Mississagi River on the northwestern shore of Lake Huron. The French, and later English applied this same designation to all Algonquian [-speaking groups] settling on the north shore of Lake Ontario" (Smith 2002:107; Smith 2013:19-20). "The term 'Mississauga'

perplexed the Algonquins, or Ojibwas, on the north shore of Lake Ontario, who knew themselves as the Anishinaabeg" (Smith 2013:20).

After a major smallpox epidemic and combined with the capture of New Netherland by the British, access to guns and powder became increasingly restricted for the Haudenosaunee. After a series of successful attacks against the Haudenosaunee by groups within the Anishinaabeg from 1653 to 1662, the Haudenosaunee dominance in the region began to fail (Warrick 2008:242; Schmalz 1991:20). Prior to 1680, groups within the Anishinaabeg had begun to settle just north of the evacuated Huron-Wendat territory and with the British entering the fur-trading market, began to expand further into southern Ontario (Gibson 2006:36; Schmalz 1991:18). By the 1690s, Haudenosaunee settlements along the northern shores of Lake Ontario were abandoned (Williamson 2013:60). By 1701, after a series of battles throughout Ontario, the Anishinaabeg replaced the Haudenosaunee in southern Ontario (Gibson 2006:37; Schmalz 1991:27-29; Coyne 1895:28).

In 1701, representatives of several groups within the Anishinaabeg and the Haudenosaunee, collectively known as the First Nations, assembled in Montreal to participate in Great Peace negotiations, sponsored by the French (Johnston 2004:10; Trigger 2004:58). The Mississaugas secured sole possession of the territory along and extending northward of Lake Ontario and Lake Erie (Hathaway 1930:433).

From 1701 to the fall of New France in 1759, the fur trade continued in Ontario with both the Ojibwa and Mississauga and various other groups within the Anishinaabeg trading with both the English and the French. Subsistence patterns include a primary focus on hunting, fishing, and gathering with little focus on agriculture (McMillian and Yellowhorn 2004:110). Groups within the Anishinaabeg, such as the Ojibwa and Mississauga, utilized housing known as a wigwam, a temporary and moveable structure that was easy to construct and disassemble, allowing them to travel swiftly throughout their territory (McMillian and Yellowhorn 2004:111).

The Seven Years War brought warfare between the French and British in North America. In 1763, the Royal Proclamation declared the Seven Years War over, giving the British control of New France. The British did not earn the respect of the Anishinaabeg, as the British did not honour fair trade nor the Anishinaabeg occupancy of the land as the French had. Consequently, the Pontiac Uprising, also known as the Beaver Wars, began that same year (Schmalz 1991:70; Johnston 2004:13-14). This uprising involved both groups within the Haudenosaunee and groups within the Anishinaabeg. After numerous attacks on the British, the Pontiac Uprising was over by 1766 when a peace agreement was concluded with Sir William Johnson, the Superintendent of Indian Affairs (Schmalz 1991:81). The fur-trade continued throughout southern Ontario until the beginning of British colonization.

The study area is located within Between the Lakes Treaty No. 3. On May 22, 1784, for the sum of £1180 worth of trade goods, the Mississaugas of the Credit ceded to the Crown approximately 3,000,000 acres of land located between Lakes Huron, Ontario, and Erie.

This purchase was to procure a permanent abode for that part of the Six Nations coming into Canada. As written in the below passage, the Between the Lakes Treaty No. 3 includes (Government of Canada 2016):

> *All that parcel or tract of land lying and being between the Lakes Ontario and Erie, beginning at Lake Ontario, four miles south' westerly from the point opposite to Niagara Fort, known by the name of Mississaugue Point, and running from thence along the said lake to the creek that falls from a small lake, known by the name of Washquarter into the said Lake Ontario, and from thence north forty-five degree west, fifty miles; thence south forty-five degrees west, twenty miles; and thence south until it strikes the River La Tranche; then down the stream of the said river to that part or place where a due south course will lead to*

the mouth of Catfish Creek emptying into Lake Erie, and from the above mentioned part or place of the aforesaid River La Tranche, following the south course to the mouth of the said Catfish Creek; thence down Lake Erie to the lands heretofore purchased from the Nation of Mississague Indians; and from thence along the said purchase at Lake Ontario at the place of beginning as above mentioned together with all the woods, ways, paths, waters, watercourses and appurtenances thereunto belonging.

4.2.2 Euro-Canadian Settlement Period (Late 1700s to 1900 AD)

4.2.2.1 Township of Humberstone, Welland County

During the American War of Independence, in the late 1700s, a large number of United Empire Loyalists, who were granted land for staying loyal to the British Crown, began to move into the Niagara Peninsula, putting greater demand on the quantity of available lands for settlement within what would become Welland County (Brown 2009:33). These land grants were very liberal, where “field officers being allowed to select 5,000 acres, captains 3,000 acres, subalterns 2,000 acres and privates 200 acres” (Murphy 1887:87-88; Michael 1967:11). By 1784, about 40 families had settled on the territory now comprising the County of Welland (Murphy 1887:88).

In 1784, the Mississauga at the western end of Lake Ontario ceded a large tract of land that “included the Niagara Peninsula, lands close to the head of Lake Ontario, and the north shore of Lake Erie as far west as Cat Fish Creek” (Surtees 1994:103). The British purchased this land for £1,180 worth of trade goods, and it became known as the Between the Lakes Purchase (Surtees 1994:103). The tract included over one million hectares of land, and a tract of land nearly ten kilometres deep on either side of the Grand River was awarded to the Six Nations (Surtees 1994:103-104). In 1792, a land sale document was produced to confirm the actual limits of this purchase, which includes the Township of Humberstone (Surtees 1994:104).

The Township of Humberstone was first surveyed by Deputy Surveyor Thomas Welsh in 1794 and was bounded by the Township of Crowland to the north, the Township of Bertie on the east, the Township of Wainfleet to the west, and Lake Erie to the south (Ott 1970:11; Murphy 1887:275). Humberstone was surveyed with concession roads running east and west, and side roads running north-south (Ott 1970:11-12). The township contains about 32,000 acres of fertile soil “which is more or less alluvial and varies in quality from black muck to clay loam, [ranking] the township amongst the best agricultural districts in Ontario” (Murphy 1887:275; Page 1876:11). A ridge of high land runs on the southern side of the township parallel to Lake Erie and the land slopes to the lake consists of well-timbered hills of “oak, ash, hemlock, cedar, linden, butternut, walnut, beech, and whole groves of sugar maple” (Murphy 1887:275). The north-western portion of the township lower and contains extensive marshes (Murphy 1887:276).

During the War of 1812, the Niagara Peninsula was heavily bombarded by both American and British artillery and much of the countryside was destroyed during the invasion and defence of Upper Canada. In 1814, an American force led by General Duncan McArthur traveled from Detroit along the shore of the lake, burning nearly everything in their path from the Detroit River to the Grand River (Brown 2009:36). The distinctively shaped lake-side hill named Sugarloaf Hill, which was located along the southern half of the Township of Humberstone and reminded “early settlers of a tasty loaf eaten by former immigrants from Pennsylvania”, was used as a “signal beacon to warn of impending American attacks” (City of Port Colborne 2013).

4.2.2.2 Welland Canal

Credit for building the first Welland Canal is attributed to William Hamilton Merritt. In 1818, Merritt, a farmer and the owner of a mill on the bank of Twelve Mile Creek, petitioned the Legislature of Upper Canada to construct a canal to divert water from the Welland River due to the seasonal variations of the water supply available from

Twelve Mile Creek (Westwater 2010). However, it was discovered that an extensive ridge ran between the two waterways and the idea was given up (Westwater 2010). A month later Merritt proposed building a canal that would allow boats to travel between Lake Ontario and Lake Erie (Westwater 2010).

After several surveys and much debate over route, a path was decided on that would utilize natural waterways as much as possible. Wooden locks would be used to lift and lower the boats to the heights required between the two lakes.

Starting from Lake Ontario, Twelve Mile Creek would be taken as far south as the town of St. Catharines. Here, Dick's Creek, a tributary of Twelve Mile Creek was followed briefly north and then south again starting a slow climb upward which eventually culminated in a rapid succession of locks that took the canal up the escarpment (Old Welland Canals Field Guide nd). From here it continued south where it eventually met up with another tributary of Twelve Mile Creek and eventually the same ridge that had prevented Merritt's original idea of a water diversion ditch. While a tunnel through the ridge was originally conceived of, the final plan called for a channel or "Deep Cut" to continue south a distance of two miles to the Welland River (Old Welland Canals Field Guide nd). Welland River would then be followed to the Niagara River (above Niagara Falls), allowing access to Lake Erie. The Welland Canal Company was formed in January 1824 to build and manage the canal with construction starting on November 30, 1824 (Old Welland Canals Field Guide no date [nd]).

In 1828, after several years of construction an unexpected problem arose at the Deep Cut. To resolve these problems, as well as time constraints, a decision was made to dig a shallower channel and to use locks to transfer ships down to the Welland River. However, due to difference in elevation, a new source of water at a higher elevation was needed to fill the canal. Therefore, a new channel, a "Feeder Canal" was commission to divert water from the Grand River to the Welland Canal. After it was completed in 1829 the canal operated this way until 1832.

In 1833, the route along the Welland River was considered too time consuming, and a new route was dug that incorporated part of the Feeder Canal and continued south through the study area and all the way to Lake Erie. The canal was run this way for 11 years from 1833 to 1844.

The Second Welland Canal was designed to follow the route of the First Welland Canal with a few small modifications. Stone was also used instead of wood. The canal was rebuilt 1842-45. The Feeder Canal was also enlarged during this time to allow ship traffic. In 1851 the Feeder Canal was also extended to Lake Erie and provided an alternative route for ships.

The Third Welland Canal was designed to provide a new and straighter route that would allow bigger ships and shorter transit times. The canal was built 1872-81, while modifications continued until 1887.**Error! Reference source not found.** Figure 2 depicts the harbour at Port Colborne in the late 19th century. The Second Welland Canal remained a distinct canal north of Allanburg and operated until 1915. The Feeder Canal was no longer the source of water for the canal but handled boat traffic until the 1920's.



Figure 2: Port Colborne ca. 1880 (Niagara Falls Library, record 102083)

The Fourth Welland Canal was constructed between the years of 1913 and 1932. The canal now runs perpendicular to the Niagara Escarpment and is the most direct route of all three previous canals. The canal starts at the man-made Port Weller piers on Lake Ontario and continues south as straight as possible to Port Colborne.

4.2.2.3 City of Port Colborne

The community of Port Colborne grew significantly after the construction of the Welland Canal was complete in 1832 (Mika and Mika 1983:231; Brown 2009:71). Prior to that, a small village had begun to develop around Sugarloaf Hill after the area's first settler, Christian Zavitz, built a gristmill (Brown 2009:71). Permanent settlement occurred by 1832 along the lakeshore at Gravelly Bay, named after the Lieutenant Governor, Sir John Colborne (Mika and Mika 1983:213). In 1834, a new village site was laid out further inland, whose early economy relied almost entirely on the operation of the canal (Mika and Mika 1983:231). By 1850, Port Colborne became a major wheat-shipping and industrial hub where the Buffalo and Lake Huron Railway, the Welland Railway, and the horse-drawn streetcar line, known as the Toronto and St. Catherine's Railway, intersected (Mika and Mika 1983:232; Brown 2009:71).

In 1866, Irish nationalists from America, wanting to separate Ireland from the British Empire known as Fenians, attacked several locations along the Canadian border, including Port Colborne (Masters 1948). In May of 1866, a small Canadian force, the Welland Canal Field Battery, was stationed to protect Port Colborne, but failed to do so (Mika and Mika 1983:232). Other Canadian troops arrived, forcing the Fenians to withdraw to the United States where they were promptly arrested (Grodzinski 2015). By 1890, Port Colborne was incorporated as a village that contained, "four churches, a public school, separate school, grist mill, sawmill, three planning mills, a sash and door factory, a branch of the Imperial Bank, offices of the Montreal and Dominion Telegraph and a grain elevator" (Mika and Mika 1983:232). Towards the end of the 19th Century, commercial and manufacturing works began to be displaced by larger industrial conglomerates supported by improvements to the canal and harbour (City of Port

Colborne2013), and as the 20th Century progressed, Port Colborne became one of the world's largest centres of the flour milling industry (*ibid*).

Port Colborne was officially declared a town in 1918, with a recorded population of 2,837 (City of Port Colborne2013), and continued growth and spread, eventually encompassing the Village of Humberstone, which was officially amalgamated in 1952.

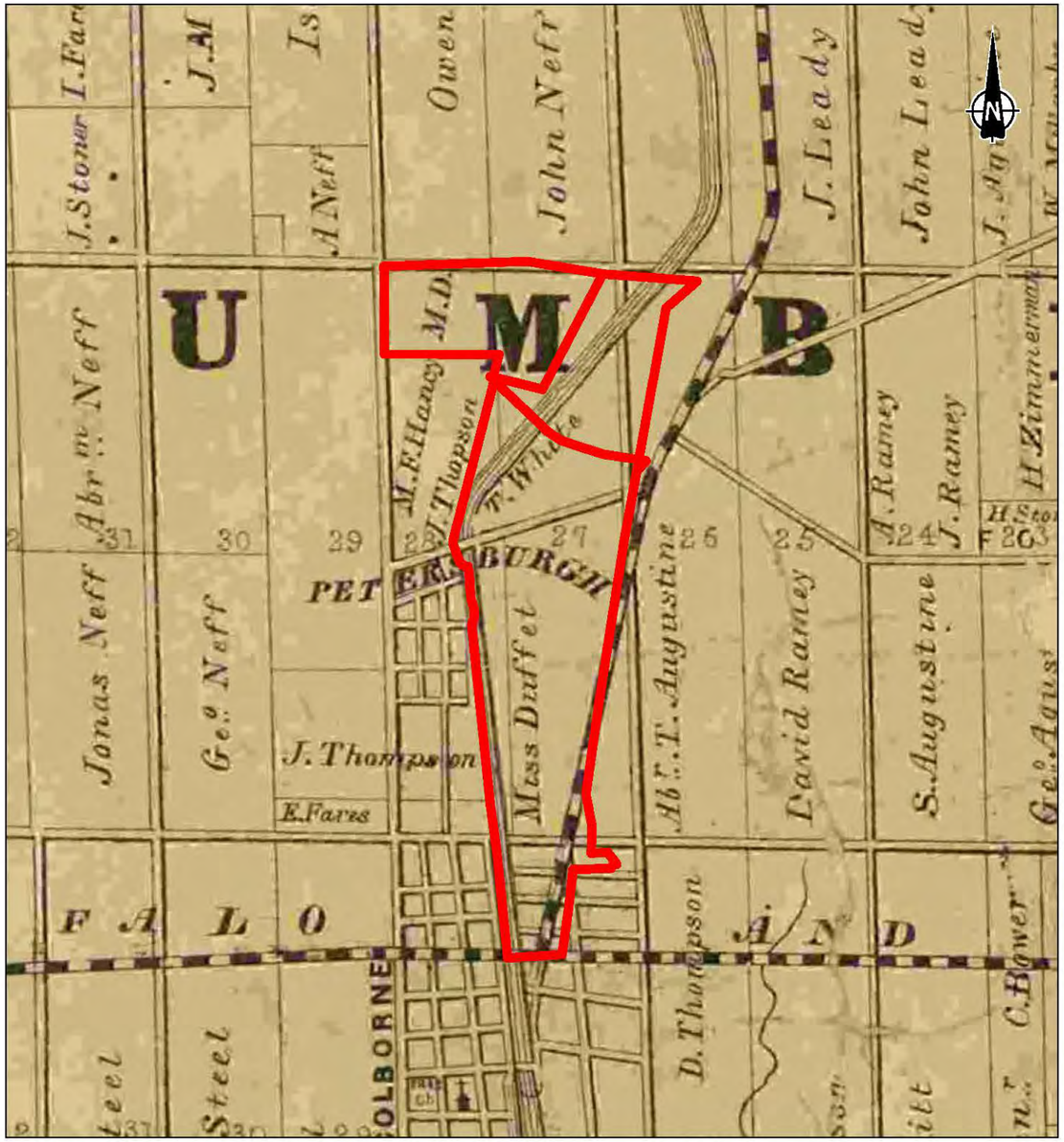
4.2.2.1 The Study Area

The study area is located within parts of Lots 27 and 28, Concession 1; Lots 26 to 28, Concession 2; and Lots 27 and 28, Concession 3, in the Geographic Township of Humberstone, County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

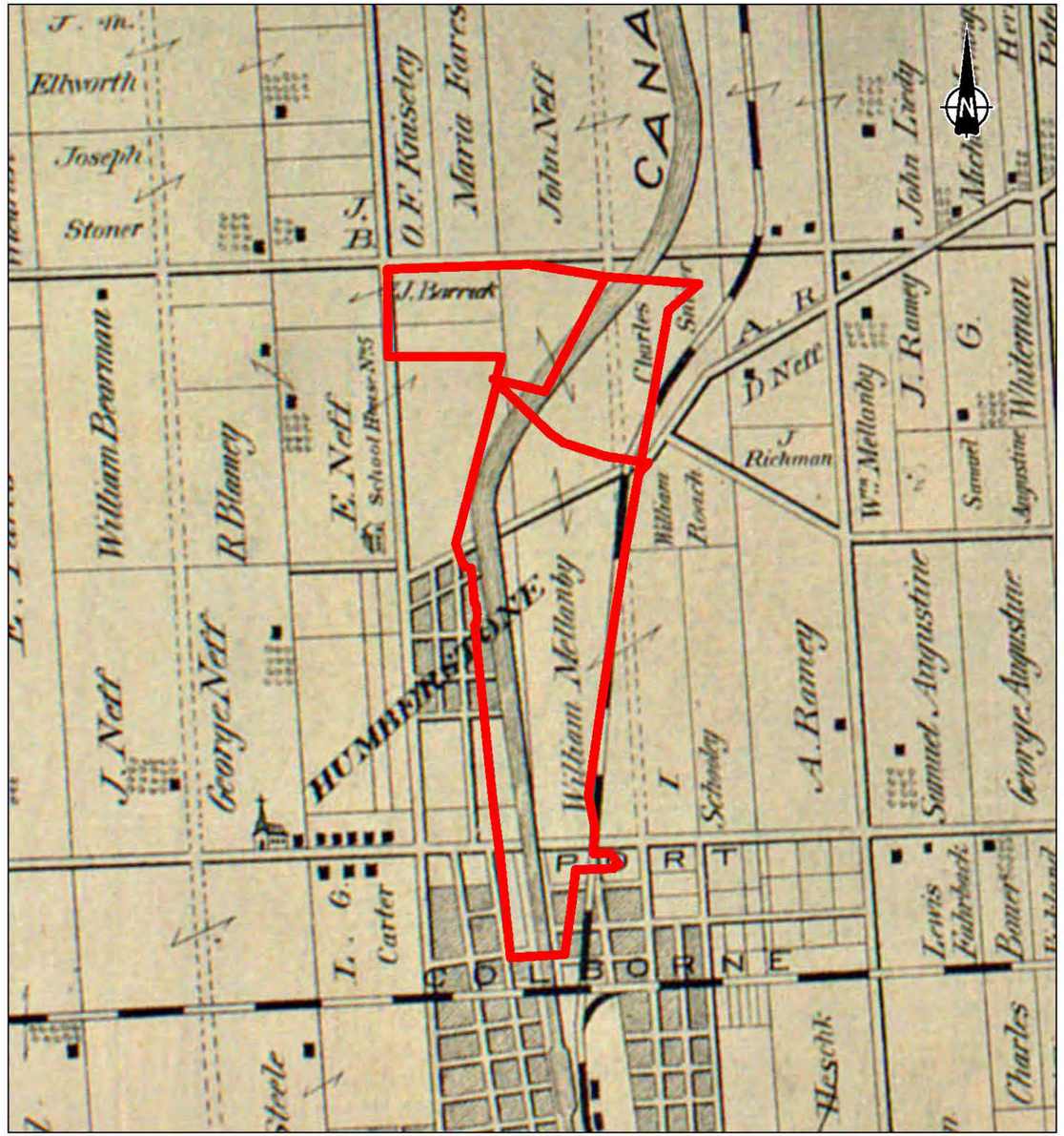
To understand the 19th century land use history of the study area, the 1862 *Tremaine's Map of the Counties of Lincoln and Welland, Canada West* and 1876 *Illustrated Historical Atlas of the Counties of Lincoln and Welland, Ontari*o were examined (Figure 3). A review of these resources reveals the study area to cross several properties owned by various individuals in the 19th century. Also, the study area either crosses and is in proximity to a number of historical features, including, historical villages and transportation routes (i.e., railways, roads, and the Welland Canal).

Topographic maps and aerial photographs from the 1900s were reviewed to understand the 20th century land use of the study area and surroundings (Figure 4). In the early 1900s, settlement continued to flourish within Humberstone and Port Colborne, whereas north Humberstone village and east of the Welland Canal remained under agricultural use. By 1929, the Fourth Canal is visible on topographic maps within Port Colborne, and settlement east of the canal begins to slowly fill. By the middle of the 20th century, the City of Port Colborne had expanded to cover much of the lands encompassing the study area (Figure 5).

1862



1876



LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

1862 TREMAINE'S MAP OF THE COUNTIES OF LINCOLN AND WELLAND, CANADA WEST, COMPILED & DRAWING FROM ACTUAL SURVEYS, PUBLISHED BY GEO. R. & G. TREMAINE, TORONTO.

1876 ILLUSTRATED HISTORICAL ATLAS OF THE COUNTIES OF LINCOLN AND WELLAND, ONTARIO, COMPILED, DRAWN, AND PUBLISHED FROM PERSONAL EXAMINATIONS AND SURVEYS BY H.R. PAGE, TORONTO.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

CULTURAL HERITAGE EXISTING CONDITIONS AND PRELIMINARY IMPACT ASSESSMENT REPORT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE

PROJECT AREA OVERLAID ON 19th CENTURY HISTORICAL MAPS

GOLDER

PROJECT No.	20139291		FILE No. 20139291-2000-R01003	
DESIGN			SCALE NTS	REV.
C-DD	-MS/DCH	Feb 2/21		
CHECK			**FIGURE 3**	
REVIEW				

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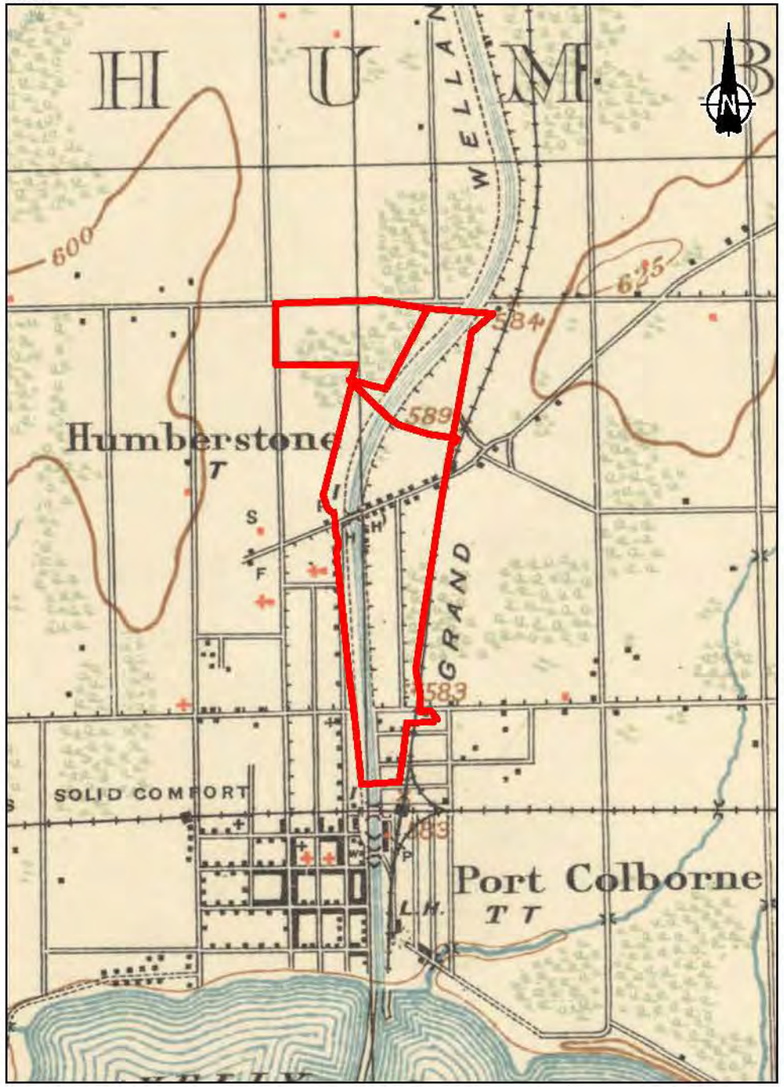
Client: Regional Municipality of Niagara

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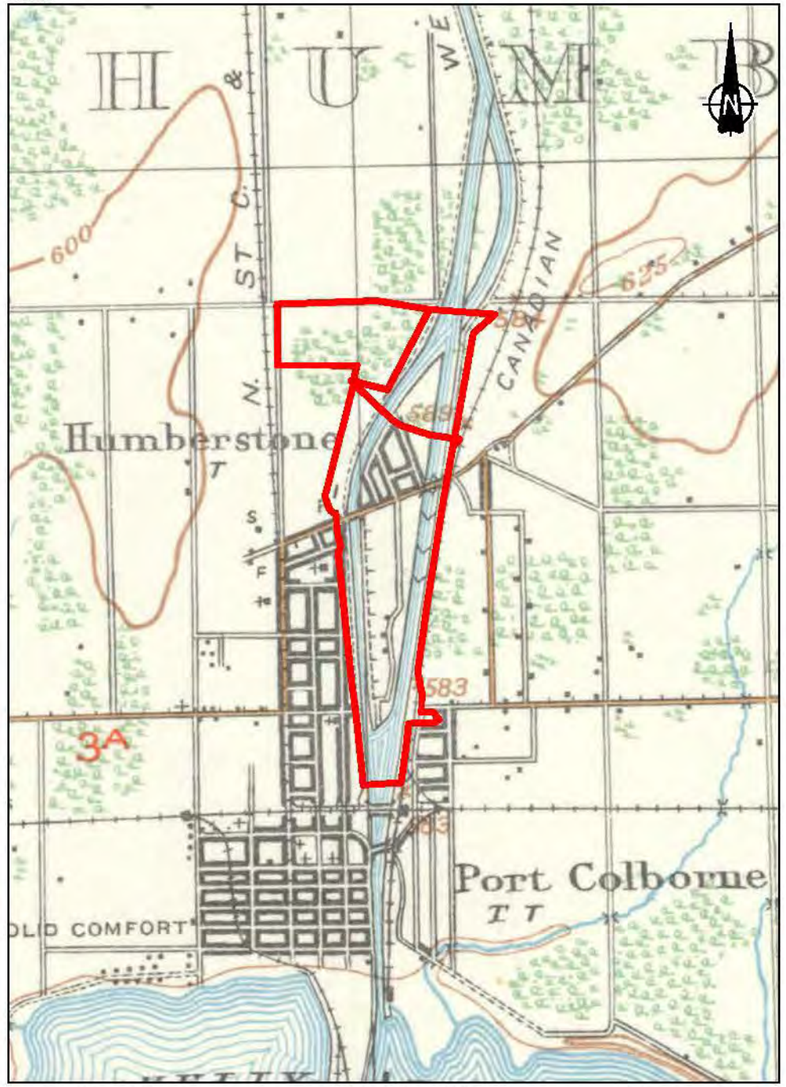
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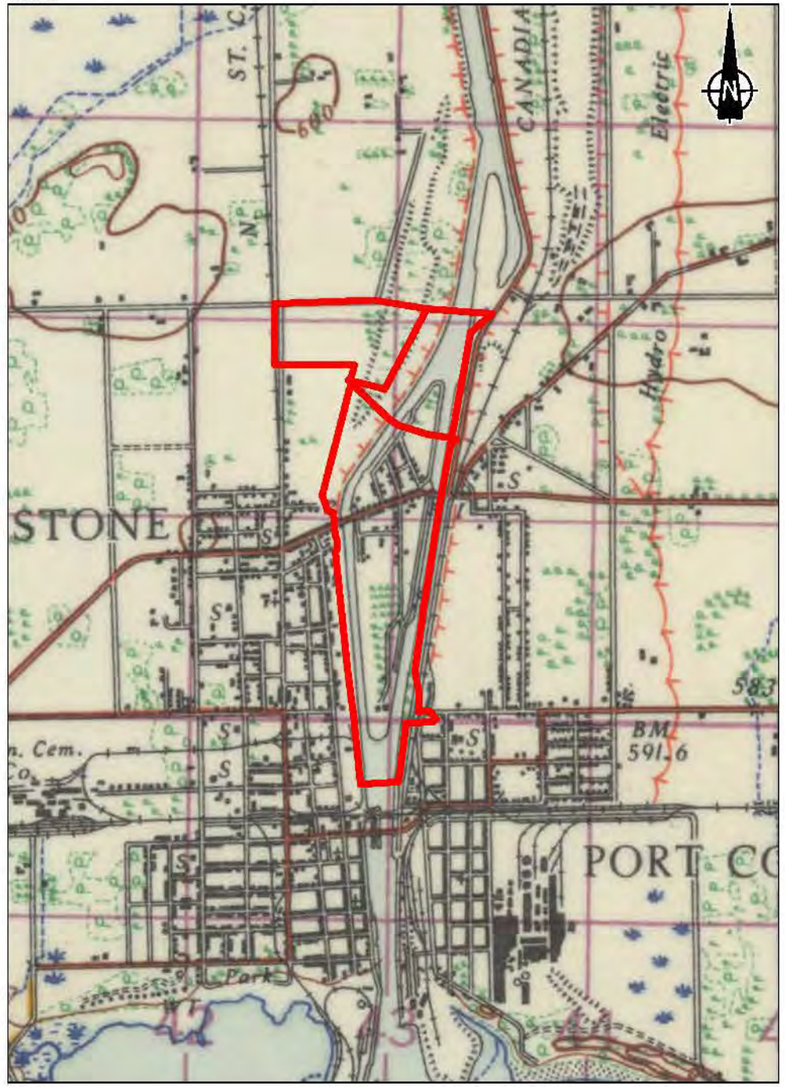
1907



1929



1938



SCALE IN KILOMETRES
0 0.5 1km
1:30

LEGEND

APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

1907 WELLAND, ONTARIO. 1:63,360. MAP SHEET 030L14, [ED. 1]. SURVEY DIVISION, DEPARTMENT OF MILITIA AND DEFENCE;

1929 WELLAND, ONTARIO. 1:63,360. MAP SHEET 030L14, [ED. 4]. GEOGRAPHICAL SECTION, GENERAL STAFF, DEPARTMENT OF NATIONAL DEFENCE;

1938 WELLAND, ONTARIO. 1:63,360. MAP SHEET 030L14, [ED. 6]. GEOGRAPHICAL SECTION, GENERAL STAFF, DEPARTMENT OF NATIONAL DEFENCE.

NOTES

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ALL LOCATIONS ARE APPROXIMATE.

PROJECT

CULTURAL HERITAGE EXISTING CONDITIONS AND PRELIMINARY IMPACT ASSESSMENT REPORT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

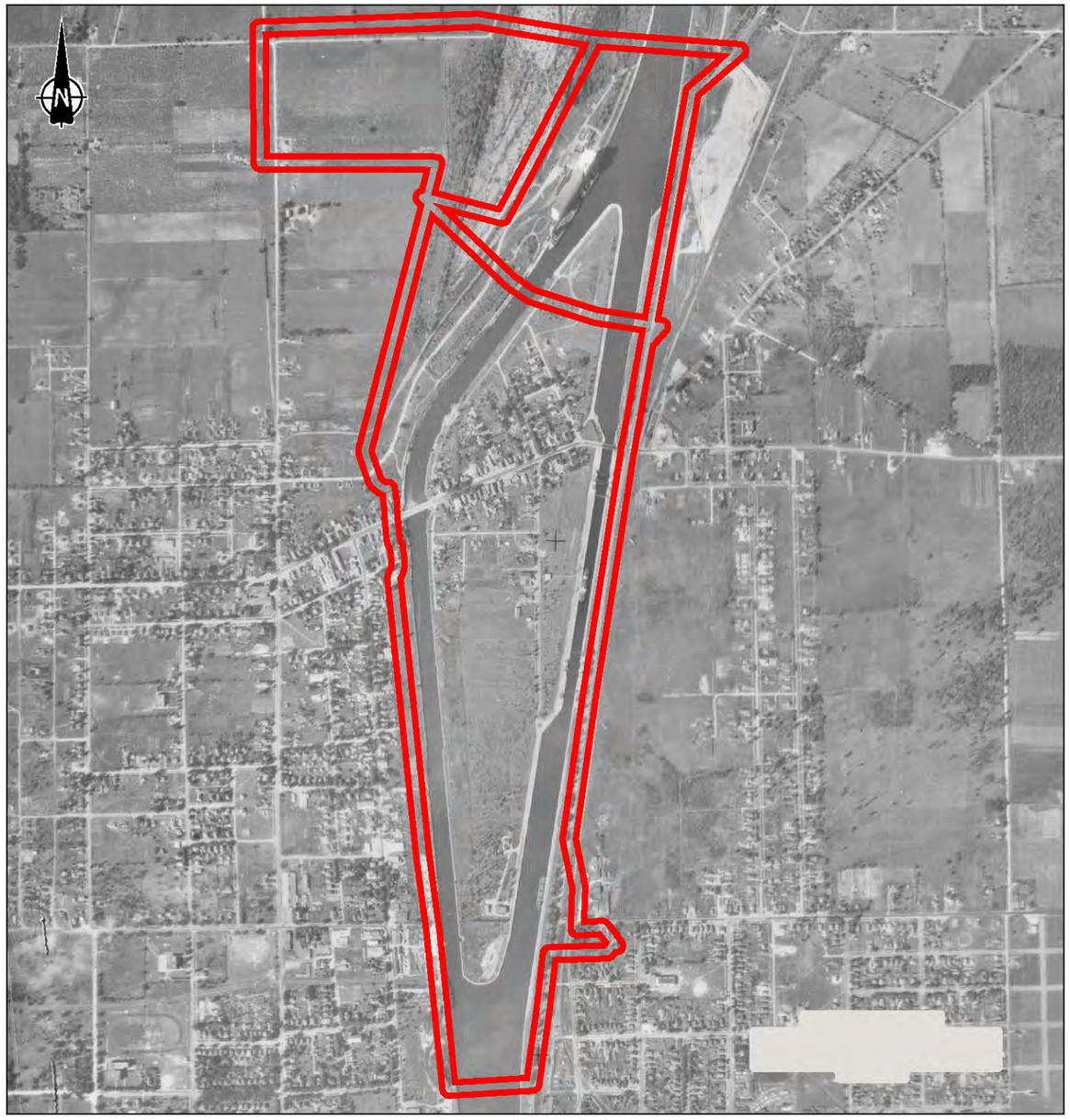
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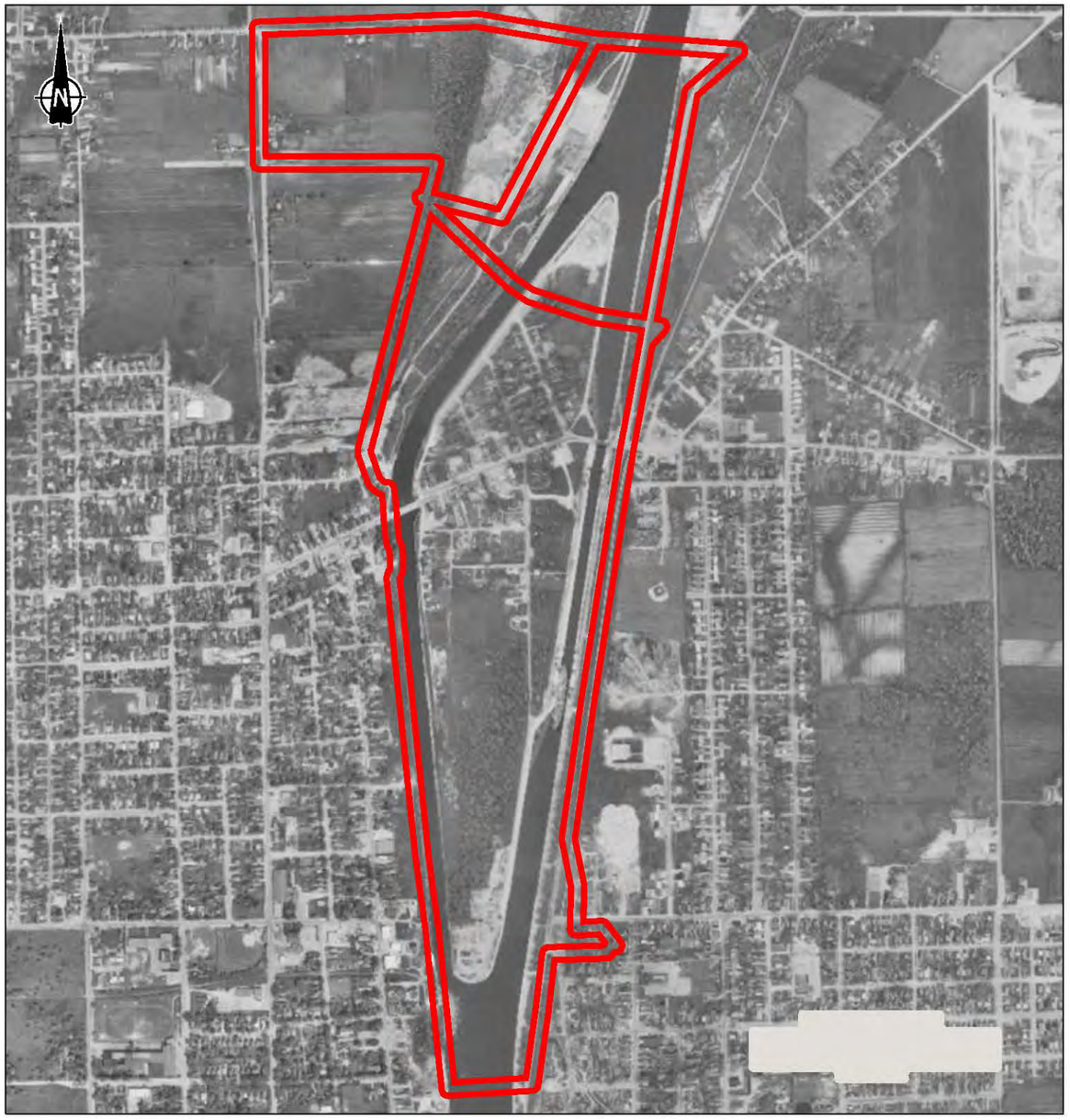
PROJECT AREA OVERLAID ON 20th CENTURY TOPOGRAPHICAL MAPS

GOLDER

PROJECT No.		20139291	FILE No. 20139291-2000-R01003
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APPROXIMATE LOCATION OF PROJECT AREA

REFERENCE

1948 [NIAGARA AIR PHOTO DIGITAL IMAGES, 1948 SERIES]. [11612-3]. ST. CATHARINES, ON: BROCK UNIVERSITY MAPS, DATA & GIS, 2016. AVAILABLE: HTTPS://WWW.ARCGIS.COM/APPS/WEBAPPVIEWER/INDEX (ACCESSED 15/JAN/2021).

1968 [NIAGARA AIR PHOTO DIGITAL IMAGES, 1968 SERIES]. [20444-35]. ST. CATHARINES, ON: BROCK UNIVERSITY MAPS, DATA & GIS, 2016. AVAILABLE: HTTPS://WWW.ARCGIS.COM/APPS/WEBAPPVIEWER/INDEX (ACCESSED 15/JAN/2021).

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT

CULTURAL HERITAGE EXISTING CONDITIONS AND PRELIMINARY IMPACT ASSESSMENT REPORT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE

PROJECT AREA OVERLAID ON 20th CENTURY AERIAL PHOTOGRAPHS

GOLDER

PROJECT No.		20139291	FILE No.	20139291-2000-R01005
DESIGN			SC-LE -S SHOWN	REV.
CADD	-MS	Feb 2/21		
CHECK				
REVIEW				

FIGURE 5

5.0 EXISTING CONDITIONS

The study area is located in the central part of the City of Port Colborne within Lots 27 and 28, Concession 1; Lots 26 to 28, Concession 2; and Lots 27 and 28, Concession 3. The study area is surrounded by farmland to the north and east, and the City of Port Colborne to the west, and south. The following Sections 5.1.1 to 5.1.4 discuss the existing conditions of the existing forcemain route (i.e. Alternative Route 1 [do nothing] / Alternative Route 4 [rehab]) and the three alternative route options (Alternative Route 2A, Alternative Route 2B and Alternative Route 3) in more detail. Alternative Route options 2A, 2B and 3 follow the same alignment between the Eastside Sewage Pumping Station and Welland Street / Barber Drive and so are discussed together in this location. Where these three alternative routes deviate, the existing conditions have been separately considered.

Table 3 summarises the identified cultural heritage resources. Further details regarding these resources are presented in the inventory tables to follow Section 5.2.1.

As described in Section 2.0, known and potential cultural heritage resources were identified based on the MHSTCI *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* (2016) checklist, which was supplemented by historical research (historic mapping) and field investigations. Properties with buildings or structures 40 or more years old determined not to have CHVI per *Ontario Regulation 9/06 Criteria for Determining Cultural Heritage Value or Interest* are listed in APPENDIX A.

5.1.1 Alternative Route 1 and Alternative Route 4

The route for both Alternative Route 1 (do nothing) and Alternative Route 4 (rehabilitation) follow the existing forcemain. These routes therefore begin at the Eastside SPS, in service since 1980 (Figure 6), located in a grassed area to the rear of properties on Fares Street and south of Killaly Street East. The Alternative Route 1 and Alternative Route 4 options then travel briefly south west, through a small woodlot, to the rear of properties on Saint Arnaud Street. Within this location the routes are within 30 m of property 110 Saint Arnaud Street, occupied by a single detached residential building listed on Port Colborne's *Heritage Property Registry*. The listing suggests the residence dates to 1880 (Port Colborne 2008) though Golder's review of available imagery and mapping suggests an interwar period between 1920 and 1940 is more likely. The pumping station appears visible, though interrupted by mature trees, from the property at 110 Saint Arnaud Street.



Figure 6: East Side SPS, facing east.

From the rear of Arnaud Street, the Alternative Route 1 and Alternative Route 4 options then travel south along the eastern bank of the Welland Canal, through a landscaped area, they cross under the Welland Canal (from east to west), south of 'The Island' and 200 m north of the Clarence Street canal crossing (Figure 1). The Island was constructed in the early 20th century to create a more direct eastern canal channel and was completed in 1932 (City of Port Colborne 2019). The Welland Canal is a dominant feature of the study area and has a federal designation as a National Historic Event under the *Historic Sites and Monuments Act* (R.S.C., 1985, c. H-4). The Canal was originally established in the early 1800's, widened in the 1850's, again in the 1880's, and again in the early 20th century. Construction of the Fourth Welland Canal began in 1913 and was officially opened in 1932 (City of Port Colborne 2019).

Upon reaching the western bank of the Welland Canal the Alternative Route 1 and Alternative Route 4 options are aligned with the railway ROW, parallel with King Street, passing to the rear of residential properties (whose grassed lots back on to the railway ROW) and travelling north to the rail underpass at Main Street West. Here, the 30 m buffer encroaches on a property noted in the field visit to have potential CHVI, 183 Main Street West. The property is a 19th century red-brick detached commercial unit, now occupied by an automotive parts business.

From the Main Street West intersection, the Alternative Route 1 and Alternative Route 4 options continue further west, along the western bank of the Welland Canal, and aligned with the railway ROW (Figure 7). They pass through vacant scrub land, before terminating at Prosperity Avenue, within an industrial / utilities zone between Elm Street and Sherwood Forest Lane (Figure 8).



Figure 7: Route of Existing Forcemain (Alternative Route 1 and Alternative Route 4) South of Prosperity Avenue



Figure 8: Existing Forcemain (Alternative Route 1 and Alternative Route 4) in the Vicinity of Prosperity Avenue

5.1.2 Alternative Route 2A, Alternative Route 2B, and Alternative Route 3

From the Eastside pumping station the three alternative routes travel the same way west along Killaly Street, towards the Welland Canal, turning northwards and aligning with Welland Street. The corner or Killaly and Welland Street is occupied by a distinctive single storey, coursed rubble property (72 Killaly Street East) with a 1925 date stone. The routes then follow the Welland Street ROW. Welland Street is a paved two lane road which runs with waterway / Lock 8 to the west and the railway to the east (Figure 9). The adjacent plots to the east are flat and largely undeveloped, interspersed with grass banks and scrub vegetation. Welland Street becomes Barber Drive at its northern extent. Here the 2A and 2B Alternative Route options continue north (as described in Section 5.1.3) whereas Route 3 (North Island Crossing) passes directly west, under the canal towards The Island (see Section 5.1.4).



Figure 9: Lock 8 from Welland Street, facing north

5.1.3 Alternative Route 2A and Alternative Route 2B

From Barber Drive, Alternative Route 2A and Alternative Route 2B turn sharply east then west, crossing under the Welland Canal, approximately 300 m north of The Island. The canal banks are generally industrial in character, with aggregate storage and loading bays to the east and with views to the grain towers and surrounding scrub/ vacant land to the west (Figure 10, Figure 11).



Figure 10: Barber Drive facing north

Once on the western side of the Welland Canal, Alternative Route 2A continues west, linking to the Barrick Road ROW and the intersection with Elm Street. Whereas Alternative Route 2B diverts, travelling directly south west,

along the north western edge of the grain terminals and former flour plant at 2 Sherwood Forest Lane. The former flour plant is a prominent feature of the canal side skyline, identified during Golder's field visit and subsequent research as having potential CHVI. The flour plant was constructed by Robin Hood Flour in the mid-1940s and is still in operation as a loading facility. The landscape in this area is industrial or vacant scrub land interspersed with small woodlots and hiking and cycling trails. The Alternative Route 2B option terminates at the Seaway Wastewater Treatment Plant, approximately 200 m southwest of the flour plant/ terminals.



Figure 11: Gravel storage and scrub to east of Barber Drive

Alternative Route 2A intersects the parcels of four properties with buildings or structures over 40 years old along Barrick Road: 186 Barrick Road, 178 Barrick Road, 172 Barrick Road, and 138 Barrick Road; however, these properties were determined to not have CHVI and are listed in APPENDIX A. Barrick Road is a wide, paved rural street with dispersed buildings, a number of mature trees and well-maintained lawns. Properties with deep setbacks line the southern side of Barrick Road while the north is mostly vacant and with far reaching rural views. There are large modern industrial complexes and a water tower at the westernmost end of Barrick Road, at the intersection with Elm Street (Figure 12).



Figure 12: Barrick Road western end, facing east (proposed Alternative Route 2A) towards the Welland Canal

Once at the Barrick Road and Elm Street intersection, the Alternative Route 2A option turns south, travelling alongside a large industrial / utilities complex setback from the street in an expansive parking lot. Elm Street is a paved rural road characterised by wide grass verges backed by woodland to the west and dispersed residential properties on the east. Reviews of historic mapping suggest the residential properties in this section of Elm Road were established between 1934 and 1968. The proposed Alternative Route 2A option intersects the parcels of two properties with buildings or structures over 40 years old: 987 Elm Street and 975 Elm Street, however, these properties were determined not to have CHVI and are listed in APPENDIX A. At 975 Elm Street, the Alternative Route 2A turns east and travels between the southern property boundary (of 975 Elm Street) and the area occupied by the Seaway Wastewater Treatment Plant, where it terminates.

5.1.4 Alternative Route 3

Where Alternative Routes 2A and 2B continue north from Barber Drive, proposed Alternative Route 3 passes under the Welland Canal towards the northern end of The Island. The Island was created in the early 20th century to create a more direct eastern channel. The former industrial landscape in this northernmost section has been redeveloped as a recreational space known as Derek Point Memorial Garden (Figure 13 and Figure 14). The garden is within the western part of property 401 Weir Road and it is this (park) area of the property which has been identified as significant from a cultural heritage perspective. The Memorial Garden park is named after Derek Zavitz, who died in 1996 during a- round the world training voyage (Welland Tribune, May 31, 2010) and the gardens are a vantage point to watch ships passing through the canal (https://www.marinerecycling.ca/page/community/). The Alternative Route 3 option continues west to the western bank of the Welland Canal where it travels north west through vacant scrub and woodlots, south of the former flour plant at 2 Sherwood Forest Lane, terminating at the Seaway Wastewater Treatment Plant.



Figure 13: View north west from Derek Point Memorial Garden



Figure 14: View south west from Derek Point Memorial Garden

5.2 Summary of Identified Cultural Heritage Resources

A summary of the identified cultural heritage resources for each route option is presented in Table 3. These are described in more detail in the inventories to follow (Section 5.2.1) and mapped in relation to the study area on Figure 15.

Table 3: Summary of identified cultural heritage resources

Cultural Heritage Resource	Options 1 and 4 (Existing)	Option 2A	Option 2B	Option 3
110 Saint Arnaud Street (property listed on the City of Port Colborne's Heritage Property Registry, 2008)	✓			
Welland Canal (National Historic Event, designated under Historic Sites and Monuments Act [R.S.C., 1985, c. H-4])	✓	✓	✓	✓
183 Main Street West (property of potential CHVI)	✓			
72 Killaly Street (property of potential CHVI)		✓	✓	✓
2 Sherwood Forest Lane – former Robin Hood Flour Plant (property of potential CHVI)			✓	
401 Weir Road - Derek Point Memorial Garden (Potential CHVI)				✓

5.2.1 Cultural Heritage Inventories

The following section includes details regarding the cultural heritage resources identified for each alternative route option. The locations of these resources are mapped in Figure 15.

110 Saint Arnaud Street –Alternative Route 1 and Alternative Route 4



Heritage Status: Property listed on the City of Port Colborne's Heritage Property Registry

Description: Single Detached Residential Property, 1880 is noted as the estimated date of construction of the Heritage Register (Port of Colborne, 2008).

CHVI: City of Port Colborne's Heritage Property Registry does not provide further information with regard to the CHVI of the listed property. It is a single storey detached residential building with rectangular massing and a steeply pitched gabled roof. The simple modest bungalow is set in an expansive plot, set back from the ROW, a separate garage / outbuilding sits to the rear of the plot. The façade features clapboard siding and small windows, with the exception of a large four-over-one multi-light window on the front (south) side. Access is from the front and west, through a narrow three paned door. Although the Heritage Register notes the estimated date of construction as 1880, the style of the property is more suggestive of an interwar period between 1920 and 1940.

Heritage Attributes: Golder suggests that the cultural heritage attributes of the property are:

- The modest, functional style associated with inter-war property;
- The rectangular massing, steep gable pitch and horizontally boarded façade; and
- Its deep set back within an expansive plot.

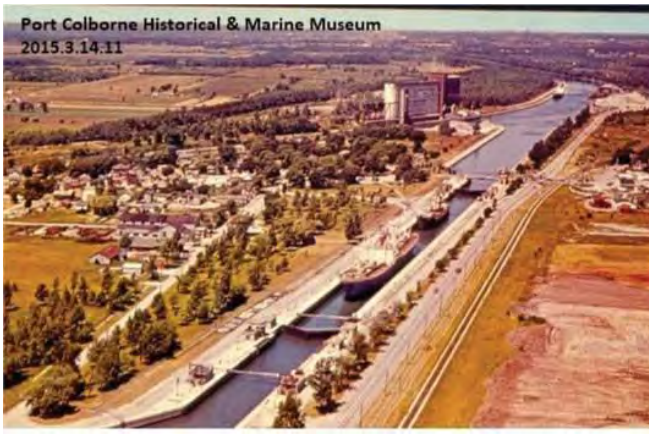
Welland Canal – Alternative Route Options 1, 2A, 2B, 3 and 4



Welland Canal, Lock 8 to left (facing north),



Welland Canal, facing north of The Island



Aerial image of Canal, lock 8 and flour mill shown, 1960s Port Colborne Historical and Maritime Museum (Ref 2015-3-14-11)



Welland Canal with Robin Hoods Flour Mill on the eastern bank (l) facing north

Heritage Status: Federally designated as a National Historic Event under the *Historic Sites and Monuments Act* (R.S.C., 1985, c. H-4), Parks Canada.

Description: National Historic Event –
The Parks Canada listing for the Welland Canal references the plaque at Thorold: "*Near this spot, on 30th November 1824, the first sod of the old Welland Canal was cut by George Keefer, President of the Welland Canal Company, in the presence of William Hamilton Merritt, chief promoter of the enterprise and about 200 other persons. This great work, connecting Lake Erie and Ontario for ship navigation, was planned and carried out by a private company".*
(https://www.pc.gc.ca/apps/dfhd/page_nhs_eng.aspx?id=1583).

Golder has described the following to provide further, local, historical context: The Canal was originally established in the early 1800's to increase the water supply to the grist-mill. The mill owner, William Hamilton Merritt, diverted the Welland River to the Twelve Mile Creek creating a deep channel to allow boats to pass through with a series of locks down the Niagara Escarpment (City of Port Colborne 2019). By 1829, the channel, dubbed "Mr. Merritts Ditch" was too long and

dangerous and by 1833, an extension to the original canal was completed, traveling through Welland to Gravelly Bay, known today as Port Colborne.

CHVI: The federal designation for the Welland Canal (Parks Canada, 1985) does not reference any associated tangible, built heritage features or landscapes, rather the *event,* which notes its value as a 'great work' of 19th century engineering and the impact its construction had on the ability to move produce between Lake Erie and Ontario. It may also be suggested that the Welland Canal (and its associated built heritage features in the vicinity of Port Colborne i.e., locks / bridges) have local and provincial historical significance. Lock 8, alongside Welland Street, is the second longest lock in the world. While the canal's visual setting, particularly the relationship between the waterway and the surrounding town contributes to its contextual value.

Heritage Attributes: based on the field visit and the information provided in the federal designation, Golder suggests that the cultural heritage attributes of the Welland Canal (as a *National Historic Event*) are its:

- Historic values linked to the construction of the waterway to connect Lake Erie and Lake Ontario, and its associated components, as a key feat of 19th century engineering and economic progress;
- Historic values afforded by the construction of the waterway and its resultant impact on the development and prosperity of Port Colborne; and
- The scenic views afforded by watercourse and riverine habitat, contributing to the local character and sense of place, used for local recreation.

183 Main Street West – Alternative Route Option 1 and Alternative Route Option 4



Canal and Weir Bridge in the 1930s, the 183 Main Street West Property is visible in the centre right of the image (Port Colborne Historical and Marine Museum, Ref: 980-38-5)



Heritage Status: Property of potential CHVI

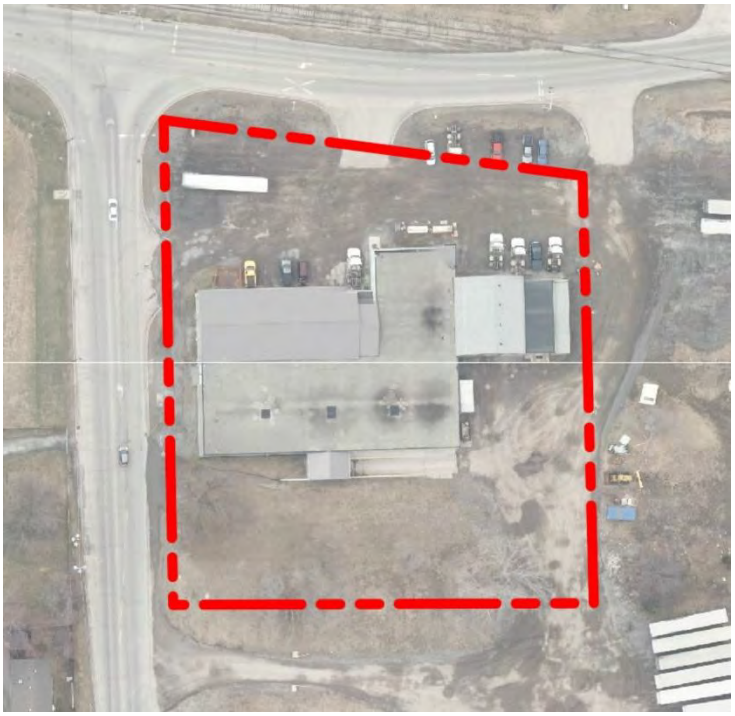
Description: Two-storey, detached commercial building

CHVI: Based on a review of historic mapping and available imagery, the property features a detached commercial residence set within a wide parking lot on the northern side of Main Street West. The detached commercial building is consistent with commercial properties of the 19th century Italianate style, the building is visible in the 1907 map. Key features include the rectangular massing and flat roof, the large picture window and the red 'stretcher' brick façade on the upper level.

Heritage Attributes: Golder suggests that the cultural heritage attributes of the property are:

- Rectangular form and flat roof;
- Large picture window; and
- Red brick 'stretcher' bond on upper level, decorative voussoirs.

72 Killaly Street East – Alternative Route Options 2A, 2B and 3



Heritage Status: Potential CHVI

Description: Single storey, distinctive commercial unit with an inscription date of 1925 over doorway.

CHVI: Based on a review of historic mapping and available imagery the property features a rectangular unit with a low gable roof and a side panelled, flat roofed, extension. The coursed rubble façade of the main commercial building is divided by coursed pilasters. There are small fixed, horizontally set rectangular windows on the western frontage with Welland Street (two within each bay). The main access appears to be from a doorway with a plain lintel, transom and two side lights.

The inscription date of 1926 is above the transom. Two fixed plain windows with a transom to match the shape of the remaining window openings are present to the west of the front access. The property is set back with a parking lot on the western (Welland Street) side.

Golder suggests that the cultural heritage attributes of the property are its:

- Historical values in its 1920s date and inscription above the doorway;
- Distinctive architectural details including horizontal windows and coursed rubble façade, divided by widely spaced coursed pilasters.

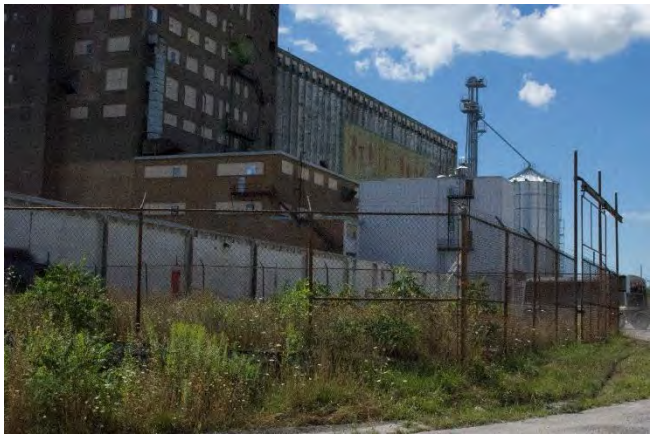
2 Sherwood Forest Lane: Former Robin Hood Flour Plant – Alternative Route Option 2B



View of Former Robin Hood Flour Plant from Derek Point Memorial Garden (Golder, 2020)



Recreational trails at 2 Sherwood Forest Lane (Golder, 2020)



View of Former Robin Hood Flour Plant facing south (Golder, 2020)



The Red Wing Ship docked in Port Colborne next to the Robin Hood Flour Plant, 1974 (Niagara Library ref 102090)

Heritage Status: Potential CHVI

Description: Flour plant and grain elevator constructed by the Robin Hood Flour Company on the west bank of the Welland Canal in the mid-1940s.
CHVI: Golder's suggests the CHVI of the property includes it striking steel structure on the west bank of the Welland Canal, constructed mid-1940s and still in use as a conveyor belt for loading and unloading cargo onto the passing cargo ships travelling through between Lake Erie and Lake Ontario.
Heritage Attributes: based on the field visit and supplementary research Golder suggests that the cultural heritage attributes of the property are its: ■ Historic values as a flour plant built during the Second World War to meet increases in local demand for commodity products, sited to make use of both the canal and the railway for the transportation of goods; ■ The contextual values afforded by the mill's prominence on the skyline, as an iconic canal-side building and its contribution to local vistas and sense of place; and ■ The property's recreational land – the flour mill is surrounded by cycling and hiking trails both canal side (The Welland Canals Trail) and in the wooded areas to the south and west, the site is also accessible from Derek Point.

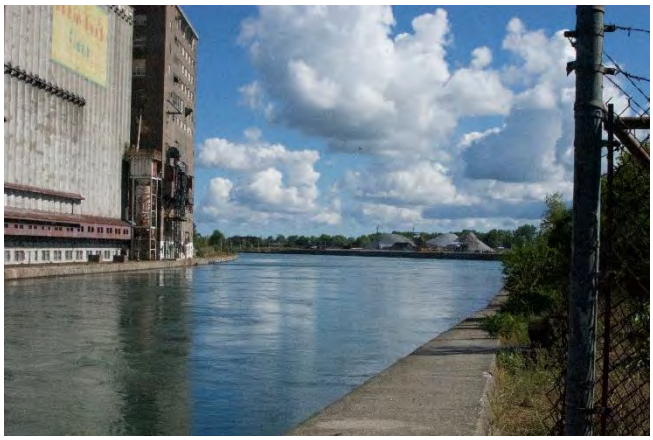
401 Weir Road - Derek Point Memorial Garden – Route Option 3



Entrance to the gardens (Golder, 2020)



Internal view / recreational trail (Golder, 2020)



View north west from the gardens (Golder, 2020)



View north east from the gardens (Golder, 2020)

Heritage Status: Potential CHVI

Description: recreational area on the northernmost point of The Island developed by the Marine Recycling Corporation in 2003. The Island was constructed in the early 20th century to create a more direct eastern channel. The garden is a local landmark and a historical reference point, its placement tied to the (re)development of the industrial landscape associated with the Welland Canal. The garden was established to transform an old industrial area for recreation, and as a vantage point to watch ships passing through the canal (https://www.marinerecycling.ca/page/community/). The park is named after Derek Zavitz, who died in 1996 during a-round the-world training voyage (Welland Tribute, May 31, 2010)

CHVI: Golder considers that the is a local landmark and a historical reference point for the modern (re)development of post-industrial spaces associated with Welland Canal. The gardens have contextual value in their visual character and natural setting which provide a local landmark and recreational asset.

Heritage Attributes: Golder's research suggests that the heritage attributes of the garden are its:

- Location on The Island, with vistas over the Welland Canal;
- Historical associations with Canal, the creation of the Island in the early 20th century, and the (re)development of post-industrial landscape in the early 2000s;
- Contextual values as a local cultural and historical landmark, memorial landscape and as a recreational space.

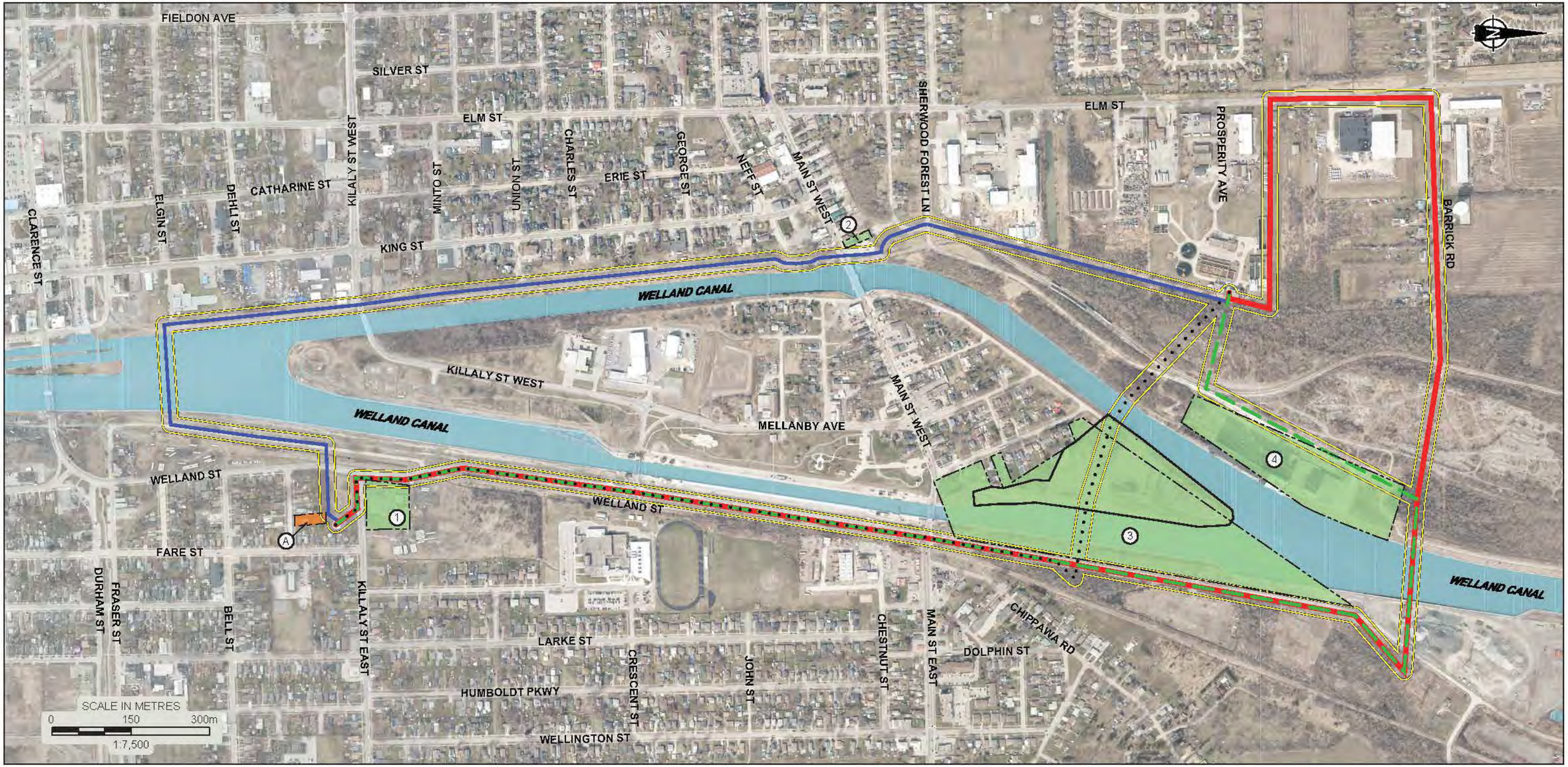
Client: Regional Municipality of Niagara

Original Format is Tabloid 279mm x 432mm

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LEGEND

- PARCEL IDENTIFIED WITH HERITAGE STATUS
- 15m BUFFER FROM ALTERNATIVES

ROUTE ALTERNATIVES
- 1 - DO NOTHING / 4 - REHAB
- 2A - BARRICK ROAD CROSSING - ROW
- 2B - BARRICK ROAD CROSSING - SEAWAY
- 3 - NORTH ISLAND CROSSING

- NATIONAL HISTORIC EVENT - WELLAND CANAL
- DEREK POINT MEMORIAL GARDEN

CULTURAL HERITAGE STATUS
- LISTED
  - (A) MN: 110 Saint Arnaud ST
- POTENTIAL CHVI
  - (1) MN: 72 Kilally St East
  - (2) MN: 183 Main St West
  - (3) MN: 401 Weir Road (Derek Point Memorial Garden)
  - (4) MN: 2 Sherwood Forest Lane (Robin Hood Flour Plant)
  - (5) MN: 975 Elm St

REFERENCE

DRAWING BASED ON AERIAL IMAGERY AND PARCEL DATA PROVIDED BY THE REGION OF NIAGARA; ROUTE ALTERNATIVES PROVIDED BY GM BLUEPLAN, SEPTEMBER 29 - 2020;

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
CULTURAL HERITAGE EXISTING CONDITIONS AND PRELIMINARY IMPACT ASSESSMENT REPORT
EASTSIDE SEWAGE PUMPING STATION FORCEMAIN REPLACEMENT
PORT COLBORNE, ONTARIO

TITLE
OVERVIEW OF CULTURAL HERITAGE SITES

GOLDER

PROJECT No.		20139291	FILE No. 20139291–2000–R01015
			SCALE -S SHOWN REV.
C-DD	DCH	Feb 3/21	
CHECK			FIGURE 15

6.0 IMPACT ASSESSMENT

6.1 Development Description

Niagara Region has begun the Schedule 'B' MCEA for the planned improvements to the City of Port Colborne's Eastside SPS Forcemain. Niagara Region has identified four alternative forcemain routes and preliminary borehole locations (Figure 1).

The four alternative route options are:

- **Alternative Route 1 (Do Nothing) / Alternative Route 4 (Rehabilitation)**: both routes are aligned with the existing forcemain route extending west from the Eastside SPS (53 Killaly Street East) to Fraser Street, south along Fraser Street, crossing the Welland Canal north of Clarence Street. The forcemain extends north along the west side of the canal to the Seaway Wastewater Treatment Plant, located at 30 Prosperity Avenue.
- **Alternative Route 2A (Barrick Road Crossing – ROW):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the canal north of The Island to Barrick Road, east to Elm Street, south to 975 Elm Street and 59 Prosperity Avenue, and east to the Seaway Wastewater Treatment Plant.
- **Alternative Route 2B (Barrick Road Crossing – SEAWAY):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the canal north of The Island to Barrick Road, southwest through 2 Sherwood Forest Lane, and west to the Seaway Wastewater Treatment Plant.
- **Alternative Route 3 (North Island Crossing):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the northern tip of The Island north of Main Street East/West, and northwest to the Seaway Wastewater Treatment Plant.

The preferred alignment is expected to be completed through a combination of open-cut construction and tunnelling operations. Alternative Route 1 involves a 'do nothing' approach and as consequence, this alternative was not carried forward for impact assessment, or consideration of mitigation.

6.2 Assessment Methodology

When determining the impact, a development or site alteration may have on known or identified built heritage resources or cultural heritage landscapes, the MHSTCI *Heritage Resources in the Land Use Planning Process* advises that the following "negative impacts" be considered:

- *Destruction* of any, or part of any, significant heritage attributes, or features[2]
- *Alteration* that is not sympathetic or is incompatible, with the historic fabric and appearance[3]
- *Shadows* created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden[4]

[2] This is used as an example of a *direct* impact in the MHSCTI *Info Bulletin 3.*

[3] A *direct* impact in the MHSCTI *Info Bulletin 3.*

[4] An *indirect* impact in the MHSCTI *Info Bulletin 3.*

- *Isolation* of a heritage attribute from its surrounding environment, context or a significant relationship[5]
- *Direct or indirect obstruction* of significant views or vistas within, from, or of built and natural features[6]
- *A change in land use* such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces[7]
- *Land disturbances* such as a change in grade that alters soils, and drainage patterns that adversely affect a cultural heritage resource[8]

Other potential impacts may also be considered such as encroachment or construction vibration (Figure 16). Historic structures, particularly those built-in masonry, are susceptible to damage from vibration caused by pavement breakers, plate compactors, utility excavations, and increased heavy vehicle travel in the immediate vicinity. Like any structure, they are also threatened by collisions with heavy machinery or subsidence from utility line failures (Randl 2001:3-6).

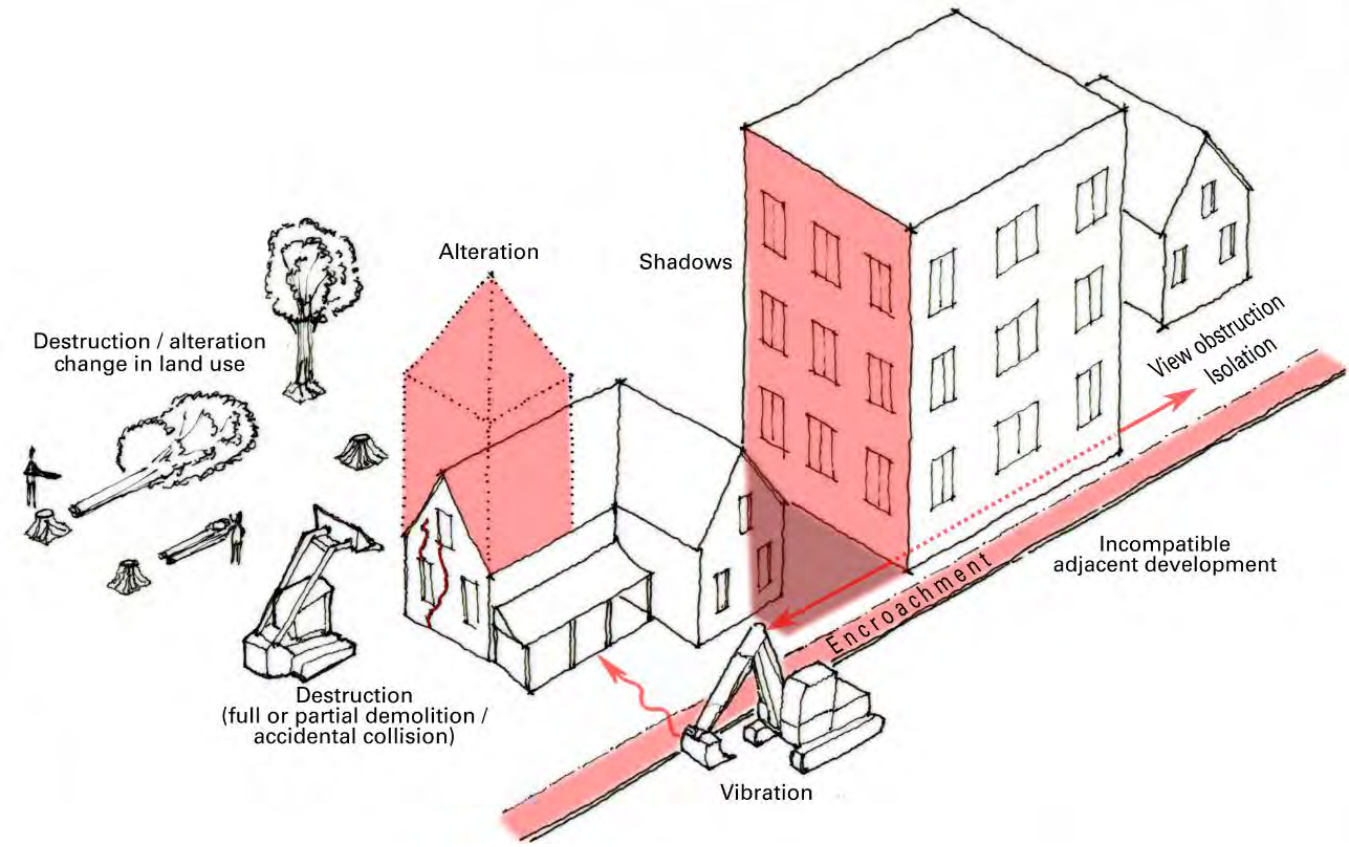


Figure 16: Examples of negative impacts

[5] An *indirect* impact in the MHSCTI *Info Bulletin 3*.

[6] An example of a *direct* and *indirect* impact in the MHSCTI *Info Bulletin 3*. It is a direct impact when significant views or vistas within, from or of built and natural features are obstructed, and an indirect impact when "a significant view of or from the property from a key vantage point is obstructed".

[7] A *direct* impact in the MHSCTI *Info Bulletin 3*.

[8] In the MHSTCI *Heritage Resources in the Land Use Planning Process* this refers only to archaeological resources but in the MHSCTI *Info Bulletin 3* this is an example of a *direct* impact to "provincial heritage property, including archaeological resources".

Although the MHSTCI *Heritage Resources in the Land Use Planning Process* identifies types of impact, it does not advise on how to describe its nature or extent. For this, the MHSTCI *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (1990:8) provides criteria of:

- Magnitude (amount of physical alteration or destruction that can be expected)
- Severity (the irreversibility or reversibility of an impact)
- Duration (the length of time an adverse impact persists)
- Frequency (the number of times an impact can be expected)
- Range (the spatial distribution, widespread or site specific, of an adverse impact)
- Diversity (the number of different kinds of activities to affect a heritage resource)

Since the 1990 MHSTCI *Guideline* guidance — nor any other Canadian guidance — does not include advice to describe magnitude, the ranking provided in the 2007 edition of the UK Highways Agency *Design Manual for Roads and Bridges* [DMRB]*: Volume 11*, HA 208/07 (2007: A6/11) is used here. Despite its title, the DMRB provides a general methodology for measuring the nature and extent of impact to cultural resources in urban and rural contexts and is the only assessment method to be published by a UK government department (Bond & Worthing 2016:167). It also formed the basis for the ICOMOS *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS 2011; Bond & Worthing 2016:166-167), and aligns in approach to those the Irish Environmental Protection Agency (reproduced in Kalman and Letourneau 2020:390) and New Zealand Transport Agency (2015).

The DMRB impact assessment ranking is:

- Major
  - Change to key historic building elements, such that the resource is totally altered. Comprehensive changes to the setting.
- Moderate
  - Change to many key historic building elements, such that the resource is significantly modified.
  - Changes to the setting of an historic building, such that it is significantly modified.
- Minor
  - Change to key historic building elements, such that the asset is slightly different.
  - Change to the setting of an historic building, such that it is noticeably changed.
- Negligible
  - Slight changes to historic building elements or setting that hardly affect it.
- No impact
  - No change to fabric or setting.

The analysis of impacts includes a summary of each impacted property's cultural heritage significance, and terms provided under conservation or mitigation recommendations are defined as follows:

- **Avoid**: A recommendation to avoid means to move project components to locations a distance from the identified cultural heritage resource. In all cases avoidance is the preferred approach, although it is recognized that other factors may preclude selecting this option.
- **Monitor for construction vibration**: Although direct impact to cultural heritage resource may be avoided, indirect impacts from construction vibration may still present a risk. If a vibration risk is identified, the following measures are usually recommended:
  - *Site control & communication*: The property and specifically the footprint of the building should be clearly marked on project mapping and communicated to all project personnel for avoidance during design, construction, and subsequent operation.
  - *Create a physical buffer*: Temporary fencing should be erected at the nearest property line or lines to ensure that all excavation, installation, and associated vehicle traffic during construction will not accidentally impact the property.
  - *Monitor for vibration impact*: Continuous ground vibration monitoring should be carried out near the foundations of the building using a digital seismograph capable of measuring and recording ground vibration intensities in digital format in each of three orthogonal directions. The instrument should also be equipped with a wireless cellular modem for remote access and transmission of data. The installed instrument should be programmed to record continuously, providing peak ground vibration levels at a specified time interval (e.g., 5 minutes) as well as waveform signatures of any ground vibrations exceeding a threshold level that would be determined during monitoring. The instrument should also be programmed to provide a warning should the peak ground vibration level exceed the guideline limits specified (such as 8.0 mm/s). In the event of either a threshold trigger or exceedance warning, data would be retrieved remotely and forwarded to designated recipients.
- **Conduct a Cultural Heritage Evaluation Report (CHER) or Cultural Heritage Impact Assessment (CHIA)**
  - If a potential cultural heritage resource cannot be avoided and will be directly impacted by the project, a cultural heritage evaluation report (CHER) is recommended to determine if the potential resource meets the criteria for CHVI as prescribed in *O. Reg. 9/06*. If the CHER determines the property has CHVI, a CHIA will be required to determine the impact of the proposed detailed design on the property's heritage attributes.

For recognized built heritage resources and cultural heritage landscapes and those evaluated to have CHVI, a CHIA is recommended to determine the impact of the proposed detailed design on the property's heritage attributes and recommend mitigation and conservation measures to reduce or avoid adverse effects. The CHIAs should follow guidance provided by the MHSTCI and any municipal terms of reference or official plan policies.

6.2.1 Impact Assessment – Alternative Route 2A: Barrick Road ROW

Table 4: Impact Assessment & Conservation Recommendations for Alternative Forcemain Route 2A

Alternative Route 2A: Barrick Road ROW		
Resource Type & Civic Address	**Analysis of Impact to Identified Cultural Heritage Resources**	**Conservation/Mitigation Measures**
National Historic Event: **Welland Canal**	The proposed forcemain route passes underneath the canal south of The Island north of the Clarence Street bridge. Construction works in the vicinity are unlikely to be invasive at ground level (the existing route is bored under the canal). Any impacts associated with related fixtures on the canal banks associated with the project would be temporary, reversible and site specific, these would not impact the (intangible) heritage attributes associated with the Canal's designation as a National Historic Event.	No conservation or mitigation is recommended.
Potential cultural heritage resource: **72 Killaly Street East**	The proposed forcemain route passes on the opposite side of Killaly Street East, approximately 30 m from the identified built heritage resource at 72 Killaly Street. Although the details of the construction work proposed along the route are unknown, it is likely that some disturbance (opencut tunneling) would occur that may induce vibration effects in the vicinity. Any potential vibration impacts would be indirect, minor and site-specific impacts to the physical heritage attributes of 72 Killaly Street.	Monitor the built heritage resource for vibration impacts during disturbance associated with the construction of the forcemain route.

6.2.2 Impact Assessment – Alternative Route 2B: Barrick Road Seaway

Table 5: Impact Assessment & Conservation Recommendations for Alternative Forcemain Route 2B

Alternative Route 2B		
Resource Type & Civic Address	**Analysis of Impact to Identified Cultural Heritage Resources**	**Conservation/Mitigation Measures**
National Historic Event: **Welland Canal**	The proposed forcemain route crosses underneath the canal between The Island and the Clarence Street bridge. Construction works in the vicinity are unlikely to be invasive at ground level (the existing route is bored under the canal). Any related fixtures on the canal banks associated with the project would be temporary, their impacts would be reversible and site specific, these would not impact the (intangible) heritage attributes associated with the Canal's designation as a National Historic Event.	No conservation or mitigation is recommended.
Potential cultural heritage resource: **72 Killaly Street East**	The proposed forcemain route passes on the opposite side of Killaly Street East, approximately 30 m from the identified built heritage resource at 72 Killaly Street. Although the details of the construction work proposed along the route are unknown, it is likely that some disturbance (opencut tunneling) would occur that may induce vibration effects in the vicinity. Any potential vibration impacts would be indirect, minor and site-specific impacts to the physical heritage attributes of 72 Killaly Street.	Monitor the built heritage resource for vibration impacts during ground disturbance associated with the construction of the forcemain route.
Potential cultural heritage resource: **2 Sherwood Forest Lane: former Robin Hood Flour Plant**	The proposed forcemain route passes along the north western edge of the property line, approximately 30 – 60 m from the identified built heritage resource at 2 Sherwood Forest Lane. Although the details of the construction work proposed along the route are unknown, it is likely that some disturbance (i.e., opencut tunneling) would occur that may induce vibration effects in the vicinity. Any potential vibration impacts would be indirect, minor and site-specific impacts to the physical heritage attributes of the flour plant at Robin Hood Lane. No impact to the setting of the potential heritage resource is predicted since the visual attributes of the resource relate to its canal side frontage and the vistas between the property and The Island / Welland Canal (i.e., the south eastern side of the flour plant).	Monitor the built heritage resource for vibration impacts during disturbance associated with the construction of the forcemain route

6.2.3 Impact Assessment – Alternative Route 3: North Island Crossing

Table 6: Impact Assessment & Conservation Recommendations for Alternative Forcemain Route 3

Alternative Route 3		
Resource Type & Civic Address	**Analysis of Impact to Identified Cultural Heritage Resources**	**Conservation/Mitigation Measures**
National Historic Event: **Welland Canal**	The proposed forcemain route crosses underneath the canal between The Island and the Clarence Street bridge. Construction works in the vicinity are unlikely to be invasive (the existing route is bored under the canal). Any related fixtures on the canal banks associated with the project would be temporary, and their impacts would be reversible and site specific, these would not impact the (intangible) heritage attributes associated with the Canal's designation as a National Historic Event.	No conservation or mitigation is recommended.
Potential cultural heritage resource: **72 Killaly Street East**	The proposed forcemain route passes on the opposite side of Killaly Street East, approximately 30 m from the identified built heritage resource at 72 Killaly Street. Although the details of the construction work proposed along the route are unknown, it is likely that some disturbance (opencut tunneling) would occur that may induce vibration effects in the vicinity. Any potential vibration impacts would be indirect, minor and site-specific impacts to the physical heritage attributes of 72 Killaly Street.	Monitor the built heritage resource for vibration impacts during disturbance associated with the construction of the forcemain route.
Potential cultural heritage resource: **401 Weir Road - Derek Point Memorial Garden**	The proposed forcemain route passes through the centre of the potential cultural heritage resource, Derek Point Memorial Garden. Although the details of proposed construction activities along the route are unknown, it is likely that some disturbance (opencut tunneling) would occur in the vicinity of the park. These works would have a temporary, site specific, minor impact on setting (within the park), and its recreational and aesthetic values. No impact on the wider setting is predicted, with the vistas between the garden, the canal and the flour mill site unaffected.	To reduce the temporary impacts on setting, any vegetation clearance required should be limited to reduce any impacts on the visual context, setting and the heritage attributes of the memorial garden. Where vegetation removal is unavoidable, incorporate into the detailed design a strategy for replacement planting.

6.2.4 Impact Assessment – Alternative Route 4 (Rehabilitation)[9]

Table 7: Impact assessment & conservation recommendations for Alternative Route 4

Alternative Route 4 (Rehabilitation)		
Resource Type & Civic Address	**Analysis of Impact to Identified Cultural Heritage Resources**	**Conservation/Mitigation Measures**
Property listed on Port of Colborne Heritage Register: **110 Saint Arnaud Street**	The existing (subsurface) forcemain route is 30 – 50 m south of the identified built heritage resource at 110 Saint Arnaud Street. Although the details of the rehabilitation work proposed along the route are unknown, it is likely that some disturbance would occur that may induce vibration effects. Any potential vibration impacts would be indirect, minor and site-specific impacts to the potential heritage attributes of 110 Saint Arnaud Street.	Monitor the built heritage resource for vibration impacts during disturbance associated with the rehabilitation of the existing forcemain route.
National Historic Event: **Welland Canal**	The existing forcemain route crosses underneath the canal between The Island and the Clarence Street bridge. Rehabilitation works in the vicinity are unlikely to be invasive (the existing route is bored under the canal). Any rehabilitation fixtures on the canal banks associated with the project would be temporary, and their impacts would be reversible and site specific, these would not impact the (intangible) heritage attributes associated with the Canal's designation as a National Historic Event.	No conservation or mitigation is recommended.
Potential cultural heritage resource: **183 Main Street West**	The existing (subsurface) forcemain route is approximately 15 m east of the built heritage resource at 183 Main Street West. Although the details of the rehabilitation work proposed along the route are unknown, it is likely that some disturbance would occur that may induce vibration effects. Any potential vibration impacts would be indirect, minor and site-specific impacts to the physical heritage attributes of 183 Main Street West.	Monitor the built heritage resource for vibration impacts during disturbance associated with the rehabilitation of the existing forcemain route.

[9] Alternative Route 1 involves a 'do nothing' approach and as consequence, this alternative is not carried forward for impact assessment, or consideration of mitigation.

7.0 CONSIDERATION OF ALTERNATIVES

The preceding impact assessments of Route Alternatives 2A, 2B, 3 and 4 has determined a range of potential outcomes from no impact to indirect impacts that can be fully mitigated. These are listed in the following subsections. As Alternative Route 1 involves a 'do nothing' approach, this option was not carried forward for impact assessment.

7.1 No Impact

All three route options considered for the Study will result in sections where no impacts to identified cultural heritage resources is anticipated:

- **Route 2A**: Welland Canal (National Historic Event)
- **Route 2B**: Welland Canal (National Historic Event)
- **Route 3**: Welland Canal (National Historic Event)
- **Route 4:** Welland Canal (National Historic Event)

7.2 Indirect Impacts that can be fully mitigated

All three route options will result in potential impacts that can be fully mitigated if the proposed recommendations are implemented:

- **Route 2A**: 72 Killaly Street East
- **Route 2B**: 72 Killaly Street East, 2 Sherwood Forest Lane: former Robin Hood Flour Plant (potential CHVI)
- **Route 3**: 72 Killaly Street East and 401 Weir Road: Derek Point Memorial Garden (potential CHVI)
- **Route 4**: 110 Saint Arnaud Street (property listed on the Port Colborne Heritage Register) and 183 Main Street West (potential CHVI)

8.0 SUMMARY STATEMENT AND RECOMMENDATIONS

In August 2020, Niagara Region (the Client) retained Golder Associates Ltd. (Golder) to conduct a Cultural Heritage Existing Conditions and Preliminary Impact Assessment to support a Municipal Class Environmental Assessment (MCEA) to assess alternative routes for the Eastside Sewage Pumping Station (SPS) forcemain in the City of Port Colborne (the Project). The Cultural Heritage Existing Conditions and Preliminary Impact Assessment evaluated four alternative routes generally bound by Barrick Road to the north, Highway 140/Elizabeth Street to the east, Kent Street and Lakeshore Road East to the south and Fielden Avenue to the west.

The four alternative route options are:

- **Alternative Route 1 (Do Nothing) / Alternative Route 4 (Rehabilitation)**: both routes are aligned with the existing forcemain route extending west from the Eastside SPS (53 Killaly Street East) to Fraser Street, south along Fraser Street, crossing the Welland Canal north of Clarence Street. The forcemain extends north along the west side of the canal to the Seaway Wastewater Treatment Plant, located at 30 Prosperity Avenue.
- **Alternative Route 2A (Barrick Road Crossing – ROW):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, it crosses the Welland Canal north of The Island to Barrick Road, east to Elm Street, south to 975 Elm Street and 59 Prosperity Avenue, and east to the Seaway Wastewater Treatment Plant.
- **Alternative Route 2B (Barrick Road Crossing – Seaway):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses The Welland Canal north of The Island to Barrick Road, southwest through 2 Sherwood Forest Lane, and west to the Seaway Wastewater Treatment Plant.
- **Alternative Route 3 (North Island Crossing):** the route extends west from the Eastside SPS to Killaly Street East, west to Welland Street, north to Barber Drive, crosses the northern tip of The Island north of Main Street East/West, and northwest to the Seaway Wastewater Treatment Plant.

The preferred alignment is expected to be completed through a combination of open-cut construction and tunnelling operations.

The Cultural Heritage Existing Conditions and Preliminary Impact Assessment assessed a 30 m buffer (15 m either side of the centre line) around the alternative route options (the study area). As alternative Route 1 involves a ‘do nothing’ approach this alternative was not carried forward for impact assessment, or consideration of mitigation. The study area is located within Lots 27 and 28, Concession 1; Lots 26 to 28, Concession 2; and Lots 27 and 28, Concession 3, in the Geographic Township of Humberstone, former County of Welland, now in the City of Port Colborne, Regional Municipality of Niagara.

Following guidelines provided by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI), municipal documents such as the Regional Municipality of Niagara and City of Port Colborne official plans, as well as recognized conservation manuals such as Canada’s Historic Places *Standards and Guidelines for the Conservation of Historic Places in Canada* (2010), this Cultural Heritage Existing Conditions and Preliminary Impact Assessment identified the applicable heritage policies, summarized the study area’s geography and history, identified known and potential built heritage resources and cultural heritage landscapes, and evaluated

properties identified to have potential built heritage resources and cultural heritage landscapes using *Ontario Regulation 9/06 Criteria for Determining Cultural Heritage Value or Interest*. Subsequently, identified built heritage resources and cultural heritage landscapes were assessed for impacts, and, based on the impacts identified conservation or mitigation strategies to avoid or reduce adverse effects to the identified built heritage resources and cultural heritage landscapes were recommended.

In summary, this Cultural Heritage Existing Conditions and Preliminary Impact Assessment identified:

- One (1) National Historic Event under *Historic Sites and Monuments Act* (R.S.C., 1985, c. H-4)
- One (1) property listed (not designated) on the City of Port Colborne's Heritage Property Registry
- Four (4) properties of potential cultural heritage value or interest (CHVI)

Recommendations to avoid or reduce adverse impacts to the identified known and potential cultural heritage resources are summarized below. Note that these recommendations are based on Golder's current understanding of the Project and may need to be revisited if components are moved or altered.

Alternative Forcemain Route 2A Barrick Road Crossing ROW	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
National Historic Event: **Welland Canal**	**No conservation or mitigation is recommended.**
Potential Cultural Heritage Resource: **72 Killaly Street East**	■ Indirect impacts from vibration during construction works associated with the alignment which runs approximately 30 m from the identified built heritage resource. **Recommendation**: Monitor the built heritage resource for vibration impacts during ground invasive works associated with construction.

Alternative Forcemain Route 2B Barrick Road Crossing Seaway	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
National Historic Event: **Welland Canal**	**No conservation or mitigation is recommended.**
Potential Cultural Heritage Resource: **72 Killaly Street East**	■ Indirect impacts from vibration during construction works associated with the alignment which runs approximately 30 m from the identified built heritage resource.

Alternative Forcemain Route 2B Barrick Road Crossing Seaway	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
	Recommendation: ■ Monitor the built heritage resource for vibration impacts during ground invasive works associated with construction.
Potential Cultural Heritage Resource: 2 Sherwood Forest Lane: former Robin Hood Flour Plant	■ The proposed route passes along the north western edge of the property line, approximately 30 – 60 m from the identified built heritage resource at 2 Sherwood Forest Lane. ■ Any invasive groundworks (i.e., opencut tunneling) would induce vibration effects in the vicinity. Any potential vibration impacts would result in indirect, minor, site specific impacts to the physical heritage attributes of the flour plant at Robin Hood Lane. ■ No impact to the setting of the potential heritage resource is predicted since the visual attributes of the resource relate to its canal-side frontage and the vistas between the property and The Island / Welland Canal (i.e., the south eastern side of the flour plant). **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during disturbance associated construction.

Alternative Forcemain Route 3 North Island Crossing	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
National Historic Event: **Welland Canal**	**No conservation or mitigation is recommended.**
Potential Cultural Heritage Resource: **72 Killaly Street East**	■ Indirect impacts from vibration during construction works associated with the alignment which runs approximately 30 m from the identified built heritage resource.

Alternative Forcemain Route 3 North Island Crossing	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
	Recommendation: ■ Monitor the built heritage resource for vibration impacts during disturbance associated with construction.
Potential CHVI: **401 Weir Road - Derek Point Memorial Garden**	■ Disturbance (opencut tunneling) would occur in the vicinity of the park. These works would have a temporary, site specific, minor impact on setting (within the park), and its recreational and aesthetic values. ■ No impact on the wider setting is predicted, with the vistas between the garden, the canal and the flour mill site unaffected. **Recommendation**: ■ To reduce the temporary impacts on setting, any vegetation clearance required should be limited to reduce any impacts on the visual context, setting and the heritage attributes of the memorial garden. Where vegetation removal is unavoidable, incorporate into the detailed design a strategy for replacement planting.

Alternative Forcemain Route 4 (Rehabilitation)	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
Property listed on Port of Colborne Heritage Register: **110 Saint Arnaud Street**	■ Indirect impacts from vibration during sub-surface rehabilitation works associated with the existing alignment which runs 30 – 50 m from the identified built heritage resource. **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during disturbance associated with the rehabilitation of the existing forcemain route.
National Historic Event: **Welland Canal**	**No conservation or mitigation is recommended.**

Alternative Forcemain Route 4 (Rehabilitation)	
Resource Type & Civic Address	**Summary of Impact and Mitigation Measures**
Potential Cultural Heritage Resource: **183 Main Street West**	■ Indirect impacts from vibration during sub-surface rehabilitation works associated with the existing alignment which runs approximately 15 m from the identified built heritage resource. **Recommendation**: ■ Monitor the built heritage resource for vibration impacts during disturbance associated with the rehabilitation of the existing forcemain route.

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https://golderassociates.sharepoint.com/sites/123072/project files/6 deliverables/02 checpia/20139291-r01_rev0-4mar21_niagara forcemain colborne checpia.docx

APPENDIX A

Properties with buildings or structures 40 years old or more evaluated not to have potential CHVI

Table 8: Properties with structure 40 or more years old that do not have CHVI

Civic Address	Brief Description	Evaluation
138 Barrick Road	Single-detached one-and-a -half storey, gabled residence with an adjacent hipped roof outbuilding.	The property does not demonstrate CHVI since it is executed with an average level of construction expertise. It has no apparent historical associations.
172 Barrick Road	Single storey two bay gabled residence with horizontal siding.	The property does not demonstrate CHVI since it is executed with widely available materials and an average level of construction expertise. It has no apparent historical associations.
178 Barrick Road	One-and-a-half storey detached mid-century residence with low pitched roof.	The property does not demonstrate CHVI since it is executed with widely available materials and an average level of construction expertise. It has no apparent historical associations.
186 Barrick Road	Single storey, two bay detached residence	The property does not demonstrate CHVI since it is executed with widely available materials and an average level of construction expertise. It has no apparent historical associations.
975 Elm Street	Single storey detached residence. Recently remodelled.	The property does not demonstrate CHVI since it is executed with widely available materials and an average level of construction expertise. It has no apparent historical associations.
987 Elm Street	One -and-a-half-storey detached residence.	The property does not demonstrate CHVI since it is executed with an average level of construction expertise. It has no apparent historical associations.



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APPENDIX E: HYDROGEOLOGICAL ASSESSMENT AND GEOTECHNICAL ASSESSMENT (PREPARED BY TERRAPROBE INC)

Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

GEOTECHNICAL REPORT
EASTSIDE SPS FORCEMAIN REPLACEMENT
THE REGIONAL MUNICIPALITY OF NIAGARA
CITY OF PORT COLBORNE, ONTARIO

PREPARED FOR: The Regional Municipality of Niagara
1815 Sir Isaac Brock Way
Thorold, Ontario
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SGS Final Report Laboratory Test Results – Ground Water Chemistry

1.0 INTRODUCTION

Terraprobe has been retained by The Regional Municipality of Niagara (Niagara Region) to provide consulting engineering services in support of a Municipal Class Environmental Assessment study for the Eastside Sewage Pumping Station (SPS) forcemain replacement in the City of Port Colborne.

The terms of reference and the scope of work for the geotechnical engineering services are outlined in the Region's RFP No. 2019-RFP-337. This report presents factual data and preliminary design recommendations on the proposed forcemain crossing in a tunnel below the Welland Canal in Port Colborne, Ontario.

2.0 SITE AND PROJECT DESCRIPTION

The site (with UTM coordinates of N 4,752,230; E 643,350) is located in Port Colborne, Ontario. The crossing is approximately 200 m long and extends from the east bank of the Welland Canal at Barber Drive to the west bank of the Welland Canal in the vicinity of an asphalt paved path located approximately 125 m northeast of Omer Avenue. The Welland Canal at this location is approximately 105 m wide. Terraprobe's Borehole Location Plan (Drawing 4) provides an overview of the site location.

3.0 REGIONAL GEOLOGY

The physiography of the City of Port Colborne generally reflects the topography of the local bedrock surface. The area is generally flat except for the Onondaga Escarpment which is an irregular east-west trending bedrock feature in the area. The Onondaga Escarpment acts as a ground water divide with recharge from this area moving north to Lake Ontario and south to Lake Erie. This regional flow pattern is also modified in the vicinity of the Welland Canal[1].

The overburden soils are underlain by Paleozoic sedimentary rocks consisting of the surficial Bois Blanc bedrock formation, underlain by the Bertie-Akron formation followed by the Salina formation. The Bertie-Akron formation can be divided into four units. The lowermost unit is a massive to medium-bedded dolomite. This lowermost unit is consecutively overlain by a thin-bedded shaley dolomite, a massive to laminated brown dolomite and an upper mottled dolomite.

4.0 PREVIOUS INVESTIGATIONS

In the early 1970's the Department of Transportation and Communications (currently Ministry of Transportation, Ontario) considered a proposed Highway 3 crossing of the Welland Canal to the south of this proposed crossing. Field investigations were carried out along two tunnel alignments. A total of eleven boreholes were drilled, ten of which were extended approximately 30.5 m below ground surface and one borehole was extended to a depth of 12.2 m below ground surface. This study reported the following geologic bedrock formations and lithology extending from ground surface to the borehole termination depths:

- Bois Blanc Formation - approximately 10.3 m thick bedrock consisting of coralline limestone, limestone and fossiliferous limestone;

1 Ontario Geological Survey, Aggregate Resources Inventory of the Port Colborne and Town of Fort Erie, Regional Municipality of Niagara, Ontario Geological Survey, Aggregate Resources Inventory, Paper 117, 1985.

- Oriskany Formation - approximately 0.2 m to 0.6 m thick sandstone bedrock;
- Akron (Bertie-Akron) Formation - approximately 14 m to 19 m thick bedrock consisting of mottled dolomite, shaley dolomite, brown porous dolomite, shale and dolomitic shale; and
- Salina Formation - bedrock consisting of gypsum rich shale and dolomitic shale extending to the borehole termination depths.
- The borehole location plan and stratigraphic profiles of the two tunnel alignments are provided as Drawings 1, 2 and 3. The stratigraphic profiles indicate that the bedrock was excavated to construct the current waterways.

5.0 INVESTIGATION PROCEDURES

The field work for this project was carried out during the period of August 24 to September 01, 2020. Two boreholes numbered Borehole 4 and Borehole 5 were drilled and sampled to depths of 25.6 m and 25.7 m respectively below ground surface at the approximate locations shown on Drawing 4. The boreholes were marked in the field by Terraprobe's staff in relation to existing features shown on the drawing provided by GM BluePlan Engineering Limited (GM BluePlan). The boreholes were also surveyed for coordinates and geodetic elevation with a Trimble R10 Receiver connected to the Global Navigation Satellite System. The borehole data is summarized in the following table.

Borehole No.	UTM NAD 83 Coordinates (Zone 17)		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing (m)	Easting (m)		
BH 4	4 752 277.4	643 508.5	176.9	25.6
BH 5	4 752 295.2	643 298.0	177.0	25.7

The boreholes were drilled with a track mounted drill rig supplied and operated by a specialist drilling contractor. Terraprobe's staff observed and recorded the drilling, sampling and in situ testing operations and logged the boreholes and rock cores.

Samples of the overburden soils were generally obtained at intervals of 0.75 m depth using a 50 mm outer diameter (O.D.) split-spoon sampler in conjunction with the Standard Penetration Testing (SPT) procedures as specified in ASTM Method D 1586[2]. The bedrock was also cored by HQ-size diamond coring techniques. During drilling headspace vapour readings were also measured for volatile organic compounds and hydrocarbons with a photoionization detector and a flame ionization detector respectively.

Ground water conditions in the open boreholes were observed during the drilling operations and standpipe piezometers were installed in both boreholes to permit longer term ground water level monitoring and hydraulic conductivity assessments of the bedrock.

The recovered soil and rock samples were subjected to Visual Identification (VI). Select soil samples were subjected to a laboratory testing programme consisting of natural moisture content, grain size distribution analyses and Atterberg limits determinations. Select rock samples were also subjected to a laboratory testing programme consisting of unconfined compressive strength, unit weight and point load index determinations. All tests were carried out in accordance with MTO and/or ASTM Standards as appropriate. Rock samples were also submitted to Geomechanica Inc. for CERCHAR abrasivity and slake durability

2 ASTM D1586 – Standard Test Method for Standard Penetration Tests and Split Barrel Sampling of Soils.

testing. Soil, rock and ground water samples were also submitted to SGS Canada Inc. (SGS) for chemical testing.

6.0 SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole Sheets in Appendix A. Details of the encountered soil and bedrock stratigraphy are presented in this appendix. An overall description of the stratigraphy is given in the following paragraphs.

The stratigraphic boundaries shown on the Record of Borehole Sheets and on the interpreted stratigraphic sections are inferred from non-continuous soil sampling and therefore represent transitions between soil types rather than exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

In summary, a flexible pavement, and fill soils consisting of compact gravelly sand and firm silty clay to clay were encountered at the site. The fill material is further underlain by a deposit of firm to hard silty clay to clay. The overburden soils are further underlain by limestone bedrock.

6.1 Flexible Pavement

Borehole 5 was drilled through the existing pathway pavement and encountered a flexible pavement consisting of 95 mm thick asphaltic concrete underlain by a 405 mm thick layer of gravelly sand fill that extends to a depth of 0.5 m (elevation 176.5 m) below ground surface.

A Standard Penetration test carried out in the gravelly sand fill measured a SPT N-value of 12 blows for 0.3 m of penetration indicating a compact relative density. The natural water content of a sample of the gravelly sand fill is 6% by weight.

6.2 Fill - Gravelly Sand

Gravelly sand fill material was encountered at Borehole 4. The gravelly sand fill layer is approximately 0.6 m thick and extends to elevation 176.3 m. A Standard Penetration test carried out in the gravelly sand fill, measured a SPT N-value of 22 blows for 0.3 m of penetration, indicating a compact relative density. The natural water content of a sample of the gravelly sand fill is 5% by weight.

6.3 Fill - Silty Clay to Clay

Silty clay to clay fill was encountered at this site. The locations, thicknesses, depths and base elevations of the silty clay to clay fill are summarized in the following table.

Borehole No.	Fill Thickness (m)	Fill Depth (m)	Fill Base Elevation (m)
BH 4	1.5	2.1	174.8
BH 5	0.9	1.4	175.6

Standard Penetration tests carried out in the silty clay to clay fill measured SPT N-values of 7 blows for 0.3 m of penetration indicating a firm consistency. The natural water content of samples of the silty clay to clay fill range from 26% to 36% by weight.

The grain size distribution curve of a sample of the silty clay to clay fill is depicted on Figure B1 in Appendix B. These results show a grain size distribution consisting of 0% gravel, 3% sand, 26% silt and 71% clay size particles.

A sample of the silty clay to clay fill was also subjected to Atterberg Limits tests and the results are presented on Figure B2 in Appendix B. These results indicate that the fill is a high plasticity (CH) cohesive soil. The results from the Atterberg limits tests are summarized below:

Liquid Limit:	60%
Plastic Limit:	26%
Plasticity Index:	34%
Natural Moisture Content:	26%

6.4 Silty Clay to Clay

A native silty clay to clay deposit was encountered at this site. The locations, thicknesses, depths, and base elevations of the silty clay to clay deposit are summarized in the following table.

Borehole No.	Thickness (m)	Depth (m)	Base Elevation (m)
BH 4	1.6	3.7	173.2
BH 5	0.7	2.1	174.9

Standard Penetration tests carried out in the silty clay to clay deposit measured SPT N-values that range from 7 to more than 100 blows for 0.3 m of penetration indicating a firm to hard consistency. The moisture content of two samples of the silty clay to clay deposit are 27% and 28% by weight.

A grain size distribution test was carried out on a sample of the silty clay to clay deposit and the grain size distribution curve is illustrated in Figure B3, Appendix B. These results show a grain size distribution consisting of 2% gravel, 5% sand, 29% silt and, 64% clay size particles.

A sample of the silty clay to clay was also subjected to Atterberg Limits tests and the results are presented on Figure B4 in Appendix B. These results indicate that the silty clay to clay is a high plasticity (CH) cohesive soil. The results from the Atterberg limits tests are summarized below:

Liquid Limit:	53%
Plastic Limit:	24%
Plasticity Index:	29%
Natural Moisture Content:	28%

6.5 Bedrock

The overburden soils are underlain by limestone bedrock. Summarized below are the depths to bedrock and the bedrock surface elevations.

Borehole No.	Depth to Bedrock (m)	Top of Bedrock Elevation (m)
BH 4	3.7	173.2
BH 5	2.1	174.9

Within the depth of the investigations, the bedrock is described as unweathered and thickly bedded to massive consisting of an upper Dolomitic Limestone unit underlain by a Shaley Limestone unit. The Dolomitic Limestone is greyish brown in color and the Shaley Limestone has a grey to dark grey color.

Photographs of the bedrock core samples are provided in Figures B5 to B13 in Appendix B. Summarized below are the Rock Quality Designation, Rock Mass Quality, Total Core Recovery and Solid Core Recovery.

Borehole No.	Rock Quality Designation (RQD)	Rock Mass Quality[3]	Total Core Recovery (TCR)	Solid Core Recovery (SCR)
BH 4	8% to 91%	Very Poor to Excellent	47% to 100%	11% to 96%
BH 5	0% to 91%	Very Poor to Excellent	95% to 100%	74% to 100%

Point Load Index Tests were carried out on the bedrock core samples and the laboratory test data is provided in Figures B14, B15, B16 and B17. Unconfined compressive strength (UCS) tests and unit weight determination tests were also carried out on six core samples.

The UCS test results classify these tested portions of the bedrock as weak (R2 grade, 5 MPa < UCS < 25 MPa) to very strong (R5 grade, 100 MPa < UCS < 250 MPa), according to Table 3.5 of the *Canadian Foundation Engineering Manual 2006*. The unit weight of bedrock core samples ranges from 23.5 kN/m^3 to 26.5 kN/m^3. The interpreted unconfined compressive strength (UCS) results and the rock strength classification, are summarized in the following table.

Borehole No.	Elevation (m)		Lithology	UCS (MPa)	Strength Grade
	From	To			
BH 4	173.2	171.4	Dolomitic Limestone	15.2 – 115.1	R2 to R5
	171.4	164.3	Shaley Limestone	34.9 – 189.6	R3 to R5
	164.3	151.3	Shaley Limestone with Gypsum Inclusions	15.6 – 72.3	R2 to R4
BH 5	174.9	171.6	Dolomitic Limestone	25.3 – 160.0	R3 to R5
	171.6	166.6	Shaley Limestone	8.1 – 102.4	R2 to R5
	166.6	151.3	Shaley Limestone with Gypsum Inclusions	12.7 – 104.2	R2 to R5

The bedrock property data are summarized in Figures C4-1 and C4-2, Appendix C4.

6.5.1 Packer Tests (Lugeon Tests)

Packer tests were carried out in both boreholes to measure the hydraulic conductivity of the rock mass surrounding the borehole. The tests were performed at 3.0 m intervals by the packer test method, using a double pneumatic packer charged with nitrogen. The tests were performed at five to seven pressure increments, and the injected volume of water was measured with a flow meter at regular time intervals.

The Lugeon test analysis results are presented in Appendix C1. It should be noted that the interpretation of the water pressure tests was based mainly on the assumption that the features are equally distributed over the test section or the interpreted section.

3 Deere et al., 1967.

Tabulated below are the test locations, geodetic elevation, Lugeon pattern and hydraulic conductivity of the tested section.

Borehole Number	Test Interval Geodetic Elevation (m)	Lugeon Pattern Group	Hydraulic Conductivity (m/s)
BH 4	171.6 to 168.5	Turbulent	1.14×10^{-5}
	168.5 to 165.5	Turbulent	1.09×10^{-5}
	161.7 to 158.6	Wash Out	5.92×10^{-6}
	158.6 to 155.6	-	No Take
	155.6 to 152.5	-	No Take
BH 5	173.0 to 170.0	Turbulent	9.09×10^{-6}
	169.6 to 166.6	Wash Out	5.88×10^{-6}
	165.1 to 162.0	-	No Take
	160.5 to 157.4	-	No Take
	155.9 to 152.9	-	No Take

6.5.2 Rising Head Well Response Tests

Rising head or single well response tests were carried out in both boreholes to assess the hydraulic conductivity of the bedrock in the screened piezometer zone. This test involves the rapid removal of water from within the piezometer and recording the water level rise with time. The rising head test results were analysed using the Bouwer and Rice method (1976) and Hvorslev method (1951). The test data analyses are presented in Appendix C2. Tabulated below are the test locations, geodetic elevation and hydraulic conductivity of the screened strata.

Borehole Number	Well Screen Geodetic Elevation (m)	Screened Strata	Hydraulic Conductivity (m/s)
BH 4	157.1 to 160.1	Shaley Limestone Bedrock	2.9×10^{-5}
BH 5	166.3 to 169.3	Shaley Limestone Bedrock	2.6×10^{-4}

6.5.3 Cerchar Abrasiveness & Slake Durability

Geomechanica Inc. carried out CERCHAR abrasiveness and Slake Durability tests on two samples of bedrock from each borehole i.e. a total of 4 samples. The Geomechanica Inc. report including the test results is presented in Appendix D.

The average CERCHAR Abrasivity Index ranges from 0.207 to 1.224, i.e. an abrasiveness classification of less than very low to medium. The Slake Durability Index of the four tested samples ranges from 99.01% to 99.57% at the first test cycle and from 97.64% to 99.96% at the second test cycle, indicating an "Extremely High" durability based on the criteria proposed by Franklin and Chandra 1972.

6.6 Ground Water Levels

The ground water conditions were observed in the boreholes during drilling and standpipe piezometers were also installed in both boreholes. The measured ground water levels in the piezometer are summarized in the following table:

Borehole No	Date	Water Levels	
		Depth (m)	Elevation (m)
BH 4	September 01, 2020 September 16, 2020	3.6 3.5	173.3 173.4
BH 5	September 01, 2020 September 15, 2020	3.7 3.6	173.3 173.4

The ground water level is expected to fluctuate seasonally and is expected to rise during wet periods of the year. The ground water level will also be controlled by the free water level in the Welland Canal.

6.7 Organic vapours

The overburden soils and bedrock were checked for combustible gas during the drilling and coring operations. The locations where combustible vapours were detected and their concentrations are presented below.

Borehole Number	Sample ID	Sample Depth (m)	FID (ppm)	PID (ppm)
Overburden Soils				
BH 4	SS2	0.6 – 1.2	15	0
	SS3	1.2 – 1.8	20	0
	SS5	3.0 – 3.5	25	0
BH 5	Not Detected			
Bedrock				
BH 4	RUN 1	3.7 – 4.9	65	0
	RUN 5	9.4 – 10.9	30	0
BH 5	Not Detected			

FID = Flame Ionization Detector PID = Photoionization Detector

7.0 DISCUSSION AND ENGINEERING RECOMMENDATIONS

7.1 General

This section of the report presents interpretation of the geotechnical data and presents preliminary geotechnical design recommendations to assist the design team to carry out preliminary designs for the Eastside SPS forcemain installation below the Welland Canal. The discussion and recommendations presented in this report are based on our understanding of the project and our interpretation of the factual data obtained from the subsurface investigations. These geotechnical recommendations are for planning and preliminary design purposes only, as part of the assessment of the feasibility and constructability of potential alternatives.

We understand that a new Eastside Forcemain crossing is being proposed below the Welland Canal. The crossing alignment has not been finalized but based on information provided by GM BluePlan, we understand that the following preliminary design concepts are being considered:

- A launch shaft in the vicinity of Borehole 4 measuring 7 m in diameter and extending to a depth of about 20 m± (elevation 157 m±) below ground surface;
- A receiving shaft in the vicinity of Borehole 5 measuring 6 m in diameter and extending to a depth of about 20 m± (elevation 157 m±) below ground surface; and
- A 2.24 m± diameter tunnel mined in the bedrock formation.

7.2 Trenchless Installation Methods

Based on the preliminary project details provided to Terraprobe, the bedrock between elevation 157 m and 164 m was assessed as the potential zone through which the tunnel will likely be excavated. The bedrock data within this zone of tunnelling is tabulated below:

Borehole No.	Rock Quality Designation (RQD)	Rock Mass Quality[4]	Total Core Recovery (TCR)	Solid Core Recovery (SCR)
BH 4	55% to 81%	Fair to Good	95% to 100%	73% to 92%
BH 5	47% to 59%	Poor to Fair	95% to 99%	74% to 86%

Borehole No.	Elevation (m)		Lithology	UCS (MPa)	Strength Grade
	From	To			
BH 4	157.0	164.0	Shaley Limestone with Gypsum Inclusions	20.0 – 72.3	R2 to R4
BH 5	157.0	164.0	Shaley Limestone with Gypsum Inclusions	12.7 – 73.4	R2 to R4

Consideration was given to a range of tunnelling methodologies such as Horizontal Directional Drilling (HDD), Microtunnelling and excavation with a “small-diameter” Tunnel Boring Machine (TBM). The diameter, length and anticipated subsurface conditions limit the range of trenchless installation techniques that are practical and economically viable.

There are risks associated with HDD especially when drilling through variable soil and rock layers. Drilling through rock layers with different engineering strength grades can cause the HDD drilling head to deflect resulting in misalignment and in extreme cases failures due to obstructions and collapse of the bore. Furthermore, a HDD operation will require the alignment to be designed to satisfy an appropriate radius of

4 Deere et al., 1967.

curvature and the entry and exit pits will have to be located in laydown areas much further away from the Welland Canal which is likely undesirable. Finally, the proposed 2.24 m tunnel diameter marginally exceeds the practical maximum pipe diameter that HDD machines are capable of installing. For these reasons HDD was ruled out as an appropriate tunnelling methodology.

It should also be noted that with a tunnelling operation there is always a possibility that excavations may be required to retrieve tunnelling equipment or, equipment may have to be abandoned if adverse subsurface conditions are encountered.

7.2.1 Microtunnelling

Microtunnelling is a method of installing pipes behind a steerable remote controlled shield. Shields, excavation and face support can be provided for a wide variety of ground conditions including rock. The process is essentially remote controlled pipe jacking, where all operations are controlled from the surface, and the necessity for personnel to enter the bore is eliminated. Microtunnelling is a precise method of tunnelling and there is relatively little ground settlement as well as less overbreak compared to segmental tunnels mined in rock.

Microtunnelling can be applied to a wide range of ground conditions, from saturated sands and gravels, through to soft or stiff, dry or saturated clays, mudstones and rock. Construction risks increase where a microtunnel drive is required to advance through a variety of ground types. Specialist advice on machine selection should be sought and recommendations regarding the machine design for the given ground conditions should be supported by the manufacturer. Appropriate machine design refinements may be used to extend the application range of the machine to cover more adverse soil and rock conditions, including handling obstructions such as cobbles and boulders. The tunnel diameter is relatively large and approaches the upper limit of about 2.4 m for microtunnelling systems. Furthermore, it is unlikely that this size of equipment is readily available in Ontario.

7.2.2 Small Diameter Tunnel Boring Machine (TBM)

TBMs ranging from 1.5 m to 6 m in diameter are sometimes referred to as “small diameter” TBMs. A “small diameter” TBM would be best suited for this tunnel. The “small diameter” TBM is similar to a large TBM in functionality and operation. It can be steered continuously to maintain line and grade and configured to install steel ring beams and boards or precast concrete segments. Cutterheads can also be designed to replace cutterhead discs from the rear or the front depending on the rock geology.

Shielded TBMs for example Earth Pressure Balance and Slurry TBMs are best suited for relatively weak and highly fractured rock. We recommend using a sealed system that is capable of pressurizing the face to prevent ground water inflow into the excavation. Pre-grouting will also be required to reduce water leakage. This can be accomplished by drilling long holes ahead of the tunnel face and injecting grout into the rock mass. The grout spreads along the joints around the tunnel and helps to reduce the inflow of ground water into the tunnel.

Muck removal is generally by rolling stock on rails and in small spaces, it is common to use battery powered locomotives to reduce emissions and ventilation requirements. Ensuring adequate space for trailing gear, ventilation, rock removal and men and materials transport is key to a cost effective an efficient operation.

7.3 Tunnelling Assessment & Preferred Tunnelling Alternative

There are inherent risks and consequences involved with trenchless installations that could include some or all the following:

- Obstructions within the tunnel reach that will have to be removed in order to advance the tunnel. If efforts in removing obstructions prove futile, the tunnel will have to be abandoned or, an open cut excavation would be required to remove the equipment.
- Inability to correct for line and grade within the design tolerances. If misalignment occurs, it may be necessary to abandon the bore and grout the open section. Alternatively, an open cut excavation may be the most efficient way of completing the installation.

The tunnelling alternatives described in Section 7.2 are ranked on a numerical scale in order of preference with one being assigned to the most preferred alternative and two being assigned to the least preferred option. Where the risk of a failed installation is high or where the method is almost impractical "No" has been assigned to that method to indicate that the method is not suitable. The preferred alternative was selected based on installation costs, the advantages, disadvantages, risks and consequences as outlined in Table 1 following the text of this report.

Ranking of Tunnelling Alternatives		
TBM	**Microtunnelling**	**Horizontal Directional Drilling**
1	2	No

7.4 Tunnel Design Considerations

7.4.1 General

Based on the borehole data the tunnel alignment will be mined in generally undisturbed rock. However, there are indications from the investigation that the rock could contain disturbed and fractured/rubble zones within the zone of tunnelling. The programme for primary support followed by permanent tunnel liner installation will require consideration of the length of time to complete the excavation and remove the TBM as well as the time required for the relief of in-situ locked in stresses in the bedrock. Primary support and rock bolting will dependent on the rock mass quality encountered during tunnel excavation.

7.4.2 Primary Support and Rock Bolts

Experience in Ontario has indicated that tunnels of the proposed diameter, when made by mechanical excavation or a tunnel boring machine, are stable with limited roof slabbing or coning, provided that the primary support to the tunnel crown is installed promptly in conjunction with the tunnel advance. Primary support is usually in the form of bolts and steel sets with a series of steel ribs and bridging material such as timber or mesh. The purpose of this primary support is to maintain the rock in intact form as much as practically possible thereby preserving the strength and integrity of the rock mass.

Rock bolts can be designed based on the guidelines for excavation and support systems in rock tunnels (Bieniawski 1979). Based on these guidelines the recommended preliminary rock bolt designs based on Rock Mass Class are:

- Poor Rock - Systematic 20 mm diameter fully bonded rock bolts, approximately 4 m to 5 m long and spaced 1 m to 1.5 m in the crown and wall with wire mesh. Light to medium ribs spaced 1.5 m where required;
- Fair Rock - Systematic 20 mm diameter fully bonded rock bolts, approximately 4 m long and spaced 1.5 m to 2 m in the crown and wall with wire mesh in the crown. No steel sets; and
- Good Rock - Local 20 mm diameter and 3 m long fully bonded rock bolts installed in the crown and spaced 2.5 m with occasional wire mesh. No steel sets.

7.4.3 Permanent Liner

The design of the permanent tunnel liner must take into account the time-dependant deformation characteristics of the bedrock caused by locked-in in-situ bedrock stresses that are relieved due to excavation. A large portion of this initial rock stress is normally relieved by rock movements after excavation and before placement of support. Further stress relief also occurs by movement of the primary support before the final liner is installed. Primary supports should be installed as soon as possible to prevent rock loosening and deterioration.

If a rigid liner is installed shortly after excavation or in conjunction with the tunnel advance, the swell of the rock as stress is relieved will place significant pressure on the liner. Problems arise when a rigid liner is placed in close contact with rock which has a potential for future additional stress relief. If stress relief is not allowed to occur, deformable interface materials such as expanded polystyrene shall be used between a rigid liner and the rock to absorb rock displacements hence mitigating the potential for unacceptable stress development and future liner cracking.

The bedrock is expected to have locked-in residual horizontal stresses that will be relieved during and after excavation. The stress relief takes place over time and manifests itself as apparent creep of the rock face. This aspect will require consideration during detail design in order to establish the timing for permanent liner construction. For preliminary design purposes assume that a period of 90 days to 120 days is required after excavation to accommodate stress relief prior to permanent lining construction. To verify that stress relief is complete tunnel convergence monitoring will be required. Monitoring shall be carried out at 50 m intervals along the tunnel alignment.

7.4.4 Settlement

Deformations such as local instabilities due to tunnel face failure, roof collapse and tunnel squeezing/convergence can occur when tunnelling. Rock joints also contribute to the rock mass deformation. It is also important to emphasise that since the tunnelling methodology will not require drilling and blasting, the overbreak zone is significantly reduced. Rock bolt supports also enhance the overall strength of a jointed rock mass.

It is estimated that the maximum settlement at the ground surface associated with a microtunnelling or “small diameter” TBM operation will not exceed 5± mm. The estimated settlement is based on the assumption that the work will be carried out by experienced tunnellers with great care and good workmanship. However, more settlement can occur if unanticipated conditions such as obstructions and weak and fractured rock are encountered in the mined tunnel zone.

Existing structures in close proximity to the construction as well as the subsurface soils and rock will have to be monitored for movement before, during and after construction. A precondition survey will be required to document the existing conditions of structures for the purpose of determining any restoration that may be required due to construction impacts.

An instrumentation and monitoring programme will also be required as part of detail design to verify the Contractor's compliance with settlement limits and to allow adjustments to be made to the construction methodology such that structure and ground movement limits are not exceeded. The instrumentation should include:

- Arrays of settlement monitoring points installed and grouted into the shallow bedrock to obtain prior warning of ground movement that could occur due to construction methods and equipment or, unforeseen ground conditions; and
- Inclinometers installed at the banks of the Welland Canal to monitor the rock cuts for lateral movement.

7.5 Launch and Receiving Shafts

Launch and receiving shafts are required for the tunnelling operations. Summarized in the following table are the approximate launch and receiving shaft locations, the soil and rock units at these locations and their anticipated conditions at the excavation base (outlined in bold letters). The estimated ground water level, the anticipated ground behaviour and suggested treatments that will be required to maintain base stability are also included in the table.

Location	Approximate Excavation Depth (m) and Borehole No.	Ground Water Level Relative to Excavation Base (m)	Remarks
Launch Shaft	20± m (BH 4)	Above Base	▪ Compact gravelly sand fill; ▪ Firm silty clay fill; ▪ Firm to stiff silty clay to clay; ▪ Weak to very strong Dolomitic Limestone bedrock; and ▪ **Weak to strong Shaley Limestone bedrock.** ▪ Maintain dry excavation at base of shaft and expeditiously pour a 75 mm thick concrete mud mat.
Receiving Shaft	20± m (BH 5)	Above Base	▪ Compact gravelly sand fill; ▪ Firm silty clay to clay fill; ▪ Hard silty clay to clay; ▪ Weak to very strong Dolomitic Limestone bedrock; and ▪ **Weak to very strong Shaley Limestone bedrock.** ▪ Maintain dry excavation at base of shaft and expeditiously pour a 75 mm thick concrete mud mat.

Excavations can be vertically extended into the rock by line drilling techniques. As the name implies, line drilling involves drilling closely spaced holes along the excavation perimeter. Generally, these line-drilled holes are not charged with explosive. In some cases, lightly charging the holes with a detonating cord or a highly decoupled charged is helpful in destroying the integrity of the rock web. Close drilling control is essential for the method to succeed since the purpose is to create a plane of weakness that serves to limit the extent of overbreak.

7.6 Base Slabs, Uplift Pressures and Basal Stability

The base slab of launch and receiving shafts and permanent structures will be constructed on bedrock. To control ground water seepage into the excavation an under drain system with drainage directed into filtered sums is recommended.

Tabulated below are the recommended geotechnical resistance, vertical modulus of subgrade value and ground water level for preliminary design.

Base Slab Founding Elevation	Factored Geotechnical Resistance at ULS	Vertical Modulus of Subgrade Reaction	Approximate Ground Water Level Acting on Base Slab
157 m±	1,500 kPa	125 kPa/mm	16.4 m±

The ground water will impart uplift forces and resistance against uplift must be maintained at all stages during as well as after construction. The uplift pressure that acts on the base slab can be calculated as the product of the vertical depth of the base slab below the design ground water table and the unit weight of water (9.81 kN/m^3). It is generally recommended that resistance to uplift be provided by the combination of static gravity loads and the structural bending capacity of the base slab. The base slab must also be designed to transfer loads due to uplift pressures to the shaft side walls.

Excavations shall be designed such that the base is stable at each successive stage during excavation. The type of base failure condition depends on the subsurface conditions at and beneath the excavation bottom and base failure can occur if one or more of the following conditions are encountered:

- Cohesionless soils below the ground water table at or near the excavation base resulting in piping failure;
- Relatively impermeable deposits at the excavation base that are underlain by water-bearing permeable deposits with a sufficiently high hydrostatic head resulting in basal uplift; and
- Weak cohesive soils below the excavation base resulting in base heave due to the stress imposed by the vertical height of the retained overburden.

The interpreted stratigraphic profile shown on Drawing 5 indicates that the base of both shafts will be founded on bedrock. Therefore, basal stability is not a concern. The exposed rock at the shaft base should be protected from disturbance and degradation by expeditiously pouring a 75 mm thick concrete mud mat which will serve a dual purpose i.e. reducing ground water inflow into the base of the shaft and also providing support for the tunnelling equipment.

7.7 Shoring Systems

The selected shoring method shall take into account the soil and rock stratigraphy, ground water conditions, methods to control ground water, basal stability of the excavations, ground movements associated with the shoring system and, its impacts (if any) on adjacent settlement sensitive structures and utilities. Soldier Pile and Lagging systems and Continuous Concrete Walls (secant or caisson walls) are practical shoring alternatives.

Shoring systems shall be designed in accordance with OPSS.MUNI 539 and the designs shall be carried out by a licensed Professional Engineer experienced in shoring design. The governing design factor is to restrict lateral soil movement. Shoring systems shall be designed on the basis of the active earth pressure

coefficient (K_a). The performance level should be Level 2 – Angular Distortion 1:200 but shall not be more than 25 mm.

The shape of the soil pressure distribution diagram behind a shoring system depends upon the type of soil to be encountered and the amount of movement that can be permitted. The sequence of work will also alter the shape of the shoring pressure diagram during the various construction phases.

Earth pressure computations must also take into account the ground water level. Above the ground water level, earth pressure is computed using the bulk unit weight of the retained soil. Below the ground water level, the earth pressures are computed using the submerged unit weight of the soil. A hydrostatic pressure is also applied if the retained soil is not fully drained.

The appropriate lateral earth pressure parameters for use in the design of shoring systems are provided in the following table. The lateral earth pressure coefficients are based on the assumption that the ground surface behind the shoring system is horizontal. Where the retained ground is sloping, the lateral earth pressure coefficients must be adjusted to account for the slope. The values tabulated below are guideline values and the responsibility for selecting the appropriate design values is the responsibility of the shoring designer.

Stratigraphic Unit	Friction Angle ϕ (degrees)	Unit Weight γ (kN/m^3)	Active Earth Pressure Coefficient	At - Rest Earth Pressure Coefficient	Passive Earth Pressure Coefficient
			K_a	K_o	K_p
Fill Soils	29	19	0.35	0.52	2.88
Silty Clay to Clay	28	19	0.36	0.53	2.77

Where the excavation penetrates the bedrock, the rock is nominally self supporting in a vertical face, provided the rock bedding is horizontally oriented. The rock induces no pressure on shoring systems that require structural support and the requirement for lagging support of partially weathered rock depends on the cleanliness of the excavation break.

Shoring systems can be designed to be perched in the bedrock above the excavation base but care and consideration must be given to providing protection and support for the rock in the area of influence directly beneath the base of the caisson or soldier pile toe as appropriate. It has become accepted practice in the shoring design community to leave a minimum 1 m wide shelf between the excavation face and shoring system toe to minimize rock protection and support requirements. Regardless of the approach taken in the design it will be required to drape and bolt a steel screen on the excavation face to collect and direct spauling rock fragments to the base of the excavation in a way that protects workers in the rock shaft.

7.8 OHSA Soil Classification

All excavations must be carried out in accordance with the guidelines outlined in the *Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects*. Where workers must enter excavations extending deeper than 1.2 m, the trench walls must be suitably sloped and/or braced in accordance with the OHSA. Within the envisaged depths of temporary excavations, the OHSA soil classifications are:

- Fill soils – Type 3 soil; and
- Silty clay to clay – Type 3 soil.

The side slopes of temporary excavations may be formed no steeper than 1H:1V for Type 3 soils. Excavations at steeper inclinations will require temporary support. Excavations should be undertaken in accordance with OPSS.MUNI 401.

7.9 Ground Water Control

Surface water and ground water control will be required to maintain sufficiently dry conditions during construction. Provisions are also required to maintain sufficiently dry excavations in the launch and receiving shafts to permit tunnelling. The design, installation, operation and maintenance of the dewatering system is the Contractor's responsibility.

The Ontario Ministry of Environment, Conservation and Parks (MECP) requires a Permit to Take Water (PTTW) for any ground water and storm water takings in excess of 400 m^3/day. If the ground water and storm water taking is between 50 m^3/day and 400 m^3/day, then the activity must be registered on the Environmental Activity and Sector Registry (EASR).

Preliminary dewatering volumes were estimated based on two scenarios

- Scenario 1 - Shoring systems perched in the rock above the excavation base with an exposed rock face; and
- Scenario 2 - A permanently lined and relatively impermeable shaft such as a secant wall extending to the base of the excavation.

The preliminary dewatering volumes were estimated based on the bedrock hydraulic conductivity values obtained from Lugeon Tests. A two-year storm event equivalent to 32 mm of daily precipitation was also included in the analysis. The analysis indicates that:

- Scenario 1 - A PTTW is required since the estimated dewatering volume for both shafts will be approximately 500 m^3/day based on Packer Test hydraulic conductivity values and; 12,700 m^3/day based on Rising Head Well Response hydraulic conductivity values; and
- Scenario 2 - Neither a PTTW nor an EASR registration is required after shaft construction is complete since the estimated dewatering volume for both shafts will be approximately 15 m^3/day. However, as a minimum, consideration should be given to a posting to the MECP EASR to account for unanticipated potential flows through shoring systems, upwelling from the excavation base, and the accumulation of precipitation within the plan area of the shafts.

7.10 Design Frost Depth

At this site, a depth of 1.2 m of earth cover should be provided for protection from frost penetration (OPSD 3090.101 Foundation Frost Penetration Depths for Southern Ontario).

7.11 Supported Open Cut Excavations

We envisage that the sanitary sewers will be installed in supported open cut excavations. A supported open cut excavation involves trench excavation while maintaining excavation sidewall support, bedding placement and pipe installation, trench backfilling and pavement restoration as and where required. Sewers shall be installed in accordance with Ontario Provincial Standard Specification, OPSS.MUNI 410.

7.11.1 Excavation Method

The soils encountered at this site are considered to be suitable for open cut excavation using trenching and excavating equipment, such as backhoes normally used by contractors for buried utility installations. The Contractor shall always have on site adequate equipment such as pneumatic breakers or chisels and rippers to break and remove any shallow bedrock and/or boulders that are encountered above the base of the trench. Excavations shall be carried out in accordance with OPSS.MUNI 401 and OPSS.MUNI 402.

Where excavations encroach on existing utility trenches, unstable trench conditions can occur particularly where granular backfill, clear stone, or poorly compacted fill of any type are present. In such cases, ravelling of the existing fill and high rates of water infiltration through bedding can potentially occur which can in severe cases, jeopardize the stability of the existing utility. A higher standard of care in shoring is required where the trenches for the new installation are closer than 0.75H to an adjacent trench, where H is the depth of the deeper trench.

7.11.2 Pipe Bedding

For rigid pipes the installation shall conform to the requirements of OPSD 802.030, 802.031 and 802.032 as appropriate. The subsurface conditions are considered suitable to provide adequate pipe support and therefore Class “B” bedding will suffice. Additional bedding requirements that may be imposed by the pipe supplier must also be followed.

Granular A material conforming to OPSS.MUNI 1010 specifications should be used as pipe bedding. Prior to placing the pipe bedding, any accumulation of water at the base of the excavation should be removed and any soft/loose soils should be subexcavated and replaced with Granular A material. Placement of the pipe bedding must be carried out in the dry.

If bedrock is encountered at the pipe invert the pipe subgrade surface will have to be carefully prepared to avoid any projections that could damage the pipe during installation. Rock squeeze/swell is not a significant factor that merits consideration in this case, however, it is recommended that the space between the rock and pipe wall be at least 0.3 m and this space be backfilled with sand or Granular “A” material.

The bedding material and cover material, should be placed in 150 mm thick loose lifts and uniformly compacted to at least 98% of the materials Standard Proctor Maximum Dry Density (SPMDD) using suitable vibratory compaction equipment.

7.11.3 Backfill

The majority of the fill and native soils are generally considered suitable for reuse as backfill where permitted in the contract, provided they are free of topsoil, organic material or other deleterious material and provided that these soils are approved for use by the Engineer. Backfill material should be placed in maximum 300 mm loose lifts and should be uniformly compacted in accordance with OPSS.MUNI 501.

To achieve the specified compaction, soils must neither be too wet nor too dry of their optimum moisture content. Soils that are too wet cannot be used immediately because the material will have to be dried to about ± 2 % of the optimum moisture content. If the construction operations are time sensitive, the use of imported granular material may be considered. Soils that are dry of optimum can be used immediately

provided that the material is moisture conditioned (i.e. water added) to achieve a moisture content of ± 2 % of optimum.

Since backfilling will be carried out in the narrow confines of trenches achieving adequate compaction will be difficult given the space constraints and the reduced ability to compact backfill material placed between the trench wall and the outer trench box face. Therefore, it is recommended that the placing and compacting of backfill material be done under close supervision.

Normal post-construction settlement of the compacted backfill material equivalent to about 1% of the backfill height is anticipated to occur within about six months following the completion of the backfilling operations. This settlement may cause minor settlement of overlying pavement structures and it is recommended that the surface course paving be delayed for one construction season.

8.0 SOIL, ROCK AND GROUND WATER CHEMISTRY

The testing carried out is intended to provide an overview of the soil, rock and ground water quality for preliminary planning purposes. The results are not adequate for the design of a soil management plan for construction. Additional sampling/testing will be required during the detail design phase to confirm disposal or re-use options.

8.1 Soil Chemistry

8.1.1 Metals and Inorganics

Four soil samples were submitted to a CAEAL Certified Laboratory (SGS Canada) for chemical characterization with respect to general inorganic parameters including metals, pH, sodium adsorption ratio (SAR) and electrical conductivity (EC). Based on visual and/or olfactory screening of soil samples, these nominal parameters are analysed when there are no indications of environmental impacts. The Certificates of Analysis are included in Appendix D1.

The analytical results were compared to Tables 1 and 2 (Agricultural & Residential/Parkland/Industrial) and Table 3 (Residential/Parkland/Industrial) of the *MOE Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act, April 15, 2011*. A summary of soil analytical results is presented in the following tables.

BH No	Sample ID	Sample Depth (m)	Table 1	
			(Agricultural)	(Residential/Parkland/Industrial)
BH 4	SS1	0.0 – 0.6	Exceeds: ▪ Lead ▪ Molybdenum ▪ Nickel ▪ Sodium Absorption Ratio	Exceeds: ▪ Lead ▪ Molybdenum ▪ Nickel
BH 4	SS2	0.6 – 1.2	Exceeds: ▪ Electrical Conductivity ▪ Sodium Absorption Ratio	Exceeds: ▪ Sodium Absorption Ratio
BH 5	SS1	0.1 – 0.6	Exceeds: ▪ Nickel ▪ Mercury	No Exceedances
BH 5	SS2	0.6 – 1.2	Exceeds: ▪ Barium	Exceeds: ▪ Barium

BH No	Sample ID	Sample Depth (m)	Table 2		Table 3
			(Agricultural)	(Residential/Parkland/ Industrial)	(Residential/Parkland/ Industrial)
BH 4	SS1	0.0 – 0.6	Exceeds: ▪ Lead ▪ Nickel	Exceeds: ▪ Lead ▪ Nickel	Exceeds: ▪ Lead ▪ Nickel
BH 4	SS2	0.6 – 1.2	No Exceedances	No Exceedances	No Exceedances
BH 5	SS1	0.1 – 0.6	No Exceedances	No Exceedances	No Exceedances
BH 5	SS2	0.6 – 1.2	No Exceedances	No Exceedances	No Exceedances

The tabulated data indicates that excess soils will have to be disposed at a receiving site that can accept soils with the identified metal exceedances.

8.1.2 Petroleum Hydrocarbons

One soil sample located where the highest organic vapours concentration was recorded by PID and FID field screening was tested for petroleum hydrocarbons (PHCs, F1 to F4 fractions), benzene, toluene, ethylbenzene, xylenes (BTEX), volatile organic compounds (VOCs) and polycyclic aromatic hydrocarbons (PAHs). The Certificates of Analysis are included in Appendix D1

The analytical results were compared to Tables 1 and 2 (Agricultural & Residential/Parkland/Industrial) and Table 3 (Residential/Parkland/Industrial) of the *MOE Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act, April 15, 2011*. Comparison of the test results to the MOE Standard indicates that the tested soil parameters were below the guideline values and soil disposition with respect to petroleum hydrocarbons is not expected to be a concern.

8.1.3 Toxicity Characteristic Leaching Procedure

For waste classification purposes four samples were also submitted for the Toxicity Characteristic Leaching Procedure analysis for select parameters including Benzo(a)pyrene, Metals & Inorganics, Volatile Organic Compounds (VOCs) and Polychlorinated Biphenyls (PCBs). The Certificates of Analysis are included in Appendix D1

The analytical results were compared to Ontario Regulation 558. Comparison of the test results to the MOE Standard indicates that the tested parameters were below the guideline values. Therefore, the tested soils are considered to be non-hazardous.

8.1.4 Corrosivity

Five soil samples were tested for corrosivity parameters i.e. sulphide, chloride, sulphate, pH, electrical conductivity (EC), resistivity and redox potential and the Certificates of Analysis are included in Appendix D1. These parameters are used for assessing the corrosivity potential of the native soil to ductile iron pipe in accordance with the 10-point soil evaluation procedure described in ANSI/AWWA C105/A21.5 Standard[5]. Based on this soil corrosivity scale, a total of 10 points or more indicates that the soil is corrosive to as-manufactured ductile iron pipe (DIP), and additional corrosion protection measures are recommended. The Corrosivity Indices of the tested samples are tabulated below.

10-Point Soil Evaluation	Sample Number and Location				
	BH 4 SS 1 0.0 m – 0.6 m	**BH 4 SS 2 0.6 m – 1.2 m**	**BH 4 SS 5 3.0 m – 3.6 m**	**BH 5 SS 1 0.1 m – 0.6 m**	**BH 5 SS 2 0.6 m – 1.2 m**
Total Points	7.5	4.0	4.0	4.0	4.0

The water-soluble sulphate concentrations of tested samples were compared to Table 3 of the Canadian Standards Association A23-1-09. The results indicate that the degree of exposure is low i.e. less than the moderate range.

8.2 Rock Chemistry

8.2.1 Synthetic Precipitation Leaching Procedure

For waste classification purposes two rock core samples were submitted for the Synthetic Precipitation Leaching Procedure (SPLP) analysis for select parameters including Benzo(a)pyrene, Metals & Inorganics, Volatile Organic Compounds (VOCs) and Polychlorinated Biphenyls (PCBs). The Certificates of Analysis are included in Appendix D2

The analytical results were compared to Ontario Regulation 558. Comparison of the test results to the MOE Standard indicates that the tested parameters were below the guideline values. Therefore, the rock samples are considered non-hazardous.

5 American Water Works Association (AWWA) C-105 (2005) Standard, “Polyethylene Encasement for Ductile-Iron Pipe Systems”Catalog No. 43105. AWWA Denver, CO.

8.3 Ground Water Chemistry

Water quality assessments were carried out on ground water samples obtained from the standpipe piezometers installed in Boreholes 4 and 5. The ground water chemistry was compared to the Provincial Water Quality Objectives (PWQO) of the Ministry of Environment and Energy. Ground water sample results are typically compared to this document to assess suitability for discharge into waterbodies. Exceedances were reported for the tested samples as summarized in the following table. The Certificates of Analysis are included in Appendix D3.

BH No.	Exceedances				
	Total Aluminum	Total Boron	Dissolved Aluminum	Dissolved Boron	4AAP-Phenolics
BH 4	✓	✓	-	✓	✓
BH 5	✓	-	✓	-	✓

Further ground water assessment is recommended during detail design. If after reassessment the water quality exceeds the discharge criteria for the PWQO Guidelines, then the water must be treated before being discharged.

Particulate filtering systems are commonly used to reduce the concentrations of non-dissolved metals and Total Suspended Solids. Treatment for dissolved metals and inorganics if required, will require designing a treatment system that targets the dissolved metals and inorganics to be removed from solution. The design and implementation of an appropriate treatment system to remove exceedances is the Contractor's responsibility.

9.0 CONSTRUCTION CONCERNS

Potential construction concerns include, but are not necessarily limited to:

- Cam locking during microtunnelling due to debris dislodging and clogging the annular space between the rock and casing pipe;
- High rock stresses, fractured and porous rock,
- High ground water and conduits for uninterrupted and relatively large ground water flow from the Welland Canal into excavations;
- Throughgoing horizontal planes of weakness associated with bedding plane partings; and
- Bedrock permeabilities in the horizontal direction will be affected by the presence of bedding plane partings.

10.0 RECOMMENDATIONS FOR DETAIL DESIGN

The detail design should consider the following.

- Confirm and further refine the preliminary geotechnical recommendations based on the selected alternative route and carry out additional detail level foundation investigations;
- Complete a more rigorous tunnelling assessment of the preferred alignment;
- Carry out overcoring of the bedrock to assess the in-situ rock stress within the mined zone;
- Carry out a topographic survey along the tunnel alignment to establish the overburden soil and bedrock depth as well as the location of the Welland Canal base relative to the tunnel obvert;

- Review “as-built” drawings of the Welland Canal to better understand past canal excavation construction impacts e.g. base blast damage and stress relief effects on the bedrock;
- Prepare non-standard specifications for the proposed tunnelling methodology;
- Assess the potential for gypsum soluting and the probable disturbance to the existing ground water regime due to tunnel construction; and
- Preparation of a Geotechnical Base Line report to set baseline parameters for bidding by Contractors.

11.0 LIMITATIONS AND RISK

11.1 Procedures

This investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by Terraprobe and other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The discussions and recommendations that have been presented are based on the factual data obtained.

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with the most stringent level of care may fail to detect certain conditions. Terraprobe has assumed for the purposes of providing design parameters and advice, that the conditions that exist between sampling points are similar to those found at the sample locations. The conditions that Terraprobe has interpreted to exist between sampling points can differ from those that actually exist.

It may not be possible to drill a sufficient number of boreholes or sample and report them in a way that would provide all the subsurface information that could affect construction costs, techniques, equipment, and scheduling.

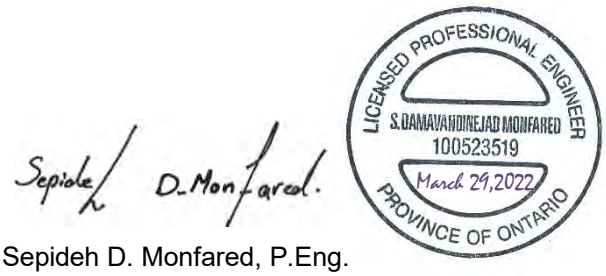
11.2 Changes in Site and Scope

It must also be recognized that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site have the potential to alter subsurface conditions. Ground water levels are particularly susceptible to seasonal fluctuations.

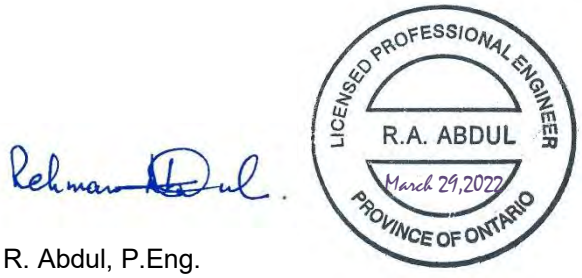
The discussion and recommendations are based on the factual data obtained from investigations made by Terraprobe and are intended for use by the owner and its retained designers in the design phase of the project. If there are changes to the project scope and development features the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructability issues and quality control may not be relevant or complete for the revised project. Terraprobe should be retained to review the implications of such changes with respect to the contents of this report.

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Terraprobe



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Ontario Provincial Standard Specifications (OPSS)

OPSS.MUNI 401	Construction Specification For Trenching, Backfilling and Compacting
OPSS.MUNI 402	Construction Specification For Excavating, Backfilling and Compacting For Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers.
OPSS.MUNI 410	Construction Specification For Pipe Sewer Installation In Open Cut
OPSS.MUNI 501	Construction Specification For Compacting.
OPSS.MUNI 539	Construction Specification For Temporary Protection Systems.
OPSS.MUNI 1010	Material Specification For Aggregates – Base, Subbase, Select Subgrade and Backfill Material

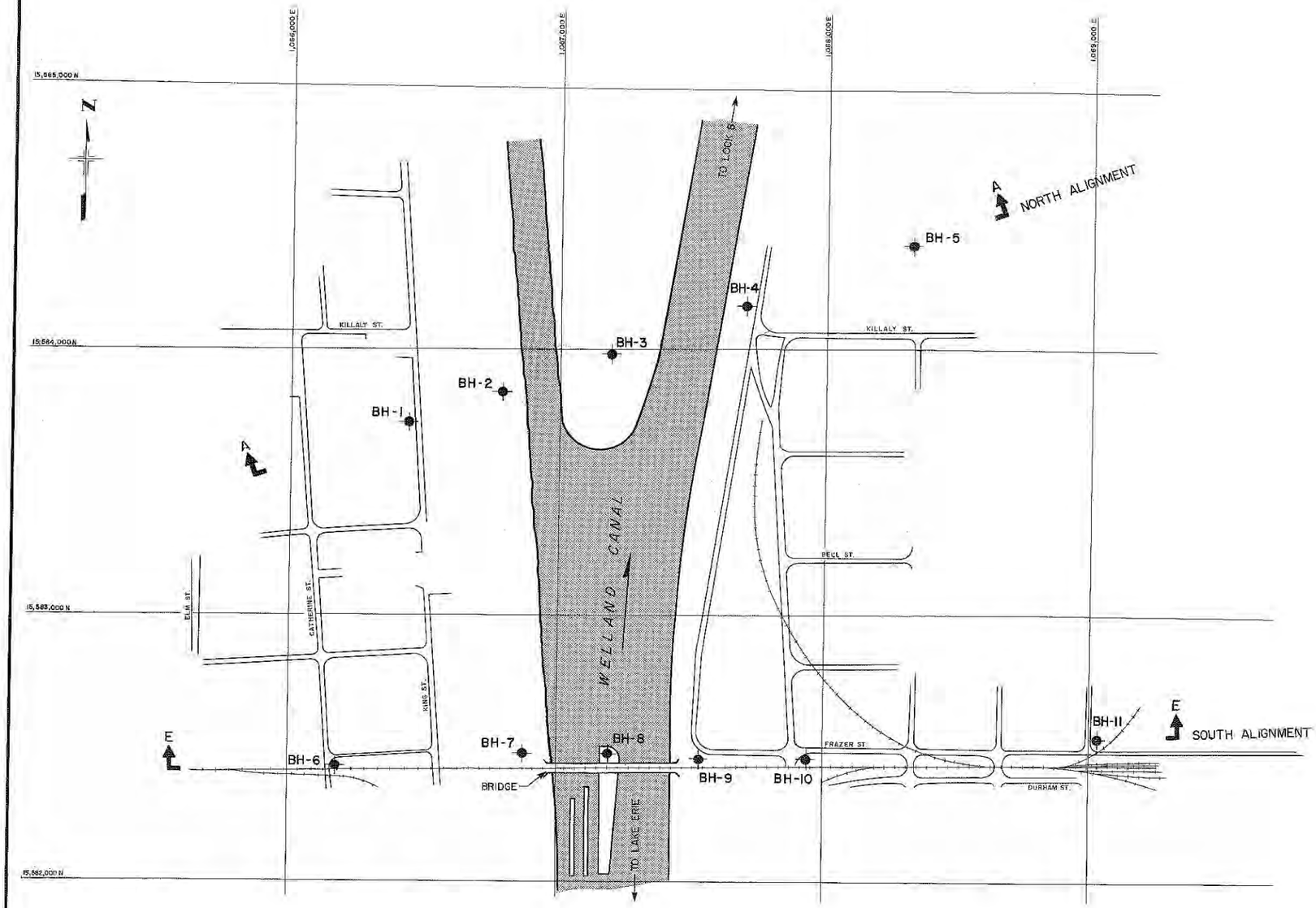
Ontario Provincial Standard Drawings (OPSD)

OPSD 802.030	Rigid Pipe Bedding, Cover and Backfill, Type 1 or 2 Soil – Earth Excavation
OPSD 802.031	Rigid Pipe Bedding, Cover and Backfill, Type 3 Soil – Earth Excavation
OPSD 802.032	Rigid Pipe Bedding, Cover and Backfill, Type 4 Soil – Earth Excavation
OPSD 3090.101	Foundation Frost Penetration Depths for Southern Ontario.

TABLE 1
EVALUATION OF TUNNELLING METHODS

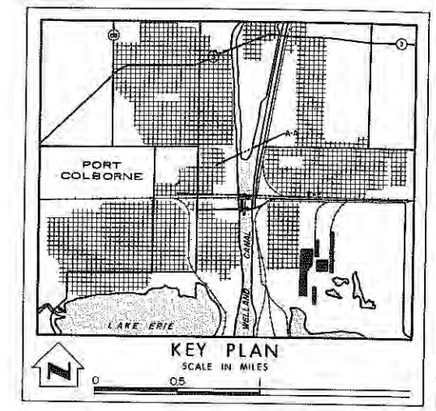
Installation Method	Ranking	Advantages	Disadvantages	Risk/Consequences
"Small Diameter" TBM	1	Does not require groundwater lowering since the TBM can counterbalance earth/rock and water pressures, thereby reducing the risk of ground losses during tunnelling. Excavation is faster compared to a MTBM because of the higher cutterhead RPMs.	Most expensive compared to other methods. High mobilization cost. Requires a skilled construction workforce. Requires installation of a primary support system before installing the tunnel liner.	Proper planning and sequencing of the tunnelling operation is required because of the tunnelling methodology and the space limitations.
Micro Tunnelling (MT)	2	Does not require groundwater lowering since the MTBM can counterbalance earth/rock and water pressures, thereby reducing the risk of ground losses during tunnelling. Does not require primary tunnel support.	It is unlikely that in Ontario more than one Contractor (if any) is equipped with a machine with a suitable diameter. High mobilization cost. Requires a skilled construction workforce. Requires intermediate jacking stations for relatively long installations. Excavation is slower compared to a TBM because of lower cutterhead RPMs. Requires an overcut to successfully advance the casing pipe. However, debris in the overcut void can create substantial and damaging increases in rock/pipe friction since the rock tunnel walls do not yield like soft ground soils. Cam locking creates point loads when objects are trapped in the overcut void. Also, slurry cuttings passing below the MTBM cutterhead can lift and wedge the MTBM and casing pipe against the tunnel roof.	Likely time delay in obtaining a suitable diameter machine. Slow excavation times as well as cam locking and MTBM wedging can cause costly delays.

DRAWINGS



PLAN

0 400 800
SCALE IN FEET



LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation.

NO.	ELEVATION	CO-ORDINATES NORTHING	EASTING
1	582.86	15583693.03	1066440.48
2	582.66	15583635.73	1066786.70
3	580.64	15584017.54	1067300.56
4	580.93	15584175.54	1067683.55
5	579.67	15584465.77	1068285.71
6	582.07	15582432.29	1066192.32
7	583.97	15582477.01	1066891.83
8	579.50	15582483.91	1067152.52
9	584.48	15582478.29	1067521.35
10	582.50	15582465.46	1067945.80
11	584.88	15582544.29	1069022.85

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS		
DATE	BY	DESCRIPTION

ACRES CONSULTING SERVICES LIMITED

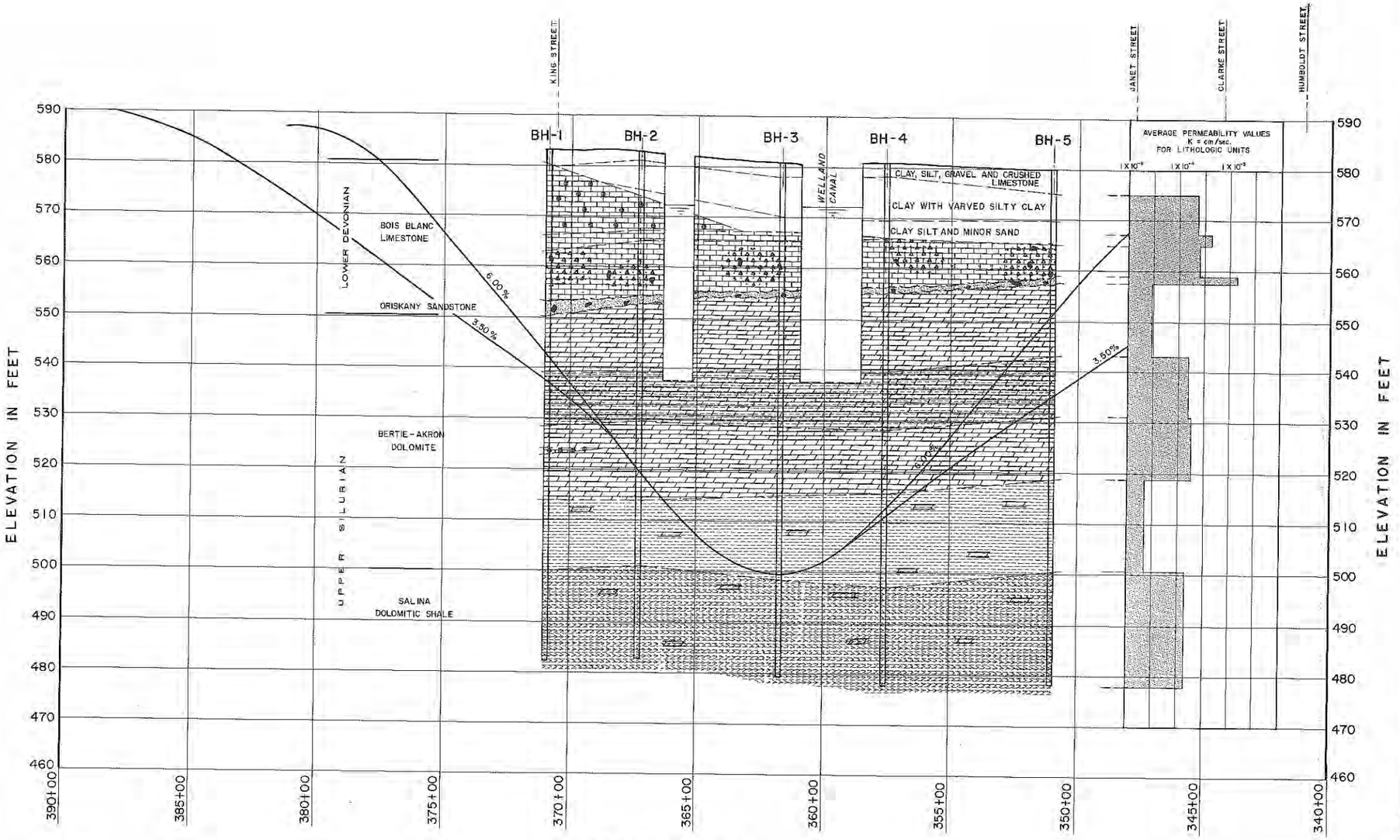
DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH — FOUNDATION OFFICE

PORT COLBORNE TUNNEL
PLAN OF INVESTIGATION AREA

HIGHWAY NO. 3 DIST. NO. 4
CO. WELLAND
TWP. LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD.	CHECKED	W.P. NO. 448-64	DRAWING NO. 1
DRAWN	CHECKED	JOB NO. P 2955	
DATE FEBRUARY, 1972		SITE NO.	BRIDGE DRAWING NO.
APPROVED ACRES CONSULTING SERVICES LIMITED		CONT. NO.	



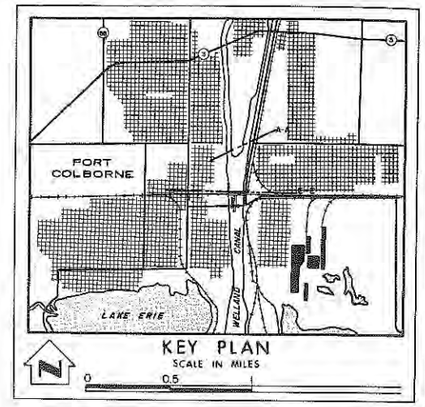
SECTION A-A

LEGEND

- LIMESTONE
- DOLOMITE
- SILTSTONE, SANDSTONE
- SHALE
- CHERT
- GYPSUM
- CORALS
- FOSSILIFEROUS
- UNCONFORMITY

VERT. SCALE IN FEET: 0, 20, 40

HORIZ. SCALE IN FEET: 0, 400, 800



LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation.

NO.	ELEVATION	CO-ORDINATES NORTHING	EASTING
1	582.86	15583693.03	1068440.48
2	582.66	15583835.73	1066786.70
3	580.64	15584017.54	1067300.56
4	580.93	15584175.54	1067689.55
5	579.67	15584465.77	1068285.71

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS

DATE	BY	DESCRIPTION

ACRES CONSULTING SERVICES LIMITED

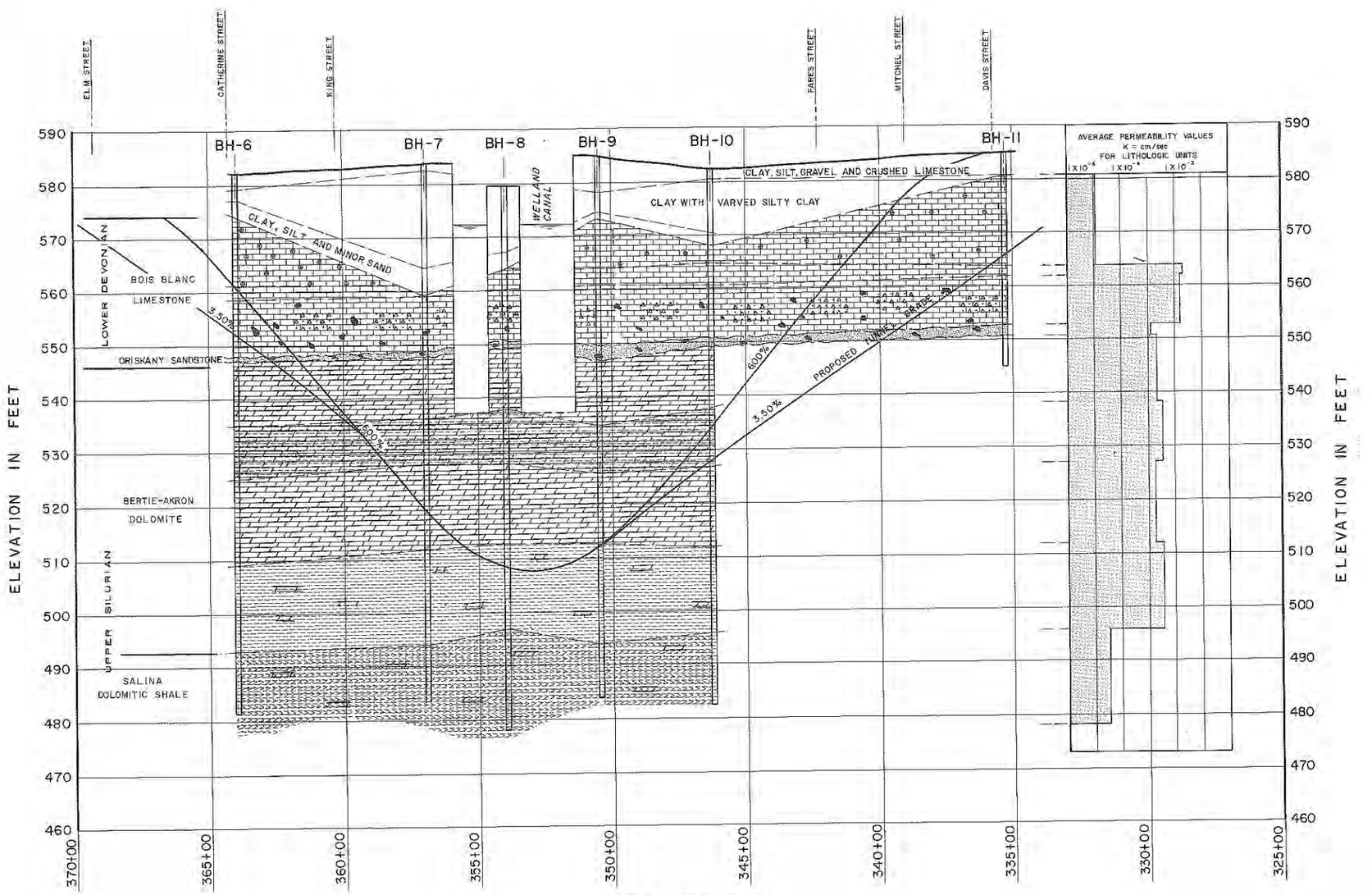
DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH — FOUNDATION OFFICE

PORT COLBORNE TUNNEL
GEOLOGIC SECTION - NORTH LINE

HIGHWAY NO. 3 DIST. NO. 4
CO. WELLAND
TWP. LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. M.H.	CHECKED D.M.	W.P. NO. 446-64	DRAWING NO. 4
DRAWN J.G.	CHECKED	JOB NO. P 2955	
DATE FEBRUARY 1972		SITE NO.	BRIDGE DRAWING NO.
APPROVED ACRES CONSULTING SERVICES LIMITED		CONT. NO.	

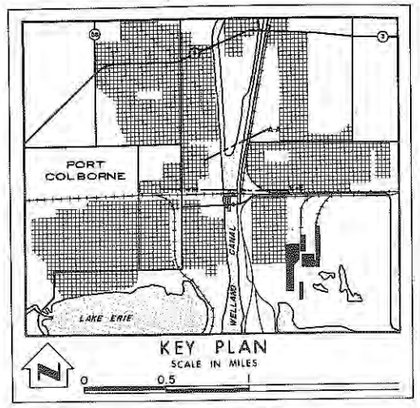


SECTION E-E

LEGEND

- LIMESTONE
- DOLOMITE
- SILTSTONE, SANDSTONE
- SHALE
- CHERT
- GYPSUM
- CORALS
- FOSSILIFEROUS
- UNCONFORMITY

0 20 40
VERT. SCALE IN FEET
0 400 800
HORIZ. SCALE IN FEET



LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation.

NO.	ELEVATION	CO-ORDINATES NORTHING	EASTING
6	582.07	15582432.29	1066192.32
7	583.97	15582477.01	1066891.83
8	579.50	15582483.91	1067152.52
9	584.48	15582478.29	1067521.35
10	582.50	15582465.46	1067945.80
11	584.88	15582544.29	1069022.86

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REVISIONS DATE	BY	DESCRIPTION

ACRES CONSULTING SERVICES LIMITED

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH — FOUNDATION OFFICE

PORT COLBORNE TUNNEL
GEOLOGIC SECTION - SOUTH LINE

HIGHWAY NO. 3 DIST. NO. 4
CO. WELLAND
TWP. LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. M.N.	CHECKED M.N.	W.P. NO. 448-64	DRAWING NO. 5
DRAWN M.N.	CHECKED	JOB NO. P 2955	
DATE FEBRUARY 1972		SITE NO.	BRIDGE DRAWING NO.
APPROVED ACRES CONSULTING SERVICES LIMITED		CONT. NO.	

EASTSIDE SPS FORCEMAIN REPLACEMENT
CITY OF PORT COLBORNE, ONTARIO

BOREHOLE LOCATION PLAN

BluePlan

Niagara Region

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



KEY PLAN

LEGEND

Borehole

BH No.	ELEV. (m)	COORDINATES (UTM, NAD83, Zone 17)	
		NORTHING (m)	EASTING (m)
BH4	176.9	4 752 277.4	643 508.5
BH5	177.0	4 752 295.2	643 298.0

NOTE

This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE

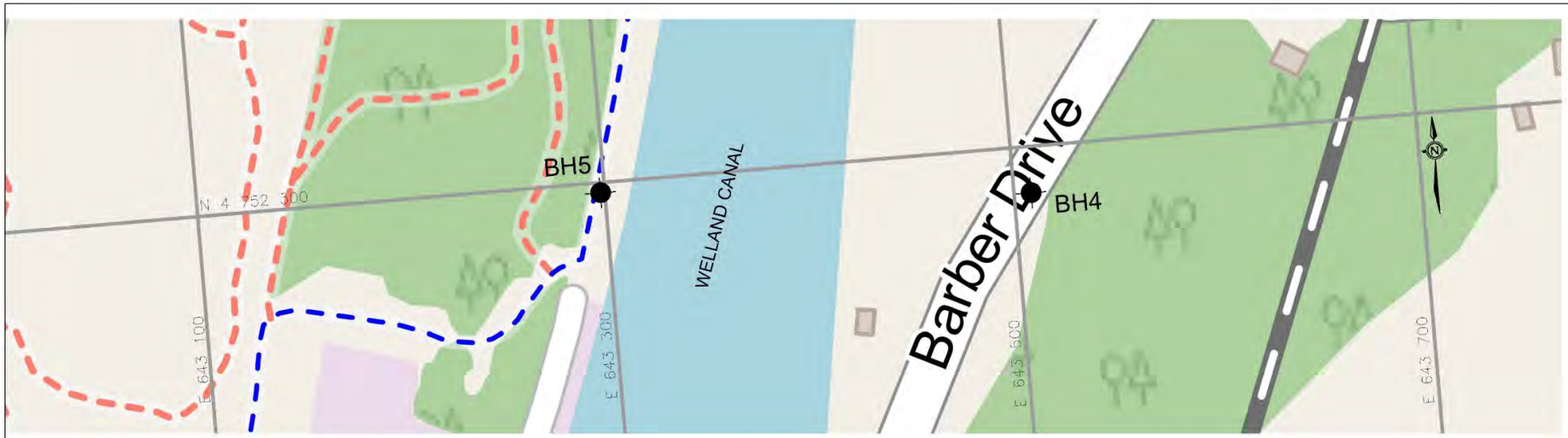
MAP DATA © OPEN STREET MAP CONTRIBUTORS, MAP LAYER BY ESRI.

REVISIONS			
	DATE	BY	DESCRIPTION

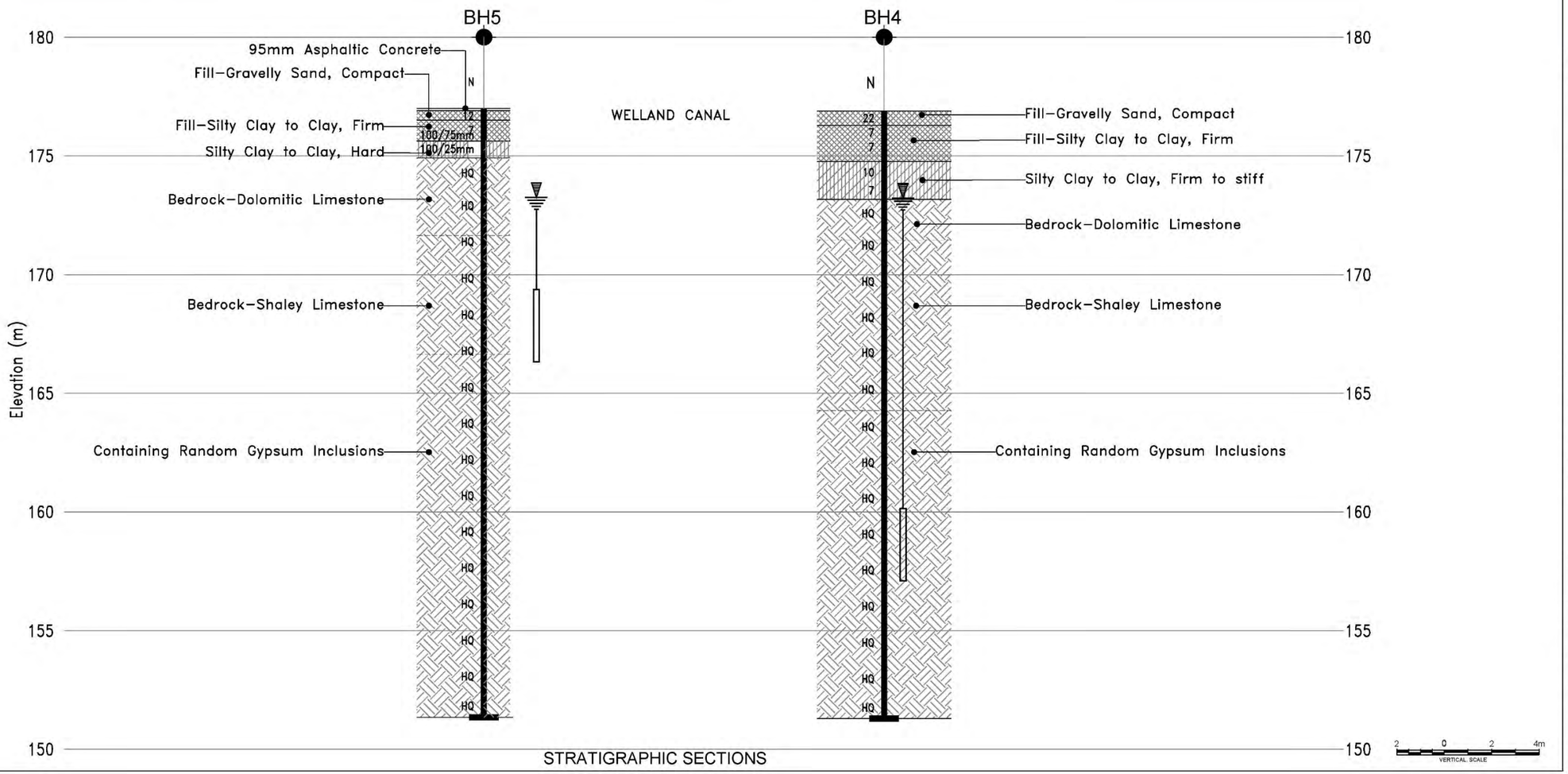
DESIGN SD	PROJECT No. 1-20-0288		DATE November 2020
DRAWN KC	CHK. RA		FIGURE No. 4

Map data © OpenStreetMap contributors, Map layer by Esri

\\192.168.1.90\vol1 Project Files\2020\1-20-0288 - Barber Drive, Port Colborne\A. Dwgs. Logs\AutoCAD\1-20-0288 BH Location Plan 2020-11-03 KC.dwg, DWG to PDF.pc3, Kamal, Kamal



PLAN
SCALE 20 10 0 10 20 30 40m



STRATIGRAPHIC SECTIONS
2 0 2 4m
VERTICAL SCALE

EASTSIDE SPS FORCEMAIN REPLACEMENT
CITY OF PORT COLBORNE, ONTARIO

STRATIGRAPHIC SECTION AT BOREHOLE LOCATIONS

BluePlan

Niagara Region

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



KEY PLAN

LEGEND

	Borehole
'N'	Blows/0.3m (Std Pen Test, 475 J/blow)
CONE	Blows/0.3m (60° Cone, 475 J/blow)
	WL at Time of Investigation
	WL in Piezometer (AUG. 2010)
	Piezometer
90%	Rock Quality Designation
A/R	Auger Refusal

BH No.	ELEV. (m)	COORDINATES (UTM, NAD83, Zone 17)	
		NORTHING (m)	EASTING (m)
BH4	176.9	4 752 277.4	643 508.5
BH5	177.0	4 752 295.2	643 298.0

NOTE
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE
MAP DATA © OPEN STREET MAP CONTRIBUTORS, MAP LAYER BY ESRI.

REVISIONS	DATE	BY	DESCRIPTION

DESIGN SD	PROJECT No. 1-20-0288	DATE November 2020
DRAWN KC	CHK. RA	FIGURE No. 5

\\192.168.1.16\test1 Project Files\2020\1-20-0288 - Barber Drive, Port Colborne\A. Dwgs, Logs\AutoCAD\1-20-0288 BH Location Plan 2020-11-03 KC.dwg, LWG to P31 pc3, Kamal, Kamal

APPENDIX A
Record of Borehole Sheets

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg. FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60/ CONE ANGLE) DRIVEN BY 475J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 – 12	12 – 25	25 – 50	50 – 100	100 – 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 – 5	5 – 10	10 – 30	30 – 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY IS:

RQD (%)	0 – 25	25 – 50	50 – 75	75 – 90	90 – 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50mm	50 – 300mm	0.3m – 1m	1m – 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ε	%	LINEAR STRAIN
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_C	1	COMPRESSION INDEX
C_S	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
C_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	- °	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	- °	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = c_u / τ_r

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1,%	VOID RATIO	e_{min}	1,%	VOID RATIO IN DENSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1,%	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER						
γ_w	kN/m^3	UNIT WEIGHT OF WATER	w	1,%	WATER CONTENT	D	mm	GRAIN DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_P	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	w_S	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_P	%	PLASTICITY INDEX = $(w_L - w_P)$	v	m/s	DISCHARGE VELOCITY
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $(w - w_P)/I_P$	i	1	HYDRAULIC GRADIENT
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	I_C	1	CONSISTENCY INDEX = $(w_L - w)/I_P$	k	m/s	HYDRAULIC CONDUCTIVITY
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL	e_{max}	1,%	VOID RATIO IN LOOSEST STATE	j	kN/m^3	SEEPAGE FORCE

Ministry of Transportation
Ontario

Terraprobe

RECORD OF BOREHOLE No 4

1 of 2

METRIC

G.W.P. _____ LOCATION Coords: E:643508.5 N:4752277.4 (UTM 17T) ORIGINATED BY MYB

DIST _____ HWY _____ BOREHOLE TYPE MUD ROTARY , HQ ROCK CORING COMPILED BY SD

DATUM GEODETIC DATE 2020-8-27 - 2020-9-1 CHECKED BY RA

ELEV / DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	SPT 'N' VALUE	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
176.9	**GROUND SURFACE**										GR SA SI CL
176.3 / 0.6	**FILL**, gravelly sand, some silt, compact, brown, dry to moist		1	SS	22		176				
	FILL, silty clay, some sand, trace gravel, firm, grey, moist to wet		2	SS	7						Resistance to augering from 0.9m to 1.2m.
174.8 / 2.1			3	SS	7		175				
	SILTY CLAY to CLAY, trace sand, trace gravel, firm to stiff, brown, wet		4	SS	10				LL=53		2 5 29 64
173.2 / 3.7			5	SS	7		174				
	BEDROCK - DOLOMITIC LIMESTONE, thickly bedded to massive, greyish brown, weak to very strong, unweathered; medium to coarse grained,including very thin shaley laminations. Horizontal jonts are gapped to open, clean to infilled with clay, planar.		1	RUN	HQ		173				Run #1 TCR: 100% SCR: 96% RQD: 91% UCS= 64.8-115.1MPa
171.4 / 5.5	**BEDROCK - SHALEY LIMESTONE**, thickly bedded to massive, grey to dark grey, medium strong to very strong, unweathered; containing open fractures with clay infills.		2	RUN	HQ		172				Run #2 TCR: 98% SCR: 88% RQD: 70% UCS= 15.2-189.6MPa
			3	RUN	HQ		171				Run #3 TCR: 98% SCR: 83% RQD: 82% UCS= 34.9-44.7MPa
			4	RUN	HQ		170				Run #4 TCR: 97% SCR: 88% RQD: 50% UCS= 35.7-41.7MPa
			5	RUN	HQ		169				Run #5 TCR: 100% SCR: 85% RQD: 72% UCS= 71.2-83.0MPa
			6	RUN	HQ		168				Run #6 TCR: 47% SCR: 11% RQD: 8% UCS= 56.5MPa
164.3 / 12.6	Containing random gypsum inclusions. Weak to strong.		7	RUN	HQ		167				Run #7 TCR: 100% SCR: 92% RQD: 81% UCS= 72.3MPa
			8	RUN	HQ		166				Run #8 TCR: 95% SCR: 73% RQD: 55%
							165				
							164				
							163				
							162				

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

file: 1-20-0288 bh logs - oct 1.gpj

Ministry of Transportation
Ontario

Terraprobe

RECORD OF BOREHOLE No 4

2 of 2 **METRIC**

G.W.P. _____ LOCATION Coords: E:643508.5 N:4752277.4 (UTM 17T) ORIGINATED BY MYB

DIST _____ HWY _____ BOREHOLE TYPE MUD ROTARY , HQ ROCK CORING COMPILED BY SD

DATUM GEODETIC DATE 2020-8-27 - 2020-9-1 CHECKED BY RA

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	(continued)							
	Containing random gypsum inclusions. Weak to strong.		8	RUN	HQ			UCS= 20.0-34.6MPa
			9	RUN	HQ		161	Run #9 TCR: 100% SCR: 92% RQD: 77%
			10	RUN	HQ		160	Run #10 TCR: 96% SCR: 90% RQD: 76% UCS= 52.3MPa
			11	RUN	HQ		159	Run #11 TCR: 100% SCR: 90% RQD: 68% UCS= 20.6-20.8MPa
			12	RUN	HQ		158	Run #12 TCR: 96% SCR: 82% RQD: 60% UCS= 17.3-37.4MPa
			13	RUN	HQ		157	Run #13 TCR: 98% SCR: 92% RQD: 36% UCS= 19.1-23.6MPa
			14	RUN	HQ		156	Run #14 TCR: 93% SCR: 78% RQD: 52% UCS= 22.6MPa
			15	RUN	HQ		155	Run #15 TCR: 97% SCR: 94% RQD: 64% UCS= 15.6MPa
151.3 25.6							154	
	END OF BOREHOLE						153	
	Piezometer installation consists of a 50mm diameter PVC pipe with a 3.0m slotted screen.						152	
	Borehole filled with drill water upon completion of drilling.							

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

UNIT WEIGHT γ kN/m^3

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 1, 2020	3.6	173.3
Sep 16, 2020	3.5	173.4

+^{3}, ×^{3}: Numbers refer to Sensitivity ○$^{3\%}$ STRAIN AT FAILURE

file: 1-20-0288 bh logs - oct 1.gpj

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RECORD OF ROCK CORE No 4

1 of 2

METRIC

G.W.P. _____ LOCATION Coords: E:643508.5 N:4752277.4 ORIGINATED BY MYB

DIST _____ HWY _____ BOREHOLE TYPE MUD ROTARY , HQ ROCK CORING COMPILED BY SD

DATUM GEODETIC DATE 2020-8-27 - 2020-9-1 CHECKED BY RA

Rock coring started at 3.7m below grade

Depth (m)	Graphic Log	GENERAL DESCRIPTION	Run Elev Depth (m)	Recovery	Elevation (m)	ISRM Weathering Zones	UCS (MPa) / Estimated Strength	Natural Fractures Frequency	Natural Fractures Spacing	Laboratory Testing	Comments	Elevation (m)
4		**Dolomitic LIMESTONE**, greyish brown, thickly bedded to massive, weak to very strong, unweathered; medium to coarse grained,including very thin shaley laminations. Horizontal jonts are gapped to open, clean to infilled with clay, planar.	3.7 R1 172.0	TCR = **100%** SCR = **96%** RQD = **91%**	173			0 2 0		**3.7m :** *UCS = 105.3 MPa **4.0m :** *UCS = 115.1 MPa **4.3m :** *UCS = 64.8 MPa	**3.7m:** *approx. 25mm rubblized zone*	173
5			4.9 R2 170.5	TCR = **98%** SCR = **88%** RQD = **70%**	172			1 1 1 0		**4.9m :** UCS = 15.2 MPa γ = 26.5 kN/m^3 **5.3m :** *UCS = 91.0 MPa	**5.1m:** *approx. 25mm dipping joint, gapped, clean, planar*	172
6		**Shaley LIMESTONE**, grey to dark grey, thickly bedded to massive, medium strong to very strong, unweathered; containing open fractures with clay infills.			171			5 4 2		**5.8m :** *UCS = 189.5 MPa	**6.1m:** *approx. 50mm rubblized zone* **6.2m:** *approx. 40mm horizontal joint, open, infilled with clay, planar*	171
7			6.4 R3 169.0	TCR = **98%** SCR = **83%** RQD = **82%**	170			2 2 1		**6.7m :** *UCS = 44.7 MPa **7.2m :** *UCS = 34.9 MPa		170
8			7.9 R4 167.5	TCR = **97%** SCR = **88%** RQD = **50%**	169			5 3 3 2		**8.5m :** *UCS = 41.6 MPa	**7.8m:** *approx. 50mm dipping joint, gapped, clean, planar* **8.2m:** *approx. 40mm horizontal joint, open, infilled with clay, planar* **8.3m:** *approx. 40mm horizontal joint, open, infilled with clay, planar* **8.6m:** *approx. 65mm horizontal joint, open, infilled with clay, planar* **9.1m:** *approx. 40mm horizontal joint, open, infilled with clay, planar*	169
9					168			5 2 3		**9.2m :** UCS = 35.7 MPa γ = 26.3 kN/m^3 **9.4m :** *UCS = 71.2 MPa		168
10			9.4 R5 166.0	TCR = **100%** SCR = **85%** RQD = **72%**	167			1 2 1 4		**10.1m :** *UCS = 83.0 MPa	**9.6m:** *approx. 25mm horizontal joint, open, infilled with clay, planar* **9.7m:** *approx. 50mm horizontal joint, open, infilled with clay, planar* **9.8m:** *approx. 40mm horizontal joint, open, infilled with clay, undulating* **9.9m:** *approx. 80mm horizontal joint, open, infilled with clay, planar* **10.3m:** *approx. 40mm horizontal joint, open, infilled with clay, planar*	167
11			10.9 R6 164.4	TCR = **47%** SCR = **11%** RQD = **8%**	166			Rubble Zone Rubble Zone Rubble Zone Core Loss		**11.1m :** *UCS = 56.5 MPa	**10.9m:** *approx. 50mm horizontal joint, open, infilled with clay, planar* **10.9m:** *approx. 180mm rubblized zone* **11.3m:** *approx. 150mm rubblized zone* **11.5m:** *approx. 50mm vertical joint, gapped, clean, planar* **11.5m:** *approx. 180mm rubblized zone* **11.7m:** *approx. 850mm core loss*	166
12					165							165
13		Containing random gypsum inclusions. Weak to strong.	12.5 R7 162.8	TCR = **100%** SCR = **92%** RQD = **81%**	164			2 1 0 1 1		**13.2m :** *UCS = 72.3 MPa	**12.5m:** *approx. 80mm rubblized zone*	164
14					163							163
15			14.1 R8 161.3	TCR = **95%** SCR = **73%** RQD = **55%**	162			4 2 2 6		**14.8m :** *UCS = 34.6 MPa **15.3m :** *UCS = 20.0 MPa	**15.0m:** *approx. 50mm rubblized zone* **15.2m:** *approx. 130mm vertical joint, gapped, clean, planar*	162
16			15.6 R9 159.8	TCR = **100%** SCR = **92%** RQD = **77%**	161			1 3 1 2 1			**15.8m:** *approx. 40mm rubblized zone*	161
17					160			1 4				160
18			17.1 R10 158.3 R11	TCR = **96%** SCR = **90%** RQD = **76%**	159			4 1 1 0 3		**17.9m :** *UCS = 52.3 MPa	**18.6m:** *approx. 25mm horizontal joint,*	159

(continued next page)

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RECORD OF ROCK CORE No 4

METRIC

G.W.P. _____ LOCATION Coords: E:643508.5 N:4752277.4 ORIGINATED BY MYB

DIST _____ HWY _____ BOREHOLE TYPE MUD ROTARY , HQ ROCK CORING COMPILED BY SD

DATUM GEODETIC DATE 2020-8-27 - 2020-9-1 CHECKED BY RA

Depth (m)	Graphic Log	GENERAL DESCRIPTION	Run / Elev / Depth (m)	Recovery	Elevation (m)	ISRM Weathering Zones I II III IV V	UCS (MPa) 5 25 50 100 250 / Estimated Strength R1 R2 R3 R4 R5 R6	Natural Fractures: Frequency	Natural Fractures: Spacing	Laboratory Testing	Comments	Elevation (m)
19		Containing random gypsum inclusions. Weak to strong.	18.6		158			3			*open, infilled with clay, planar* **18.7m:** *approx. 90mm horizontal joint, open, infilled with clay, planar*	158
			R11	TCR = **100%** SCR = **90%** RQD = **68%**				1		**19.4m :** UCS = 20.8 MPa γ = 23.5 kN/m^3	**19.3m:** *approx. 40mm horizontal joint, open, infilled with clay, planar*	
			156.8					2			**19.4m:** *approx. 50mm rubblized zone*	
20			20.1		157			1		**19.6m :** *UCS = 20.6 MPa		157
			R12	TCR = **96%** SCR = **82%** RQD = **60%**				4			**20.2m:** *approx. 25mm horizontal joint, open, infilled with clay, planar*	
			155.3					2				
21			21.6		156			1		**20.6m :** *UCS = 17.3 MPa		
			R13	TCR = **98%** SCR = **92%** RQD = **36%**				4			**20.9m:** *approx. 40mm rubblized zone*	156
			153.7					4		**21.3m :** *UCS = 37.4 MPa	**21.2m:** *approx. 40mm dipping joint, gapped, clean, planar*	
			23.2					4			**21.6m:** *approx. 25mm rubblized zone*	
22			R14	TCR = **93%** SCR = **78%** RQD = **52%**	155			3		**21.9m :** *UCS = 19.1 MPa		155
			152.2					2		**22.3m :** *UCS = 23.6 MPa		
23			24.7		154			3				
			R15	TCR = **97%** SCR = **94%** RQD = **64%**				2		**22.8m :** *UCS = 21.3 MPa		154
			151.3					5			**23.2m:** *approx. 25mm vertical joint, gapped, clean, planar*	
			25.6m					5				
24					153			3			**23.7m:** *approx. 25mm rubblized zone*	
								2			**24.0m:** *approx. 150mm rubblized zone*	153
								2		**24.4m :** *UCS = 22.6 MPa		
25					152			0				152
								2				
								2				
								2		**25.5m :** *UCS = 15.6 MPa		

END OF COREHOLE

*Uniaxial Compressive Strength determined from Point Load Strength Index values.

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RECORD OF BOREHOLE No 5

1 of 2

METRIC

G.W.P. | LOCATION Coords: E:643298 N:4752295.2 (UTM 17T) | ORIGINATED BY MYB

DIST | HWY | BOREHOLE TYPE MUD ROTARY , HQ ROCK CORING | COMPILED BY SD

DATUM GEODETIC | DATE 2020-8-24 - 2020-8-27 | CHECKED BY RA

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	SPT 'N' VALUE	REMARKS & GRAIN SIZE DISTRIBUTION (%)
177.0	**GROUND SURFACE**				
	95mm **ASPHALTIC CONCRETE**	1	SS	12	
176.5 / 0.5	405mm **FILL**, gravelly sand, some silt to silty, trace clay, compact, brown, moist	2	SS	7	0 3 26 71
	FILL, silty clay to clay, trace to some sand, trace gravel, firm, brown, moist to wet	3	SS	100 / 75mm	
175.6 / 1.4					
	SILTY CLAY to CLAY, trace to some sand, trace gravel, hard, brown, wet	4	SS	100 / 25mm	Resistance to augering from 1.5m to 1.8m.
174.9 / 2.1	**BEDROCK - DOLOMITIC LIMESTONE**, thickly bedded to massive, greyish brown, medium strong to very strong, unweathered; medium to coarse grained,including very thin shaley laminations. Horizontal jonts are gapped to open, clean, planar.	1	RUN	HQ	Run #1 TCR: 100% SCR: 91% RQD: 0% UCS= 53.4-82.8MPa
		2	RUN	HQ	Run #2 TCR: 98% SCR: 93% RQD: 20% UCS= 25.3-120.8MPa
171.6 / 5.4	**BEDROCK - SHALEY LIMESTONE**, thickly bedded to massive, grey to dark grey, wak to very strong, unweathered	3	RUN	HQ	Run #3 TCR: 96% SCR: 93% RQD: 51% UCS= 160.0MPa
		4	RUN	HQ	Run #4 TCR: 97% SCR: 91% RQD: 75% UCS= 102.4MPa
		5	RUN	HQ	Run #5 TCR: 98% SCR: 98% RQD: 83% UCS= 70.5MPa
166.6 / 10.4	Containing random gypsum inclusions. Weak to very strong.	6	RUN	HQ	Run #6 TCR: 98% SCR: 95% RQD: 61% UCS= 8.1-58.6MPa
		7	RUN	HQ	Run #7 TCR: 98% SCR: 89% RQD: 49% UCS= 104.2MPa
		8	RUN	HQ	Run #8 TCR: 99% SCR: 86% RQD: 59% UCS= 21.0-73.4MPa
		9	RUN	HQ	Run #9 TCR: 95% SCR: 74% RQD: 48%

ELEVATION SCALE: 176, 175, 174, 173, 172, 171, 170, 169, 168, 167, 166, 165, 164, 163

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

LL=60

UNIT WEIGHT γ kN/m^3

GR SA SI CL

file: 1-20-0288 bh logs - oct 1.gpj

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

○ $^{3\%}$ STRAIN AT FAILURE

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Ontario

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RECORD OF BOREHOLE No 5

2 of 2

METRIC

G.W.P. | LOCATION Coords: E:643298 N:4752295.2 (UTM 17T) | ORIGINATED BY MYB

DIST | HWY | BOREHOLE TYPE MUD ROTARY , HQ ROCK CORING | COMPILED BY SD

DATUM GEODETIC | DATE 2020-8-24 - 2020-8-27 | CHECKED BY RA

ELEV DEPTH (m)	DESCRIPTION *(continued)*	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SPT 'N' VALUE	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Containing random gypsum inclusions. Weak to very strong.		9	RUN	HQ		162				UCS= 59.7MPa
			10	RUN	HQ		161				Run #10 TCR: 97% SCR: 81% RQD: 47% UCS= 28.9MPa
			11	RUN	HQ		160				Run #11 TCR: 98% SCR: 79% RQD: 52% UCS= 12.7MPa
			12	RUN	HQ		159				Run #12 TCR: 98% SCR: 83% RQD: 50% UCS= 22.0-23.5MPa
			13	RUN	HQ		158				Run #13 TCR: 98% SCR: 82% RQD: 38% UCS= 17.7MPa
			14	RUN	HQ		157				Run #14 TCR: 100% SCR: 100% RQD: 91% UCS= 16.7-23.0MPa
			15	RUN	HQ		156				Run #15 TCR: 97% SCR: 94% RQD: 56% UCS= 25.7-36.7MPa
			16	RUN	HQ		155				Run #16 TCR: 96% SCR: 88% RQD: 21% UCS= 34.4MPa
151.3 25.7	**END OF BOREHOLE**						154				
	Piezometer installation consists of a 50mm diameter PVC pipe with a 3.0m slotted screen.						153				
	Borehole filled with drill water upon completion of drilling.						152				

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 1, 2020	3.7	173.3
Sep 15, 2020	3.6	173.4

+ ³, × ³: Numbers refer to Sensitivity ○ ³% STRAIN AT FAILURE

file: 1-20-0288 bh logs - oct 1.gpj

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RECORD OF ROCK CORE No 5

1 of 2

METRIC

G.W.P. _____ LOCATION Coords: E:643298.0 N:4752295.2 ORIGINATED BY MYB

DIST _____ HWY _____ BOREHOLE TYPE MUD ROTARY , HQ ROCK CORING COMPILED BY SD

DATUM GEODETIC DATE 2020-8-24 - 2020-8-27 CHECKED BY RA

GENERAL DESCRIPTION

Rock coring started at 2.1m below grade

Dolomitic LIMESTONE, greyish brown, thickly bedded to massive, medium strong to very strong, unweathered; medium to coarse grained,including very thin shaley laminations. Horizontal jonts are gapped to open, clean, planar.

Shaley LIMESTONE, grey to dark grey, thickly bedded to massive, weak to very strong, unweathered

Containing random gypsum inclusions. Weak to very strong.

Run	Elev Depth (m)	Recovery	Elevation (m)
	174.9		
R1	2.1 – 173.6	TCR = **100%** SCR = **91%** RQD = **0%**	174
R2	3.4 – 172.2	TCR = **98%** SCR = **93%** RQD = **20%**	173
R3	4.8 – 170.6	TCR = **96%** SCR = **93%** RQD = **51%**	172
R4	6.4 – 169.1	TCR = **97%** SCR = **91%** RQD = **75%**	171
R5	7.9 – 167.6	TCR = **98%** SCR = **98%** RQD = **83%**	170
R6	9.4 – 166.0	TCR = **98%** SCR = **95%** RQD = **61%**	169
R7	11.0 – 164.5	TCR = **98%** SCR = **89%** RQD = **49%**	168
R8	12.5 – 163.0	TCR = **99%** SCR = **86%** RQD = **59%**	167
R9	14.0 – 161.4	TCR = **95%** SCR = **74%** RQD = **48%**	166
R10	15.6 – 159.9	TCR = **97%** SCR = **81%** RQD = **47%**	165
			164
			163
			162
			161
			160

ISRM Weathering Zones: I, II, III, IV, V

UCS (MPa) / Estimated Strength: 5 25 50 100 250; R1 R2 R3 R4 R5 R6

Natural Fractures Frequency	Natural Fractures Spacing
5	
6	
4	
7	
4	
3	
5	
5	
6	
3	
3	
2	
5	
2	
3	
1	
0	
2	
3	
1	
0	
3	
0	
0	
0	
6	
3	
4	
5	
3	
4	
4	
1	
4	
4	
2	
0	
2	
9	
3	
2	
0	
1	
3	
3	
2	
3	
1	

Laboratory Testing

- **2.2m :** *UCS = 82.8 MPa
- **2.8m :** *UCS = 53.3 MPa
- **4.0m :** *UCS = 120.8 MPa
- **4.5m :** *UCS = 115.7 MPa
- **4.5m :** UCS = 25.3 MPa, γ = 25.5 kN/m^3
- **5.3m :** *UCS = 160.0 MPa
- **7.2m :** *UCS = 102.4 MPa
- **9.0m :** *UCS = 70.5 MPa
- **9.4m :** UCS = 8.1 MPa, γ = 26.5 kN/m^3
- **10.4m :** *UCS = 58.5 MPa
- **10.7m :** *UCS = 22.1 MPa
- **11.2m :** *UCS = 104.2 MPa
- **12.9m :** *UCS = 21.0 MPa
- **13.4m :** *UCS = 21.0 MPa
- **13.9m :** *UCS = 73.4 MPa
- **15.0m :** *UCS = 59.7 MPa
- **16.2m :** *UCS = 28.9 MPa

Comments

- **2.3m:** *approx. 25mm dipping joint, gapped, clean, planar*
- **2.3m:** *approx. 40mm dipping joint, gapped, clean, undulating*
- **2.4m:** *approx. 40mm vertical joint, gapped, clean, planar*
- **3.2m:** *approx. 130mm rubblized zone*
- **4.2m:** *approx. 80mm dipping joint, gapped, clean, planar*
- **5.9m:** *approx. 25mm horizontal joint, open, infilled with clay, planar*
- **7.9m:** *approx. 25mm dipping joint, gapped, clean, planar*
- **8.0m:** *approx. 25mm dipping joint, gapped, clean, planar, smooth*
- **8.7m:** *approx. 15mm horizontal joint, gapped, infilled with clay, planar*
- **10.1m:** *approx. 15mm vertical joint, gapped, clean, planar*
- **10.1m:** *approx. 15mm rubblized zone*
- **10.3m:** *approx. 25mm dipping joint, gapped, clean, rough, undulating*
- **11.0m:** *approx. 15mm dipping joint, gapped, clean, rough, undulating*
- **11.7m:** *approx. 15mm dipping joint, gapped, clean, rough, undulating*
- **11.8m:** *approx. 25mm rubblized zone*
- **12.5m:** *approx. 25mm dipping joint, gapped, clean, rough, undulating*
- **13.1m:** *approx. 50mm dipping joint, gapped, clean, rough, undulating*
- **13.2m:** *approx. 50mm dipping joint, gapped, clean, rough, undulating*
- **14.1m:** *approx. 25mm dipping joint, gapped, clean, planar*
- **14.4m:** *approx. 130mm rubblized zone*
- **15.6m:** *approx. 15mm horizontal joint, open, infilled with clay, planar*
- **15.6m:** *approx. 40mm rubblized zone*

(continued next page)

Ministry of Transportation
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RECORD OF ROCK CORE No 5

METRIC

G.W.P. _____ LOCATION Coords: E:643298.0 N:4752295.2 ORIGINATED BY MYB

DIST _____ HWY _____ BOREHOLE TYPE MUD ROTARY , HQ ROCK CORING COMPILED BY SD

DATUM GEODETIC DATE 2020-8-24 - 2020-8-27 CHECKED BY RA

Depth (m)	Graphic Log	GENERAL DESCRIPTION	Run Elev / Depth (m)	Recovery	Elevation (m)	ISRM Weathering Zones I II III IV V	UCS (MPa) 5 25 50 100 250 / Estimated Strength R1 R2 R3 R4 R5 R6	Natural Fractures: Frequency	Natural Fractures: Spacing	Laboratory Testing	Comments	Elevation (m)
			174.9									
		Containing random gypsum inclusions. Weak to very strong.						1			**17.1m:** *approx. 100mm rubblized zone* **17.2m:** *approx. 25mm rubblized zone*	
								0				
18			R11 17.1	TCR = **98%** SCR = **79%** RQD = **52%**	159			4		**18.0m :** UCS = 12.7 MPa γ = 25.3 kN/m^3		159
			158.4					3				
			18.6					4				
								6			**18.7m:** *approx. 40mm rubblized zone*	
								4			**18.8m:** *approx. 40mm rubblized zone*	
19			R12	TCR = **98%** SCR = **83%** RQD = **50%**	158			3			**18.9m:** *approx. 25mm rubblized zone*	158
								2		**19.5m :** *UCS = 23.5 MPa		
			156.9					0		**19.8m :** *UCS = 22 MPa		
20			20.1		157			5				157
								3			**20.2m:** *approx. 40mm dipping joint, gapped, clean, planar*	
								5		**20.7m :** *UCS = 17.7 MPa	**20.3m:** *approx. 25mm dipping joint, gapped, clean, planar*	
21			R13	TCR = **98%** SCR = **82%** RQD = **38%**	156			3			**20.3m:** *approx. 25mm dipping joint, gapped, clean, planar*	156
			155.4					3				
			21.6					0		**21.7m :** *UCS = 23.0 MPa	**21.2m:** *approx. 25mm rubblized zone*	
22					155			2				155
			R14	TCR = **100%** SCR = **100%** RQD = **91%**				2				
								2				
23			153.8		154			2		**23.0m :** *UCS = 16.7 MPa		154
			23.2					3				
								5				
24			R15	TCR = **97%** SCR = **94%** RQD = **56%**	153			2		**23.8m :** *UCS = 25.7 MPa **24.1m :** *UCS = 36.7 MPa		153
								3				
			152.3					2				
			24.7					6				
25			R16	TCR = **96%** SCR = **88%** RQD = **21%**	152			3			**25.0m:** *approx. 25mm dipping joint, gapped, clean, undulating*	152
			151.3					4		**25.5m :** *UCS = 34.4 MPa		
			25.7m									

END OF COREHOLE
*Uniaxial Compressive Strength determined from Point Load Strength Index values.

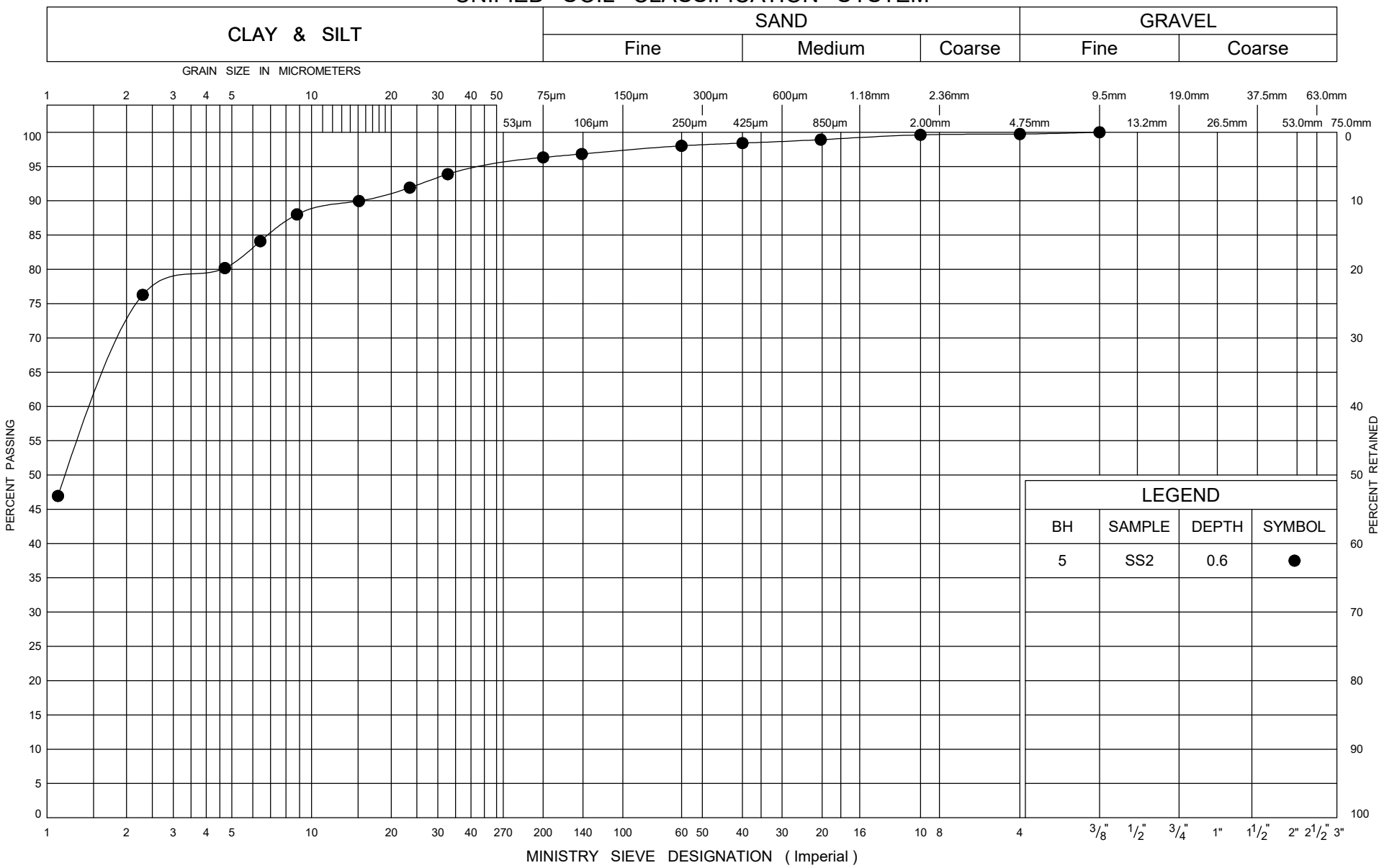
file: 1-20-0288 rock core logs - oct 1.gpj

APPENDIX B
Laboratory Test Results

Terraprobe

78 12 M

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION
FILL - SILTY CLAY TO CLAY

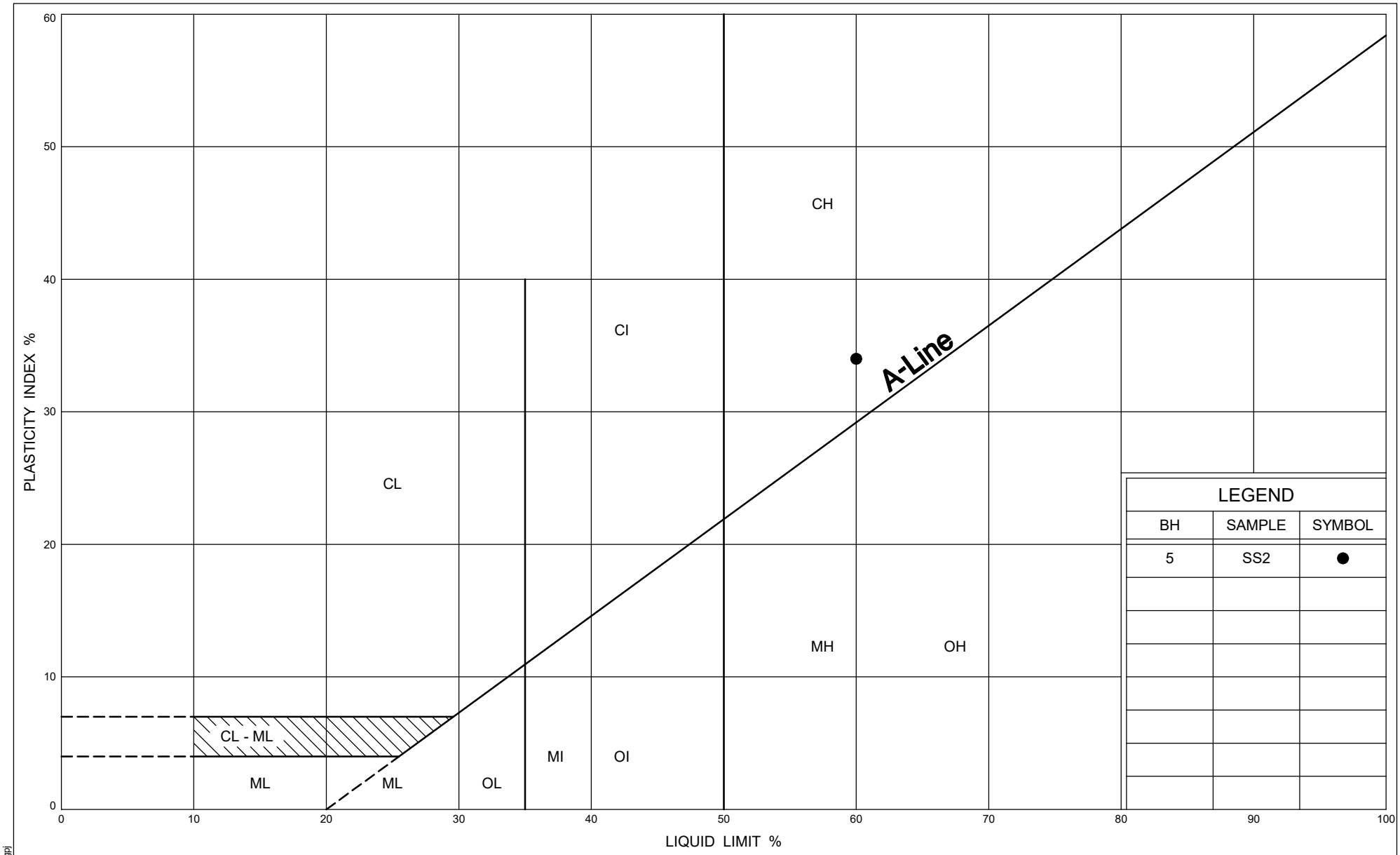
FIG No B1

G W P

Niagara SPS Forcemain Replacement

file: 1-20-0288 bh logs - oct 1.gpj

Terraprobe



Ministry of Transportation
Ontario

PLASTICITY CHART

FILL - SILTY CLAY TO CLAY

FIG No B2

G W P

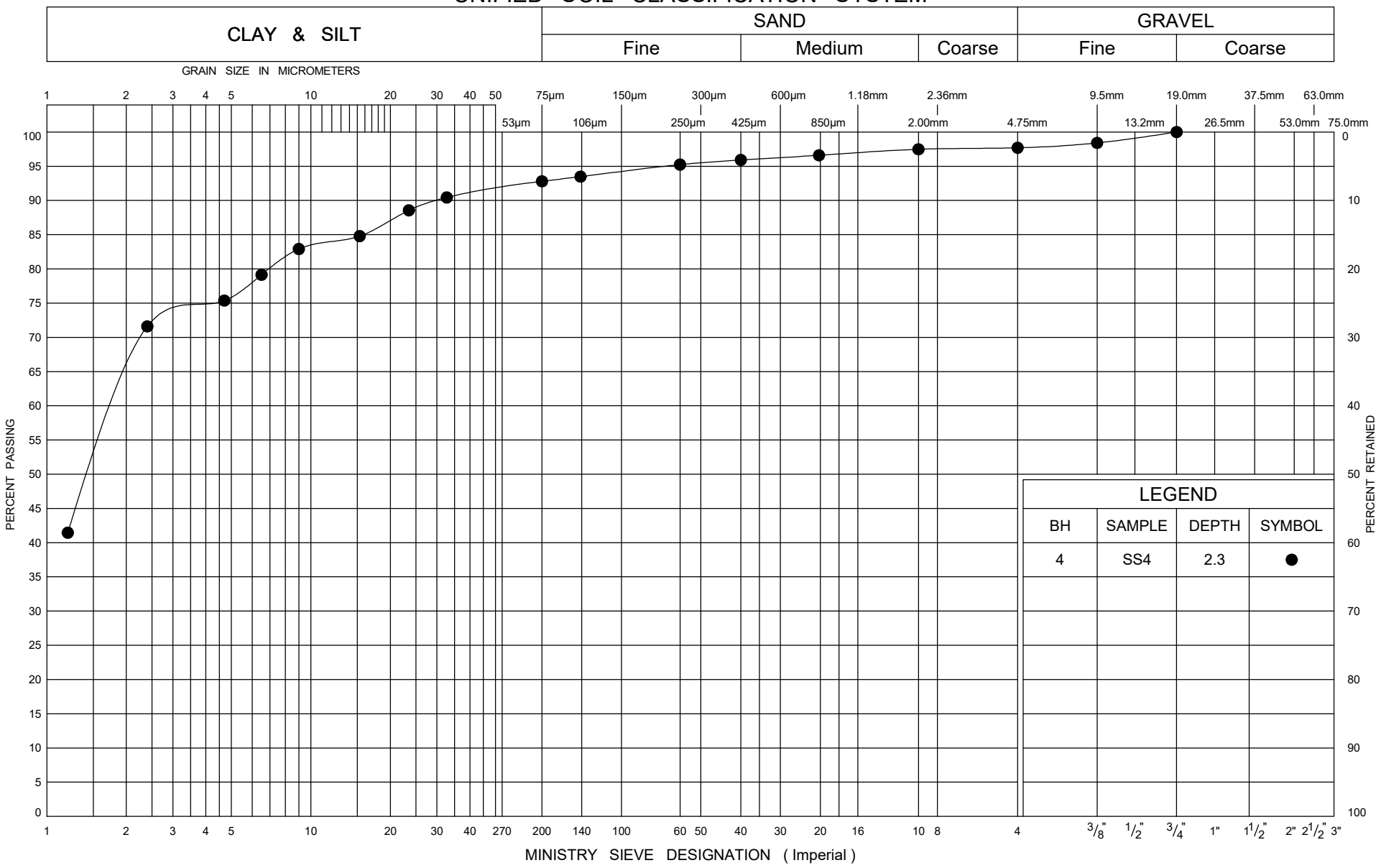
Niagara SPS Forcemain Replacement

file: 1-20-0288 bh logs - oct 1.gpj

Terraprobe

78 12 M

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION
SILTY CLAY TO CLAY

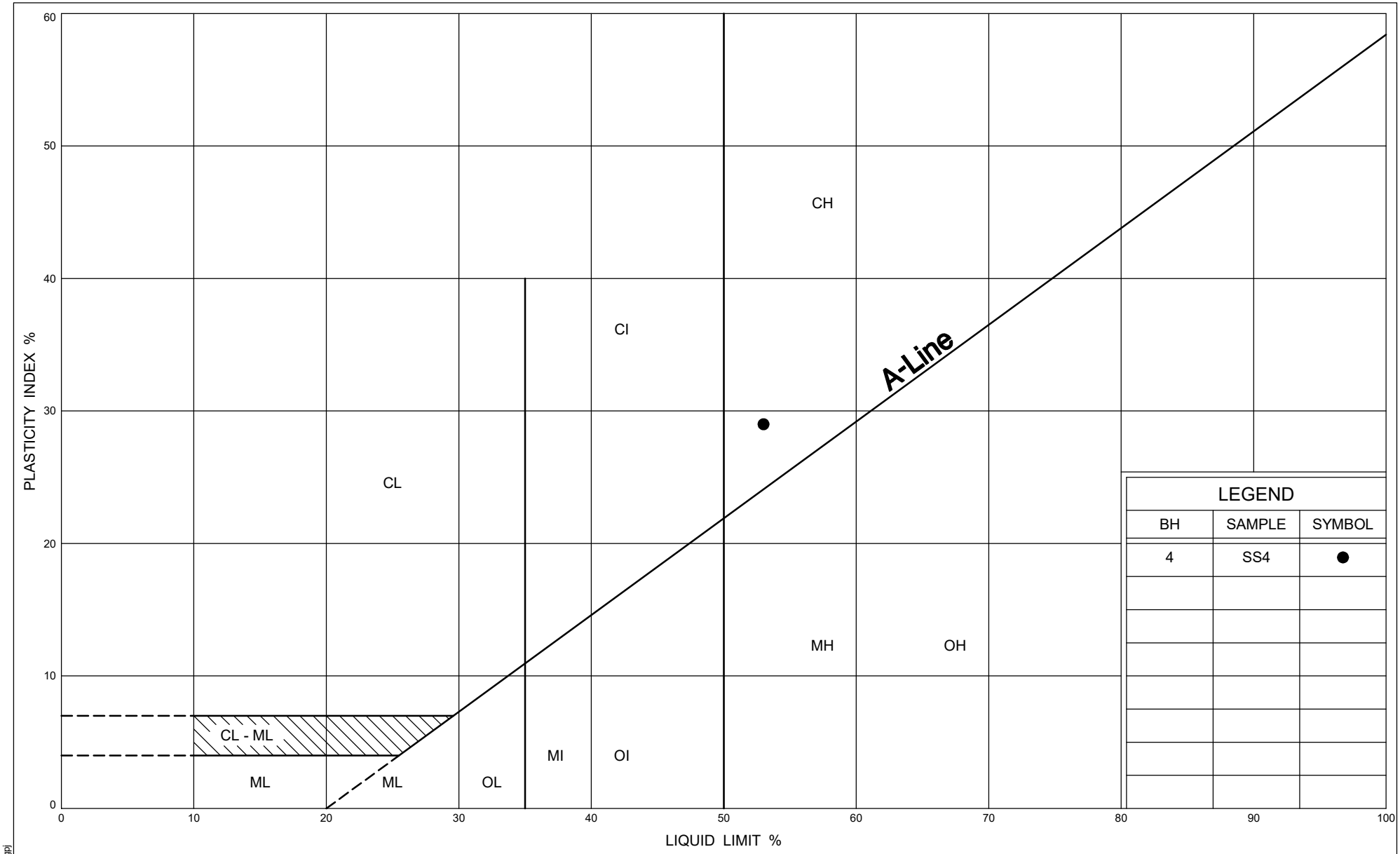
FIG No B3

G W P

Niagara SPS Forcemain Replacement

file: 1-20-0288 bh logs - oct 1.gpj

Terraprobe



Ministry of Transportation
Ontario

PLASTICITY CHART

SILTY CLAY TO CLAY

FIG No B4

G W P

Niagara SPS Forcemain Replacement

file: 1-20-0288 bh logs - oct 1.gpj

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B5

Borehole No. 4 - 12' 3" to 21" 1"



Borehole No. 4 - 21" 1" to 30" 1"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

Prepared by : SD
Checked by : RA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B6

Borehole No. 4 - 30' 1" to 40' 6"



Borehole No. 4 - 40' 6" to 49' 5"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

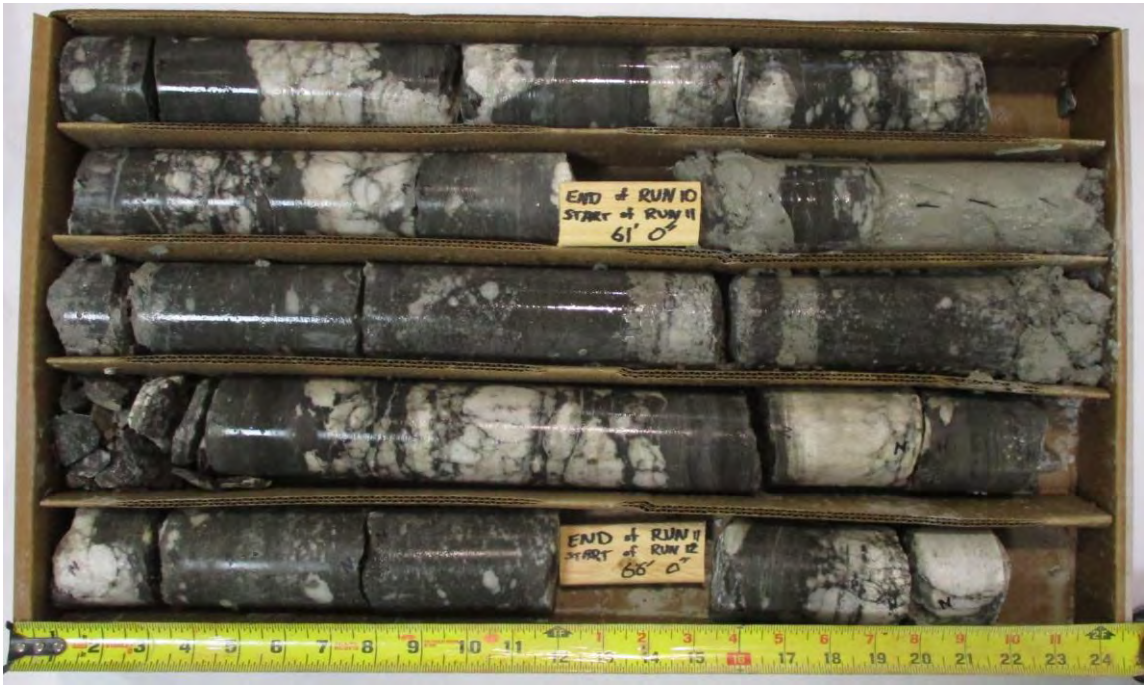
Prepared by : SD
Checked by : RA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B7

Borehole No. 4 - 49' 5" to 58' 0"



Borehole No. 4 - 58' 0" to 66' 6"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

Prepared by : SD
Checked by : RA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B8

Borehole No. 4 - 66' 6" to 75' 6"



Borehole No. 4 - 75' 6" to 84' 0"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

Prepared by : SD
Checked by : RA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B9

Borehole No. 5 - 6' 10" to 15' 6"



Borehole No. 5 - 15' 6" to 24' 8"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

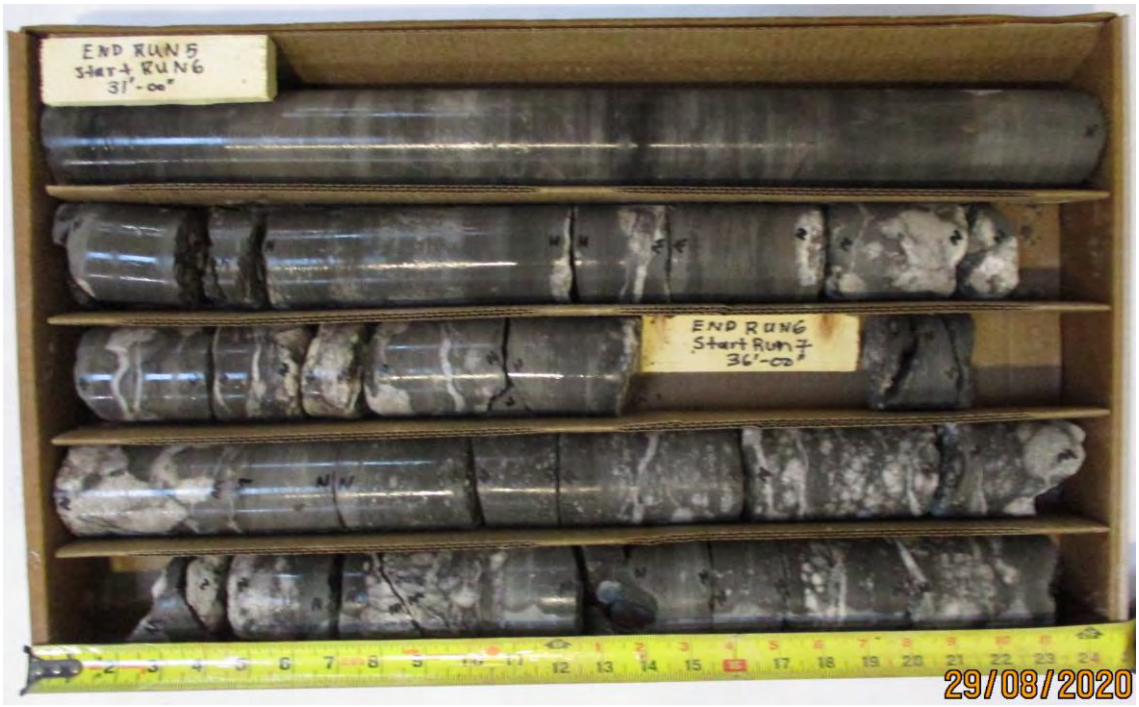
Prepared by : SD
Checked by : RA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B10

Borehole No. 5 - 24' 8" to 31' 0"



Borehole No. 5 - 31' 0" to 39' 11"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

Prepared by : SD
Checked by : RA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B11

Borehole No. 5 - 39' 11" to 48' 3"



Borehole No. 5 - 48' 3" to 56' 5"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

Prepared by : SD
Checked by : RA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B12

Borehole No. 5 - 56' 5" to 65' 6"



Borehole No. 5 - 65' 6" to 73' 9"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

Prepared by : SD
Checked by : RA

PHOTOGRAPHS OF BEDROCK CORE SAMPLES	FIGURE B13

Borehole No. 5 - 73' 9" to 82' 0"



Borehole No. 5 - 82' 0" to 84' 2"



Project No. : 1-20-0288
Date : August, 2020

Terraprobe Inc.

Prepared by : SD
Checked by : RA

POINT LOAD TEST SHEET
(ASTM D5731-16)

FIGURE B14

Test No.	Run No.	Depth (m)	Test Type	Width (mm)	Diameter (mm)	Load (KN)	D_e^2 (mm^2)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	UCS (MPa)	Rock Type	Rock Strength (after Hoek & Brown, 1997)
1	1	3.7	D //	-	63.2	15.6	3729.2	4.185	1.094	4.579	105.3	Dolomitic Limestone	Very Strong
2	1	4.0	D //	-	63.3	17.1	3732.3	4.571	1.094	5.003	115.1	Dolomitic Limestone	Very Strong
3	1	4.3	D //	-	63.3	9.6	3734.1	2.576	1.094	2.819	64.8	Dolomitic Limestone	Strong
4	2	5.3	D //	-	63.4	13.7	3806.6	3.601	1.099	3.958	91.0	Dolomitic Limestone	Strong
5	2	5.8	D //	-	43.3	21.0	2554.5	8.201	1.005	8.241	189.5	Shaley Limestone	Very Strong
6	3	6.7	D //	-	63.3	6.8	3863.9	1.763	1.103	1.945	44.7	Shaley Limestone	Medium Strong
7	3	7.2	D //	-	63.4	5.3	3867.2	1.375	1.103	1.517	34.9	Shaley Limestone	Medium Strong
8	4	8.5	A ⊥	63.3	-	6.6	4031.7	1.626	1.114	1.811	41.6	Shaley Limestone	Medium Strong
9	5	9.4	D //	-	63.3	10.8	3859.1	2.806	1.103	3.094	71.2	Shaley Limestone	Strong
10	5	10.1	D //	-	63.6	12.8	3940.9	3.258	1.108	3.610	83.0	Shaley Limestone	Strong
11	6	11.1	D //	-	63.3	8.6	3863.3	2.226	1.103	2.455	56.5	Shaley Limestone	Strong
12	7	13.2	D //	-	63.5	11.0	3871.7	2.849	1.103	3.144	72.3	Shaley Limestone	Strong
13	8	14.8	D //	-	63.4	5.3	3865.6	1.363	1.103	1.503	34.6	Shaley Limestone	Medium Strong
14	8	15.3	D //	-	63.3	3.1	3922.1	0.785	1.107	0.868	20.0	Shaley Limestone	Weak
15	10	17.9	D //	-	63.2	8.0	3855.2	2.063	1.102	2.274	52.3	Shaley Limestone	Strong

Notes: Ideally axial tests should be performed on core samples with a Diameter/Length ratio of 0.33 to 1.0. Long core samples can be tested diametrically.
Core samples subjected to Diametral Tests should have a minimum distance of 0.5 x D on either side of the test point.
Correlation factor of 23 used to obtain UCS values.
Samples were three weeks air dried at the time of testing.

D = Diametral
A = Axial
B = Block
I = Irregular
⊥ Perpendicular to Plane of Weakness
// Parallel to Plane of Weakness

Project No.: 1-20-0288
Borehole No.: 4
Date drilled: August 27, 2020
Core Size: HQ

Terraprobe Inc.

Lab Number: 1218
Date tested: September 25, 2020
Tested by: DP
Checked by: SD

POINT LOAD TEST SHEET
(ASTM D5731-16)

FIGURE B15

Test No.	Run No.	Depth (m)	Test Type	Width (mm)	Diameter (mm)	Load (KN)	D_e^2 (mm^2)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	UCS (MPa)	Rock Type	Rock Strength (after Hoek & Brown, 1997)
16	11	19.6	D //	-	63.2	3.1	3791.4	0.814	1.098	0.894	20.6	Shaley Limestone	Weak
17	12	20.6	D //	-	63.4	2.6	3866.4	0.682	1.103	0.753	17.3	Shaley Limestone	Weak
18	12	21.3	D //	-	63.5	5.6	3811.4	1.478	1.100	1.625	37.4	Shaley Limestone	Medium Strong
19	13	21.9	D //	-	63.3	2.9	3860.1	0.753	1.103	0.830	19.1	Shaley Limestone	Weak
20	13	22.3	A ⊥	63.5	-	3.8	4124.5	0.916	1.119	1.025	23.6	Shaley Limestone	Weak
21	13	22.8	D //	-	63.2	3.2	3791.6	0.841	1.098	0.924	21.3	Shaley Limestone	Weak
22	14	24.4	D //	-	63.3	3.4	3860.3	0.891	1.103	0.982	22.6	Shaley Limestone	Weak
23	15	25.5	D //	-	63.4	2.4	3930.6	0.612	1.107	0.678	15.6	Shaley Limestone	Weak

Notes: Ideally axial tests should be performed on core samples with a Diameter/Length ratio of 0.33 to 1.0. Long core samples can be tested diametrically.
Core samples subjected to Diametral Tests should have a minimum distance of 0.5 x D on either side of the test point.
Correlation factor of 23 used to obtain UCS values.
Samples were three weeks air dried at the time of testing.

D = Diametral
A = Axial
B = Block
I = Irregular
⊥ Perpendicular to Plane of Weakness
// Parallel to Plane of Weakness

Project No.: 1-20-0288
Borehole No.: 4
Date drilled: August 27, 2020
Core Size: HQ

Terraprobe Inc.

Lab Number: 1218
Date tested: September 25, 2020
Tested by: DP
Checked by: SD

POINT LOAD TEST SHEET
(ASTM D5731-16)

FIGURE B16

Test No.	Run No.	Depth (m)	Test Type	Width (mm)	Diameter (mm)	Load (KN)	D_e^2 (mm^2)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	UCS (MPa)	Rock Type	Rock Strength (after Hoek & Brown, 1997)
1	1	2.2	A ⊥	63.1	-	12.8	3935.1	3.251	1.107	3.600	82.8	Dolomitic Limestone	Strong
2	1	2.8	D //	-	63.1	8.0	3783.4	2.113	1.098	2.319	53.3	Dolomitic Limestone	Strong
3	2	4.0	D //	-	63.3	17.7	3669.9	4.819	1.090	5.254	120.8	Dolomitic Limestone	Very Strong
4	2	4.5	A ⊥	63.2	-	23.3	5555.9	4.202	1.197	5.028	115.7	Dolomitic Limestone	Very Strong
5	3	5.3	D //	-	63.2	23.7	3728.6	6.358	1.094	6.957	160.0	Dolomitic Limestone	Very Strong
6	4	7.2	A ⊥	63.3	-	13.8	3301.8	4.183	1.065	4.453	102.4	Shaley Limestone	Very Strong
7	5	9.0	D //	-	63.2	10.7	3855.6	2.780	1.102	3.065	70.5	Shaley Limestone	Strong
8	6	10.4	D //	-	63.3	8.9	3861.3	2.308	1.103	2.545	58.5	Shaley Limestone	Strong
9	6	10.7	D //	-	63.3	3.3	3797.0	0.876	1.099	0.963	22.1	Shaley Limestone	Weak
10	7	11.2	D //	-	63.3	15.4	3732.7	4.138	1.094	4.529	104.2	Shaley Limestone	Very Strong
11	8	12.9	D //	-	63.4	3.2	3802.0	0.832	1.099	0.914	21.0	Shaley Limestone	Weak
12	8	13.4	D //	-	63.4	3.2	3802.6	0.832	1.099	0.914	21.0	Shaley Limestone	Weak
13	8	13.9	D //	-	63.4	11.0	3803.4	2.904	1.099	3.191	73.4	Shaley Limestone	Strong
14	9	15.0	D //	-	63.3	8.9	3734.3	2.370	1.094	2.594	59.7	Shaley Limestone	Strong
15	10	16.2	D //	-	63.2	4.4	3852.6	1.142	1.102	1.258	28.9	Shaley Limestone	Medium Strong

Notes: Ideally axial tests should be performed on core samples with a Diameter/Length ratio of 0.33 to 1.0. Long core samples can be tested diametrically.
Core samples subjected to Diametral Tests should have a minimum distance of 0.5 x D on either side of the test point.
Correlation factor of 23 used to obtain UCS values.
Samples were three weeks air dried at the time of testing.

D = Diametral
A = Axial
B = Block
I = Irregular
⊥ Perpendicular to Plane of Weakness
// Parallel to Plane of Weakness

Project No.: 1-20-0288
Borehole No.: 5
Date drilled: August 24, 2020
Core Size: HQ

Terraprobe Inc.

Lab Number: 1218
Date tested: September 28, 2020
Tested by: DP
Checked by: SD

POINT LOAD TEST SHEET
(ASTM D5731-16)

FIGURE B17

Test No.	Run No.	Depth (m)	Test Type	Width (mm)	Diameter (mm)	Load (KN)	D_e^2 (mm^2)	I_s (MPa)	F	$I_{s(50)}$ (MPa)	UCS (MPa)	Rock Type	Rock Strength (after Hoek & Brown, 1997)
16	12	19.5	D //	-	63.3	3.6	3925.6	0.923	1.107	1.021	23.5	Shaley Limestone	Weak
17	12	19.8	D //	-	63.3	3.4	3924.6	0.863	1.107	0.955	22.0	Shaley Limestone	Weak
18	13	20.7	D //	-	63.3	2.7	3925.2	0.697	1.107	0.771	17.7	Shaley Limestone	Weak
19	14	21.7	D //	-	63.4	3.5	3868.4	0.906	1.103	0.999	23.0	Shaley Limestone	Weak
20	14	23.0	D //	-	63.1	2.6	3909.9	0.655	1.106	0.724	16.7	Shaley Limestone	Weak
21	15	23.8	D //	-	63.3	4.0	3925.6	1.008	1.107	1.116	25.7	Shaley Limestone	Medium Strong
22	15	24.1	D //	-	63.3	5.6	3860.1	1.447	1.103	1.595	36.7	Shaley Limestone	Medium Strong
23	16	25.5	A ⊥	63.3	-	5.2	3788.4	1.362	1.098	1.496	34.4	Shaley Limestone	Medium Strong

Notes: Ideally axial tests should be performed on core samples with a Diameter/Length ratio of 0.33 to 1.0. Long core samples can be tested diametrically.
Core samples subjected to Diametral Tests should have a minimum distance of 0.5 x D on either side of the test point.
Correlation factor of 23 used to obtain UCS values.
Samples were three weeks air dried at the time of testing.

D = Diametral
A = Axial
B = Block
I = Irregular
⊥ Perpendicular to Plane of Weakness
// Parallel to Plane of Weakness

Project No.: 1-20-0288
Borehole No.: 5
Date drilled: August 24, 2020
Core Size: HQ

Terraprobe Inc.

Lab Number: 1218
Date tested: September 28, 2020
Tested by: DP
Checked by: SD

APPENDIX C
Bedrock Test Results

APPENDIX C1
Packer Test Results

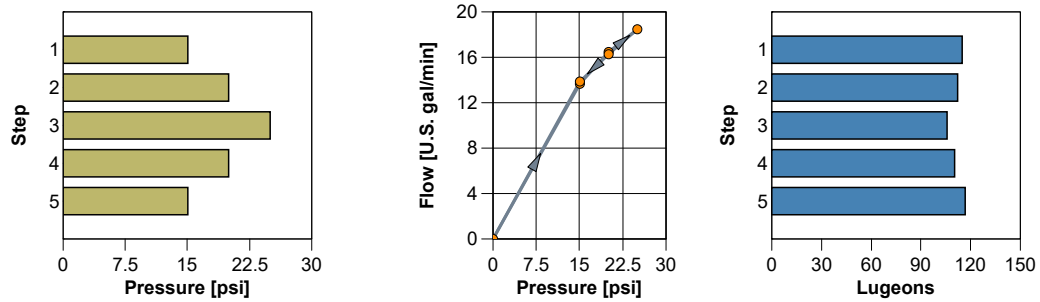
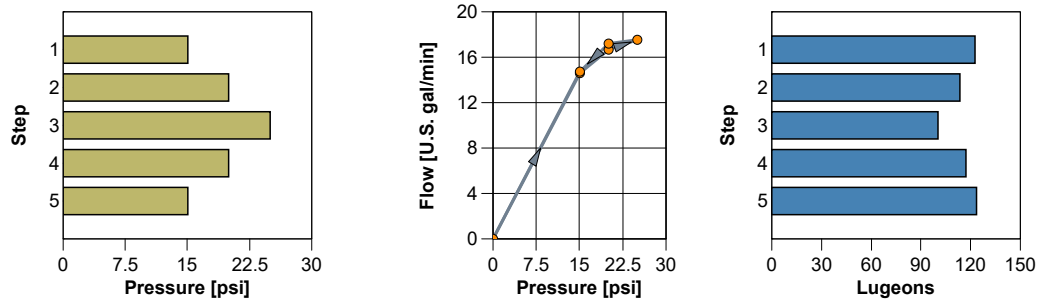
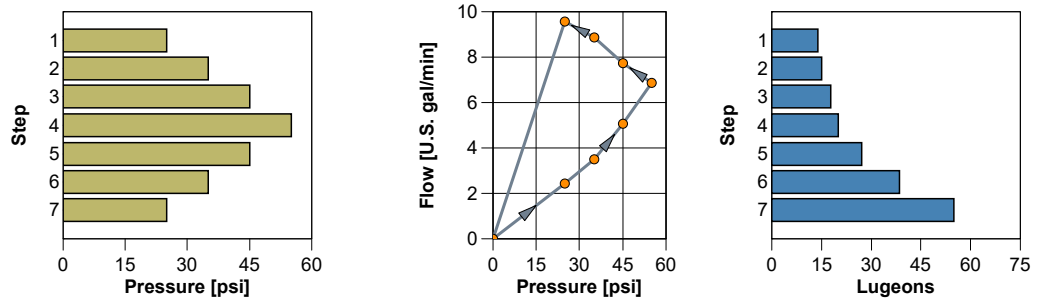
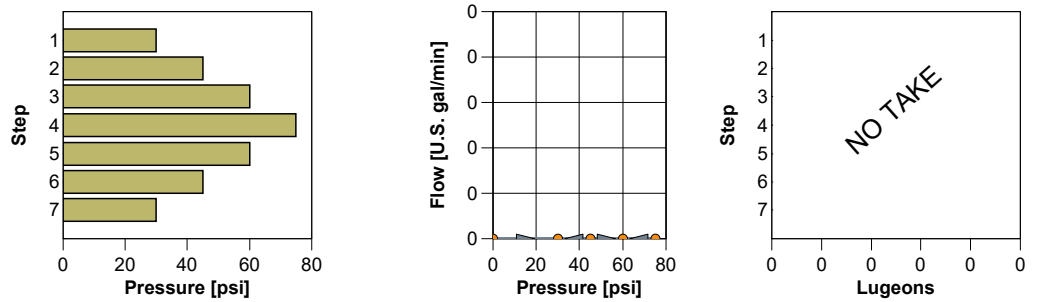
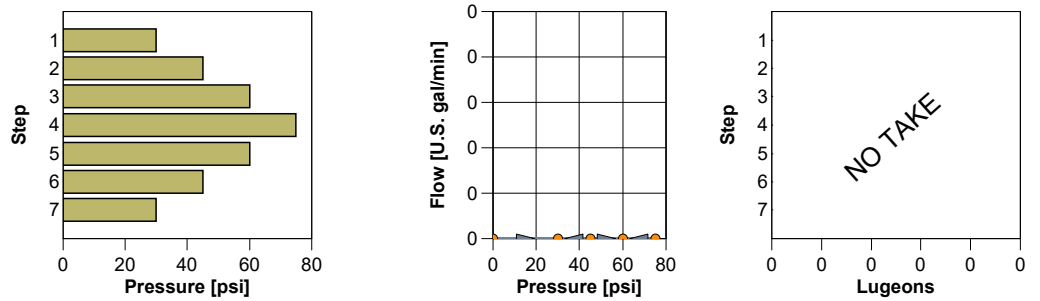
Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

Lugeon Test Summary - BH 4

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

Client: The Regional Municipality of Niagara

Test Interval Top Bottom	Graphs	Result
5.330 m 8.380 m		Turbulent Lugeon: 105.7 Hydraulic Conductivity: 1.14E-3 cm/s Hydraulic Conductivity: 1.14E-5 m/s
8.380 m 11.430 m		Turbulent Lugeon: 100.5 Hydraulic Conductivity: 1.09E-3 cm/s Hydraulic Conductivity: 1.09E-5 m/s
15.240 m 18.290 m		Wash out Lugeon: 54.8 Hydraulic Conductivity: 5.92E-4 cm/s Hydraulic Conductivity: 5.92E-6 m/s
18.290 m 21.340 m		NO TAKE
21.340 m 24.380 m		NO TAKE

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

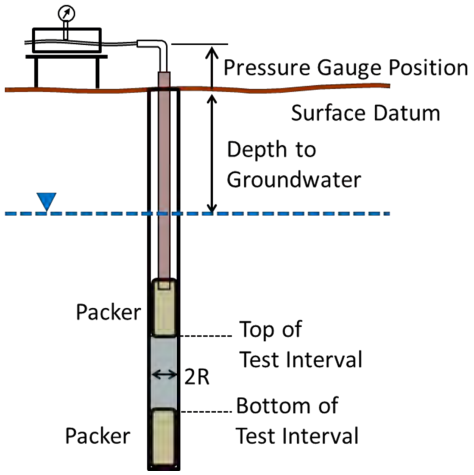
Lugeon Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

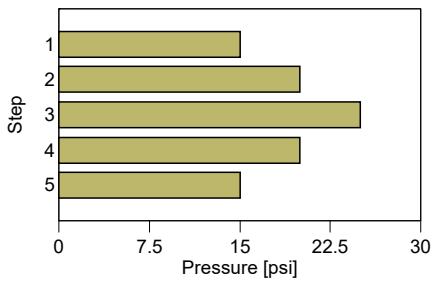
Client: The Regional Municipality of Niagara

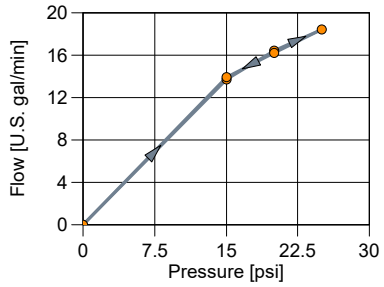
Location: Port Colborne	Lugeon Test: Test 1	Tested bore: BH 4
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

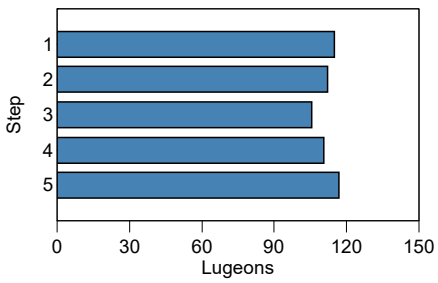


Top of Test Interval: 5.330 m
Bottom of Test Interval: 8.380 m
Length of Test Interval: 3.050 m
Gauge Position: 0.980 m
Depth to Groundwater: 3.550 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]						Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6		[cm/s]	[m/s]	Lugeon
1	15.0	13.4	27.1	41.0	54.7	68.3	81.9	13.7	1.24×10^{-3}	1.24×10^{-5}	115.0
2	20.0	16.4	33.0	49.6	66.3	83.0	98.7	16.5	1.21×10^{-3}	1.21×10^{-5}	112.0
3	25.0	18.5	36.8	55.2	73.8	92.0	110.8	18.5	1.14×10^{-3}	1.14×10^{-5}	105.7
4	20.0	16.6	33.0	49.5	65.5	81.5	97.8	16.2	1.19×10^{-3}	1.19×10^{-5}	110.6
5	15.0	14.2	28.5	42.0	56.7	70.8	83.7	13.9	1.26×10^{-3}	1.26×10^{-5}	116.7
								Average	1.21×10^{-3}	1.21×10^{-5}	112.0







Turbulent
Lugeon: 105.7

Hydraulic Conductivity: 1.14E-3 cm/s
Hydraulic Conductivity: 1.14E-5 m/s

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

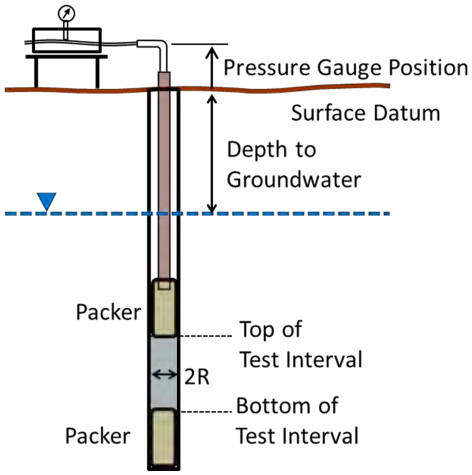
Lugeon Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

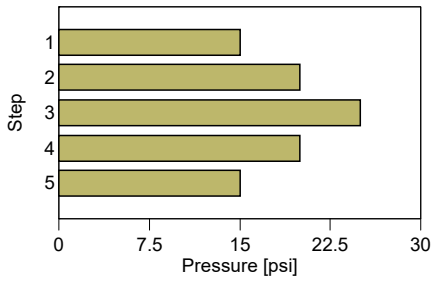
Client: The Regional Municipality of Niagara

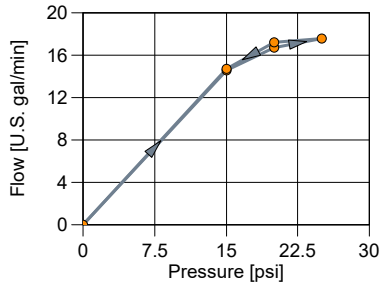
Location: Port Colborne	Lugeon Test: Test 2	Tested bore: BH 4
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

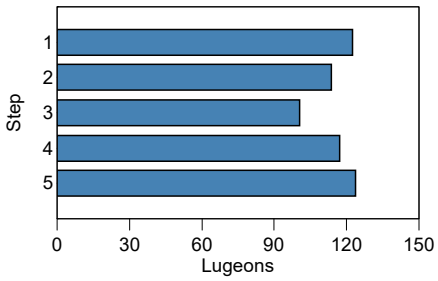


Top of Test Interval: 8.380 m
Bottom of Test Interval: 11.430 m
Length of Test Interval: 3.050 m
Gauge Position: 0.980 m
Depth to Groundwater: 3.550 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]								Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8		[cm/s]	[m/s]	Lugeon
1	15.0	14.6	29.4	44.0	58.6	73.2	87.8	102.4	116.7	14.6	1.32×10^{-3}	1.32×10^{-5}	122.4
2	20.0	16.7	33.4	49.9	66.6	83.0	99.6	116.7	133.5	16.7	1.23×10^{-3}	1.23×10^{-5}	113.6
3	25.0	18.6	37.6	56.6	75.7	94.5	113.5	122.5	141.5	17.6	1.09×10^{-3}	1.09×10^{-5}	100.5
4	20.0	106.4	125.3	142.3	159.1	176.5	192.9	209.9	226.7	17.2	1.26×10^{-3}	1.26×10^{-5}	117.0
5	15.0	14.8	29.5	44.0	58.7	73.7	88.7	103.7	118.0	14.7	1.34×10^{-3}	1.34×10^{-5}	123.8
									Average		1.25×10^{-3}	1.25×10^{-5}	115.5







Turbulent
Lugeon: 100.5

Hydraulic Conductivity: 1.09E-3 cm/s
Hydraulic Conductivity: 1.09E-5 m/s

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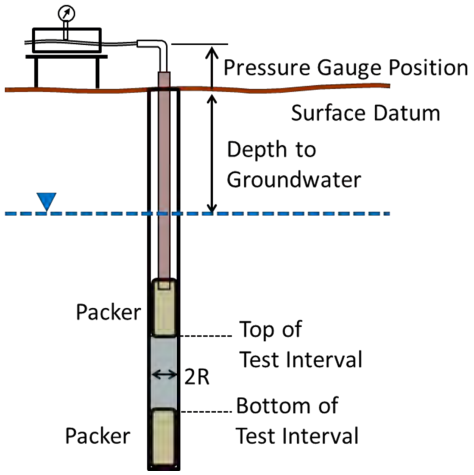
Lugeon Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

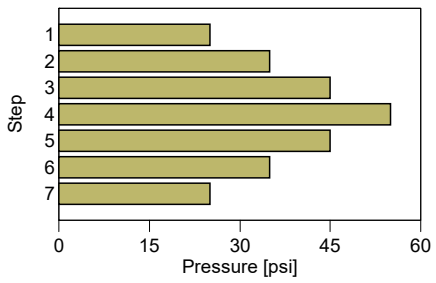
Client: The Regional Municipality of Niagara

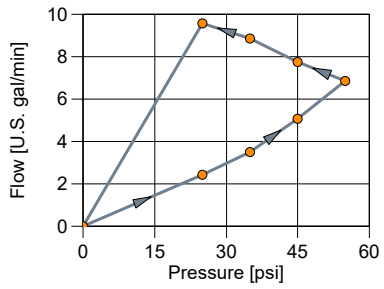
Location: Port Colborne	Lugeon Test: Test 3	Tested bore: BH 4
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

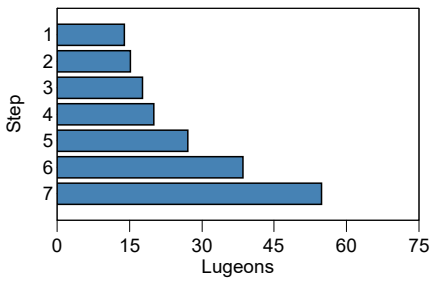


Top of Test Interval: 15.240 m
Bottom of Test Interval: 18.290 m
Length of Test Interval: 3.050 m
Gauge Position: 0.980 m
Depth to Groundwater: 3.550 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]										Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[cm/s]	[m/s]	Lugeon
1	25.0	1.8	4.2	6.3	8.5	11.0	13.4	15.9	18.3	21.0	23.7	2.4	1.50×10^{-4}	1.50×10^{-6}	13.9
2	35.0	3.4	6.8	10.0	13.5	16.9	20.3	23.6	27.3	31.0	34.8	3.5	1.64×10^{-4}	1.64×10^{-6}	15.2
3	45.0	4.9	9.7	14.6	19.6	24.6	29.6	34.7	39.8	44.9	50.4	5.1	1.91×10^{-4}	1.91×10^{-6}	17.7
4	55.0	6.5	13.6	20.0	26.4	33.4	40.3	47.0	54.3	61.2	68.3	6.9	2.17×10^{-4}	2.17×10^{-6}	20.1
5	45.0	6.9	14.0	21.2	28.5	35.9	43.6	51.8	60.0	68.3	76.6	7.7	2.93×10^{-4}	2.93×10^{-6}	27.1
6	35.0	7.9	16.1	24.5	32.8	41.2	50.0	60.2	69.3	78.4	87.6	8.9	4.15×10^{-4}	4.15×10^{-6}	38.5
7	25.0	6.8	15.6	23.4	31.3	49.5	60.5	69.4	77.5	85.0	93.0	9.6	5.92×10^{-4}	5.92×10^{-6}	54.8
												Average	2.89×10^{-4}	2.89×10^{-6}	26.8







Wash Out
Lugeon: 54.8

Hydraulic Conductivity: 5.92E-4 cm/s
Hydraulic Conductivity: 5.92E-6 m/s

Terraprobe
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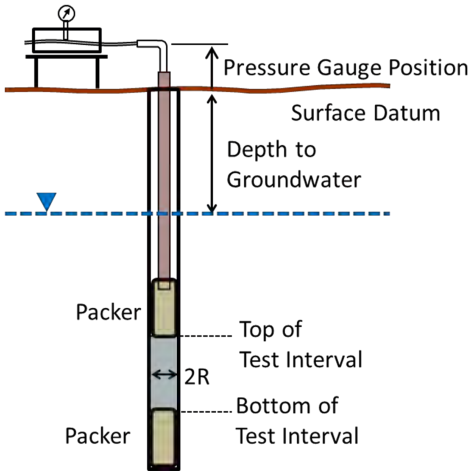
Lugeon Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

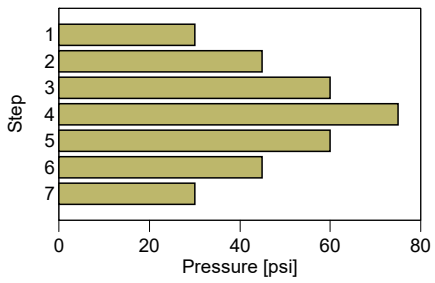
Client: The Regional Municipality of Niagara

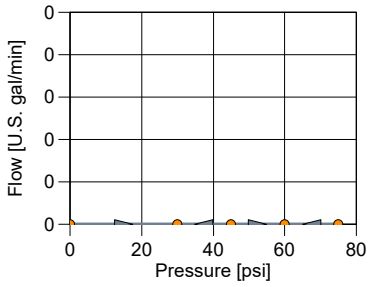
Location: Port Colborne	Lugeon Test: Test 4	Tested bore: BH 4
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

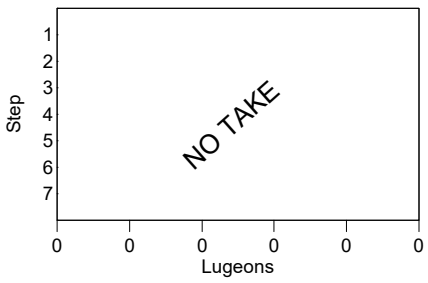


Top of Test Interval: 18.290 m
Bottom of Test Interval: 21.340 m
Length of Test Interval: 3.050 m
Gauge Position: 0.980 m
Depth to Groundwater: 3.550 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]										Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[cm/s]	[m/s]	Lugeon
1	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
3	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
4	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
5	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
6	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
7	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
												Average	0.00×10^{0}	0.00×10^{0}	0.0







NO TAKE

Terraprobe
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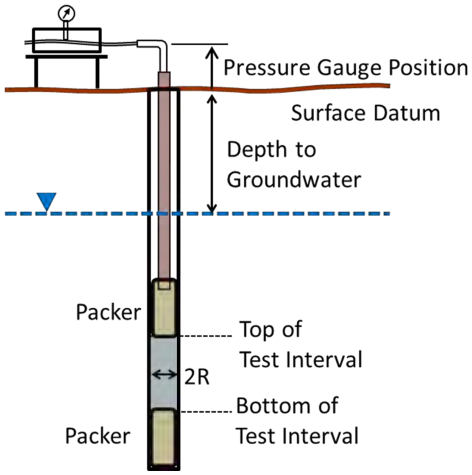
Packer Test Results

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

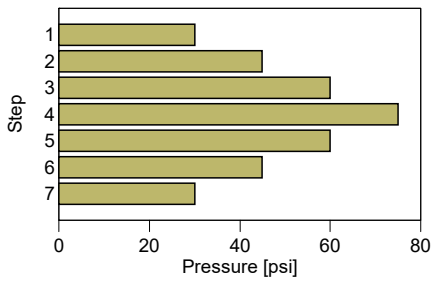
Client: The Regional Municipality of Niagara

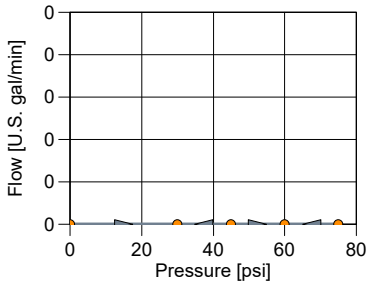
Location: Port Colborne	Lugeon Test: Test 5	Tested bore: BH 4
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

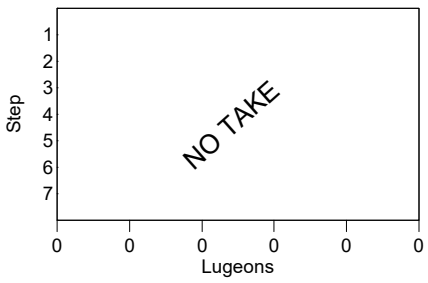


Top of Test Interval: 21.340 m
Bottom of Test Interval: 24.380 m
Length of Test Interval: 3.040 m
Gauge Position: 0.980 m
Depth to Groundwater: 3.550 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]										Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[cm/s]	[m/s]	Lugeon
1	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
2	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
3	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
4	75.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
5	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
6	45.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
7	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
												Average	0.00×10^{0}	0.00×10^{0}	0.0







NO TAKE

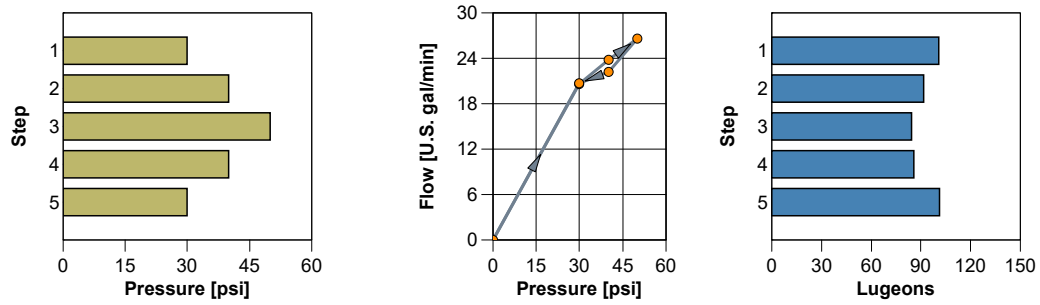
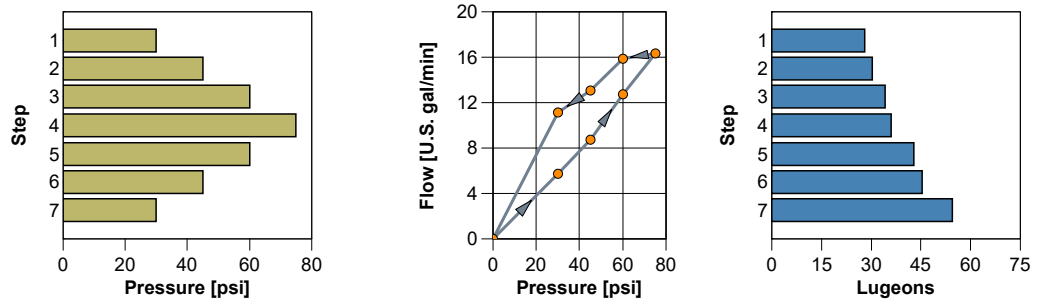
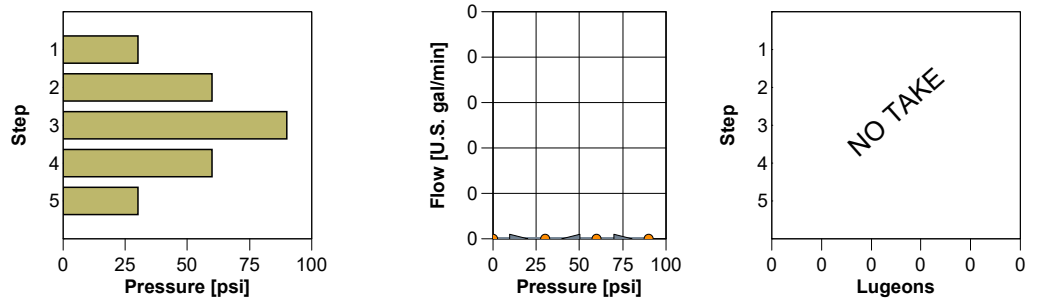
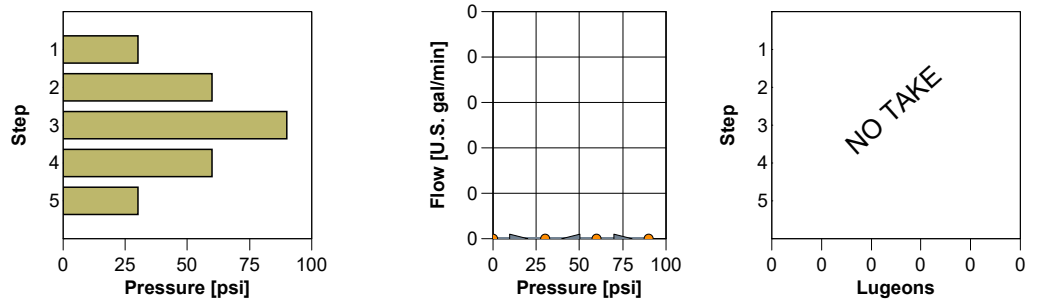
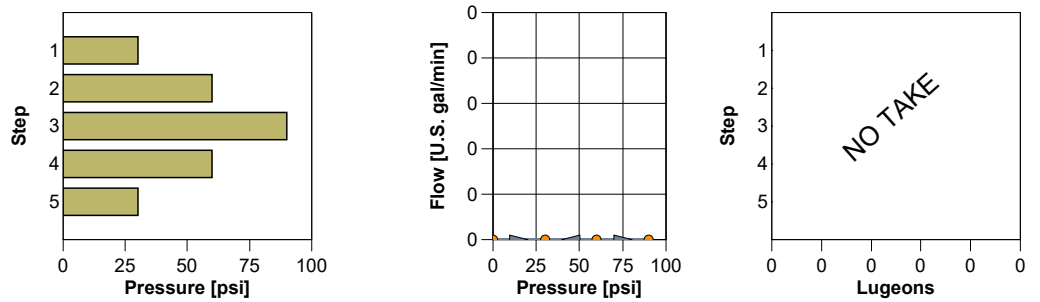
Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
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Lugeon Test Summary - BH 5

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

Client: The Regional Municipality of Niagara

Test Interval Top Bottom	Graphs	Result
3.960 m 7.010 m		Turbulent Lugeon: 91.4 Hydraulic Conductivity: 9.09E-4 cm/s Hydraulic Conductivity: 9.09E-6 m/s
7.370 m 10.420 m		Wash out Lugeon: 54.5 Hydraulic Conductivity: 5.88E-4 cm/s Hydraulic Conductivity: 5.88E-6 m/s
11.940 m 14.990 m		NO TAKE
16.510 m 19.560 m		NO TAKE
21.1 m 24.1 m		NO TAKE

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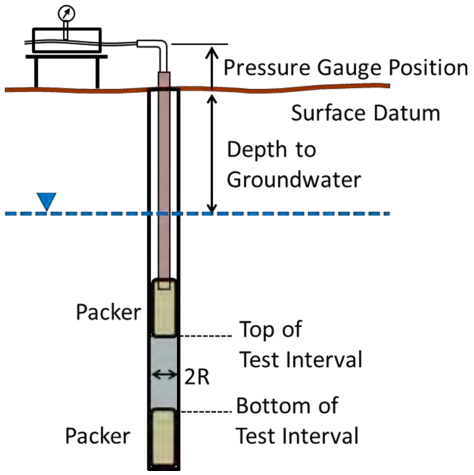
Lugeon Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

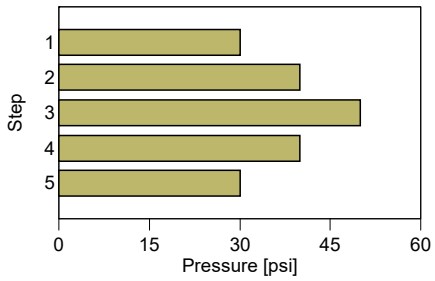
Client: The Regional Municipality of Niagara

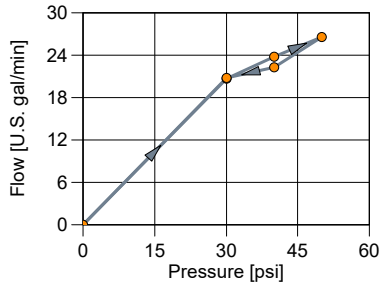
Location: Port Colborne	Lugeon Test: Test 1	Tested bore: BH 5
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

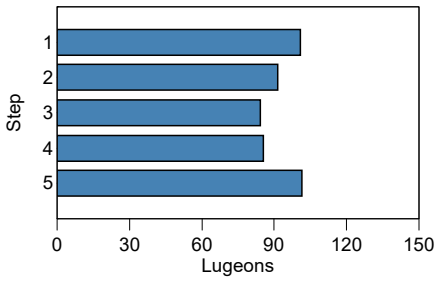


Top of Test Interval: 3.960 m
Bottom of Test Interval: 7.010 m
Length of Test Interval: 3.050 m
Gauge Position: 1.220 m
Depth to Groundwater: 3.570 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]										Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[cm/s]	[m/s]	Lugeon
1	30.0	21.4	41.8	62.6	83.4	104.0	124.6	145.3	166.0	186.8	207.1	20.6	1.09×10^{-3}	1.09×10^{-5}	100.9
2	40.0	25.0	49.8	74.5	99.6	124.5	149.3	174.5	199.5	224.0	239.0	23.8	9.87×10^{-4}	9.87×10^{-6}	91.4
3	50.0	33.0	63.0	86.1	109.5	133.5	161.3	188.7	217.0	244.3	272.0	26.6	9.09×10^{-4}	9.09×10^{-6}	84.1
4	40.0	24.4	48.8	63.5	87.8	102.3	127.1	154.7	176.0	200.5	224.5	22.2	9.23×10^{-4}	9.23×10^{-6}	85.5
5	30.0	19.0	39.8	60.1	80.7	101.8	122.5	143.0	163.6	184.6	205.7	20.7	1.10×10^{-3}	1.10×10^{-5}	101.4
												Average	1.00×10^{-3}	1.00×10^{-5}	92.7







Turbulent
Lugeon: 84.1

Hydraulic Conductivity: 9.09E-4 cm/s
Hydraulic Conductivity: 9.09E-6 m/s

Terraprobe
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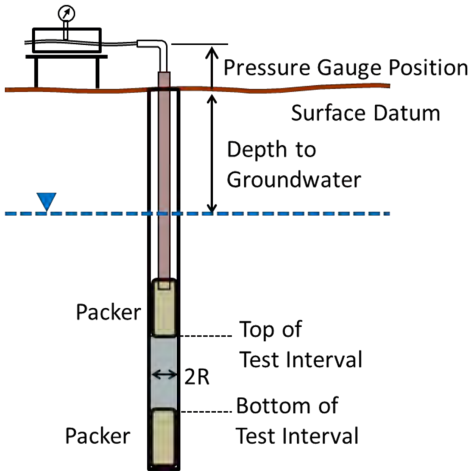
Lugeon Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

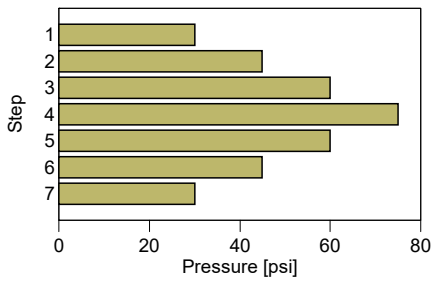
Client: The Regional Municipality of Niagara

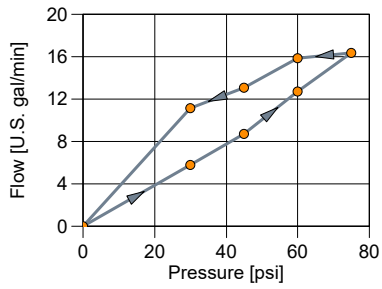
Location: Port Colborne	Lugeon Test: Test 2	Tested bore: BH 5
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

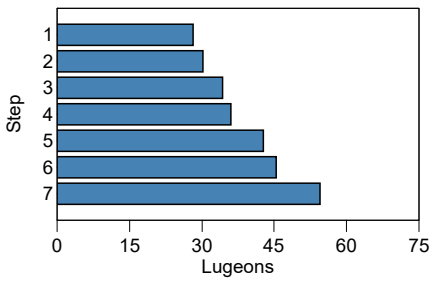


Top of Test Interval: 7.370 m
Bottom of Test Interval: 10.420 m
Length of Test Interval: 3.050 m
Gauge Position: 1.220 m
Depth to Groundwater: 3.580 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]										Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[cm/s]	[m/s]	Lugeon
1	30.0	6.9	11.0	17.1	23.0	29.0	33.6	39.4	45.5	51.1	58.7	5.8	3.04×10^{-4}	3.04×10^{-6}	28.1
2	45.0	7.8	15.7	23.6	32.1	40.2	48.4	57.1	66.7	76.3	86.2	8.7	3.27×10^{-4}	3.27×10^{-6}	30.3
3	60.0	11.6	24.1	36.5	48.6	60.5	73.6	86.2	99.2	112.5	126.1	12.7	3.70×10^{-4}	3.70×10^{-6}	34.3
4	75.0	16.3	32.3	47.3	64.0	80.2	95.0	112.7	129.2	145.5	163.5	16.4	3.89×10^{-4}	3.89×10^{-6}	36.0
5	60.0	12.5	28.2	44.0	59.2	75.3	91.0	105.1	122.0	139.0	155.5	15.9	4.62×10^{-4}	4.62×10^{-6}	42.8
6	45.0	13.4	26.1	39.0	51.9	65.3	78.0	91.5	104.8	118.0	131.0	13.1	4.90×10^{-4}	4.90×10^{-6}	45.4
7	30.0	10.9	21.7	33.0	43.9	55.2	66.3	77.5	88.3	100.0	111.2	11.1	5.88×10^{-4}	5.88×10^{-6}	54.5
												Average	4.19×10^{-4}	4.19×10^{-6}	38.8







Wash Out
Lugeon: 54.5

Hydraulic Conductivity: 5.88E-4 cm/s
Hydraulic Conductivity: 5.88E-6 m/s

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

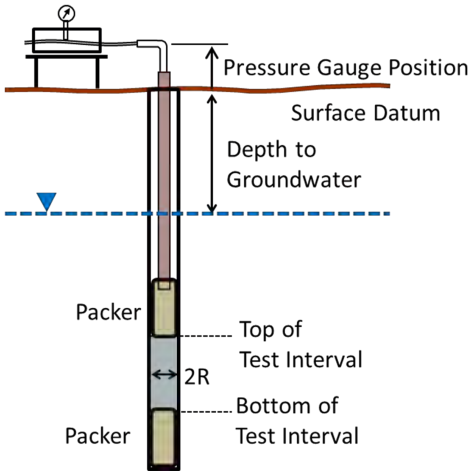
Lugeon Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

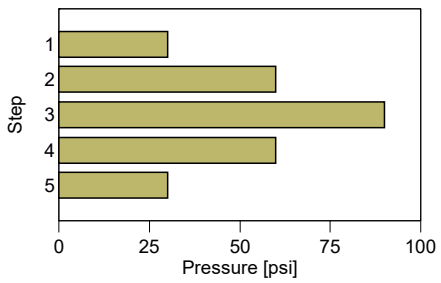
Client: The Regional Municipality of Niagara

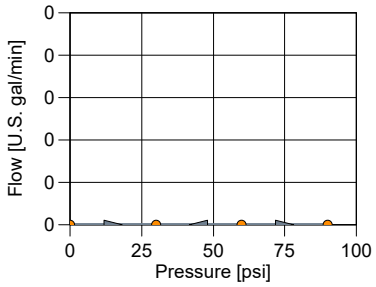
Location: Port Colborne	Lugeon Test: Test 3	Tested bore: BH 5
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

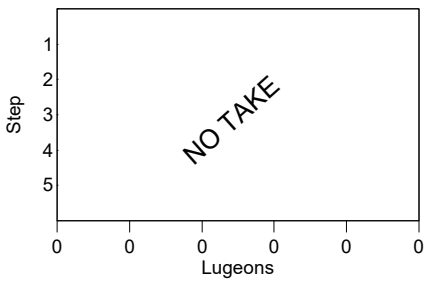


Top of Test Interval: 11.940 m
Bottom of Test Interval: 14.990 m
Length of Test Interval: 3.050 m
Gauge Position: 1.220 m
Depth to Groundwater: 3.570 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]										Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[cm/s]	[m/s]	Lugeon
1	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
2	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
3	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
4	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
5	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
												Average	0.00×10^0	0.00×10^0	0.0







NO TAKE

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

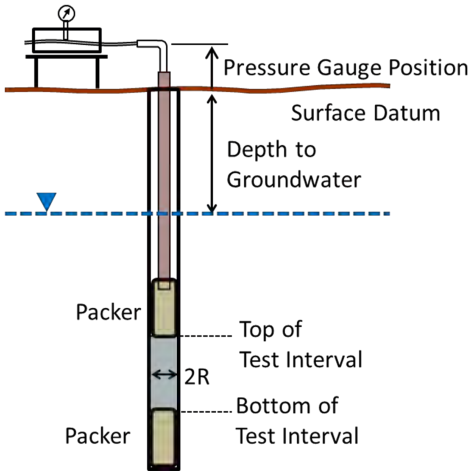
Lugeon Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

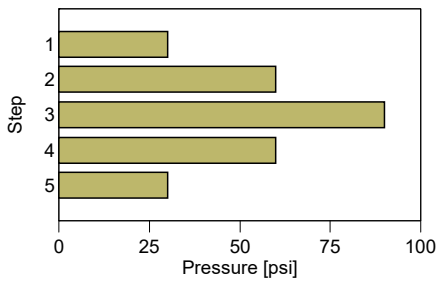
Client: The Regional Municipality of Niagara

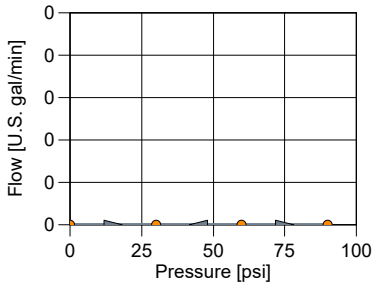
Location: Port Colborne	Lugeon Test: Test 4	Tested bore: BH 5
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

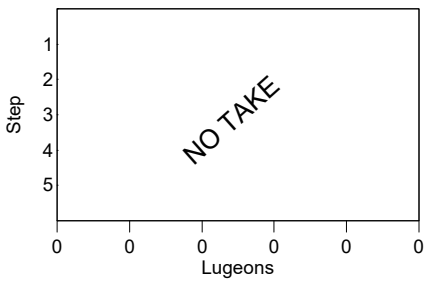


Top of Test Interval: 16.510 m
Bottom of Test Interval: 19.560 m
Length of Test Interval: 3.050 m
Gauge Position: 1.220 m
Depth to Groundwater: 3.570 m
Radius of Test Section: 0.048 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]										Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[cm/s]	[m/s]	Lugeon
1	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
2	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
3	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
4	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
5	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^0	0.00×10^0	0.0
												Average	0.00×10^0	0.00×10^0	0.0







NO TAKE

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

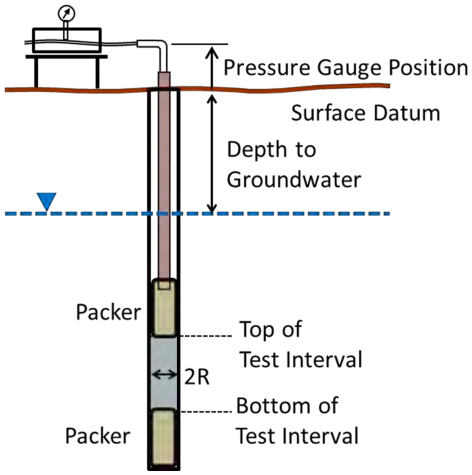
Packer Test Results

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

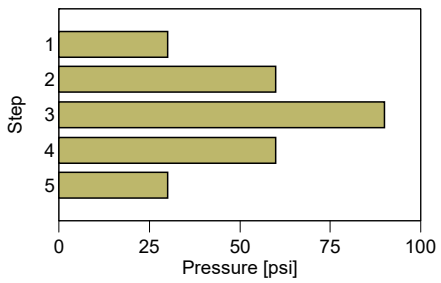
Client: The Regional Municipality of Niagara

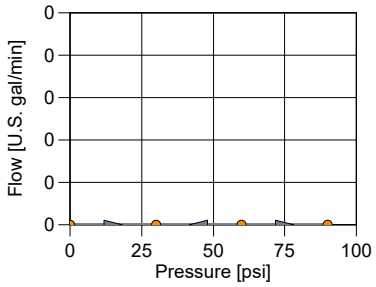
Location: Port Colborne	Lugeon Test: Test 5	Tested bore: BH 5
Test Conducted by: MYB		Test Date: 8/27/2020
Analysis Performed by: SD		Analysis Date: 10/6/2020

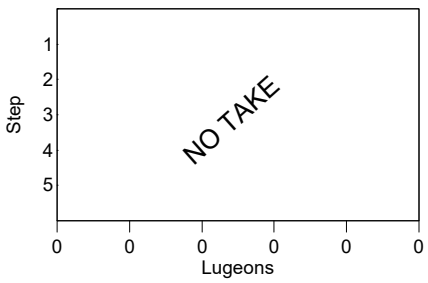


Top of Test Interval: 21.1 m
Bottom of Test Interval: 24.1 m
Length of Test Interval: 3.1 m
Gauge Position: 1.2 m
Depth to Groundwater: 3.6 m
Radius of Test Section: 0.0 m

Step	Pressure [psi]	Flow Meter Readings [U.S. gal]										Average Flow Rate [U.S. gal/min]	Hydraulic Conductivity		
		1	2	3	4	5	6	7	8	9	10		[cm/s]	[m/s]	Lugeon
1	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
2	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
3	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
4	60.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
5	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00×10^{0}	0.00×10^{0}	0.0
												Average	0.00×10^{0}	0.00×10^{0}	0.0







NO TAKE

APPENDIX C2
Rising Head Test Results

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

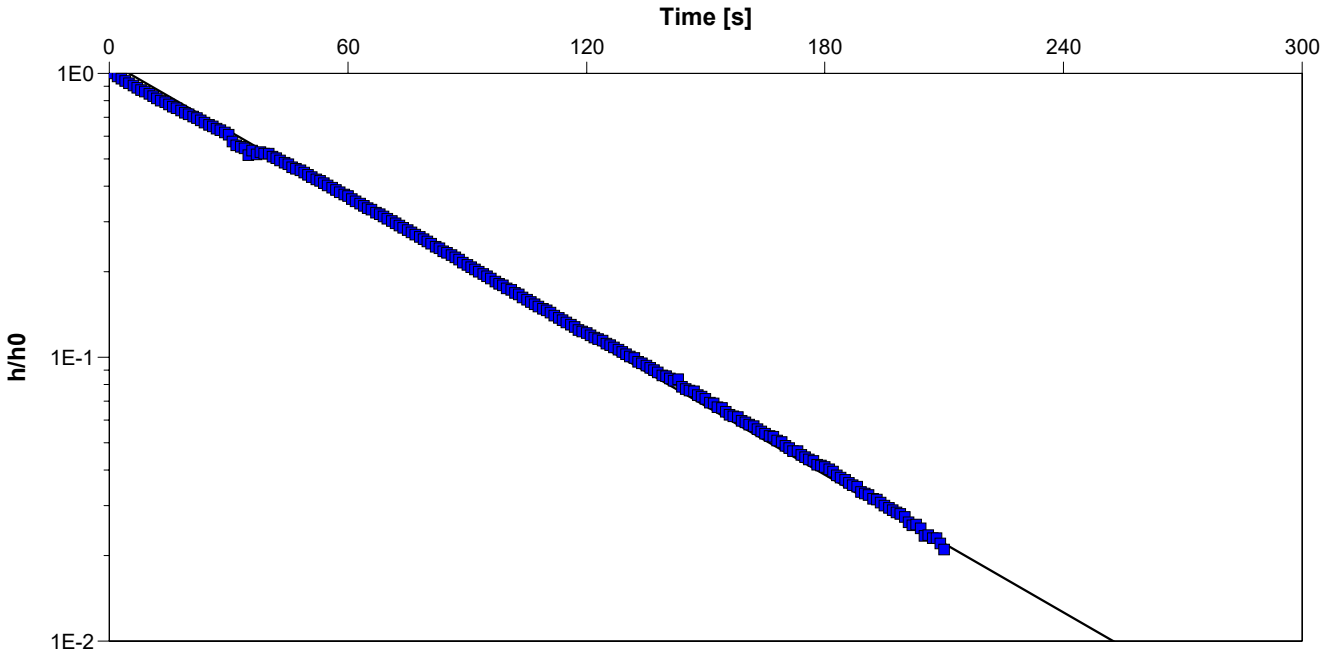
Slug Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

Client: The Regional Municipality of Niagara

Location: Port Colborne	Slug Test: BH 4	Test Well: BH 4
Test Conducted by: MYB		Test Date: 9/16/2020
Analysis Performed by: SD	Bouwer & Rice	Analysis Date: 11/2/2020
Aquifer Thickness: 19.90 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH 4	2.25×10^{-5}	

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

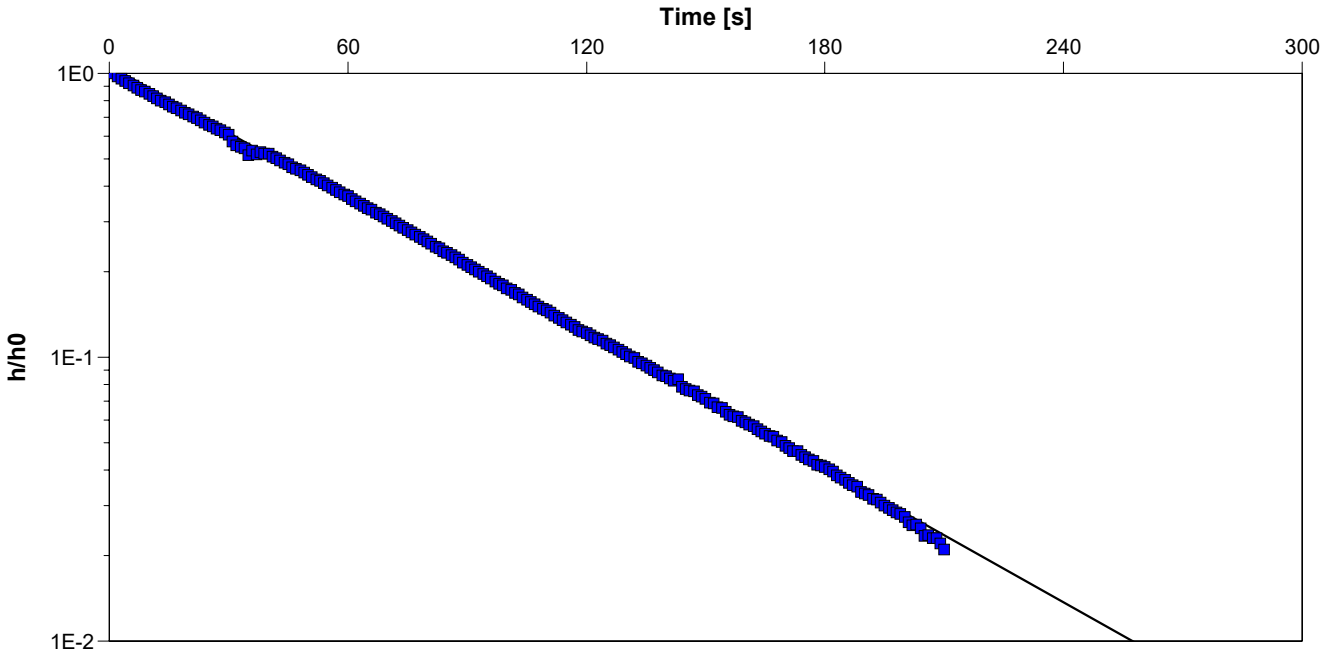
Slug Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

Client: The Regional Municipality of Niagara

Location: Port Colborne	Slug Test: BH 4	Test Well: BH 4
Test Conducted by: MYB		Test Date: 9/16/2020
Analysis Performed by: SD	Hvorslev	Analysis Date: 11/2/2020
Aquifer Thickness: 19.90 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH 4	2.86×10^{-5}	

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

Slug Test - Analyses Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

Client: The Regional Municipality of Niagara

Location: Port Colborne	Slug Test: BH 4	Test Well: BH 4
Test Conducted by: MYB		Test Date: 9/16/2020
Aquifer Thickness: 19.90 m		

	Analysis Name	Analysis Performed by	Analysis Date	Method name	Well	T [m²/s]	K [m/s]	S
1	Bouwer & Rice	SD	11/2/2020	Bouwer & Rice	BH 4		2.25×10^{-5}	
2	Hvorslev	SD	11/2/2020	Hvorslev	BH 4		2.86×10^{-5}	
					Average		2.56×10^{-5}	

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

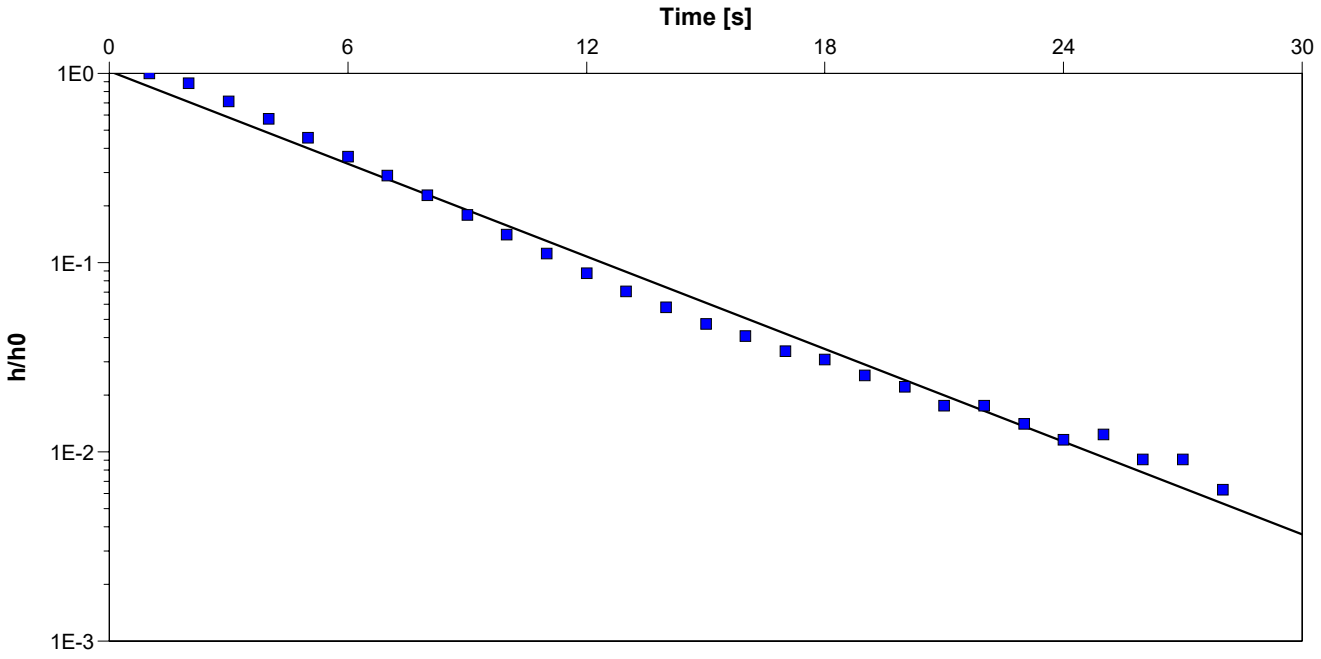
Slug Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

Client: The Regional Municipality of Niagara

Location: Port Colborne	Slug Test: BH 5	Test Well: BH 5
Test Conducted by: MYB		Test Date: 9/16/2020
Analysis Performed by: SD	Bouwer & Rice	Analysis Date: 11/2/2020
Aquifer Thickness: 10.80 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH 5	2.27×10^{-4}	

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

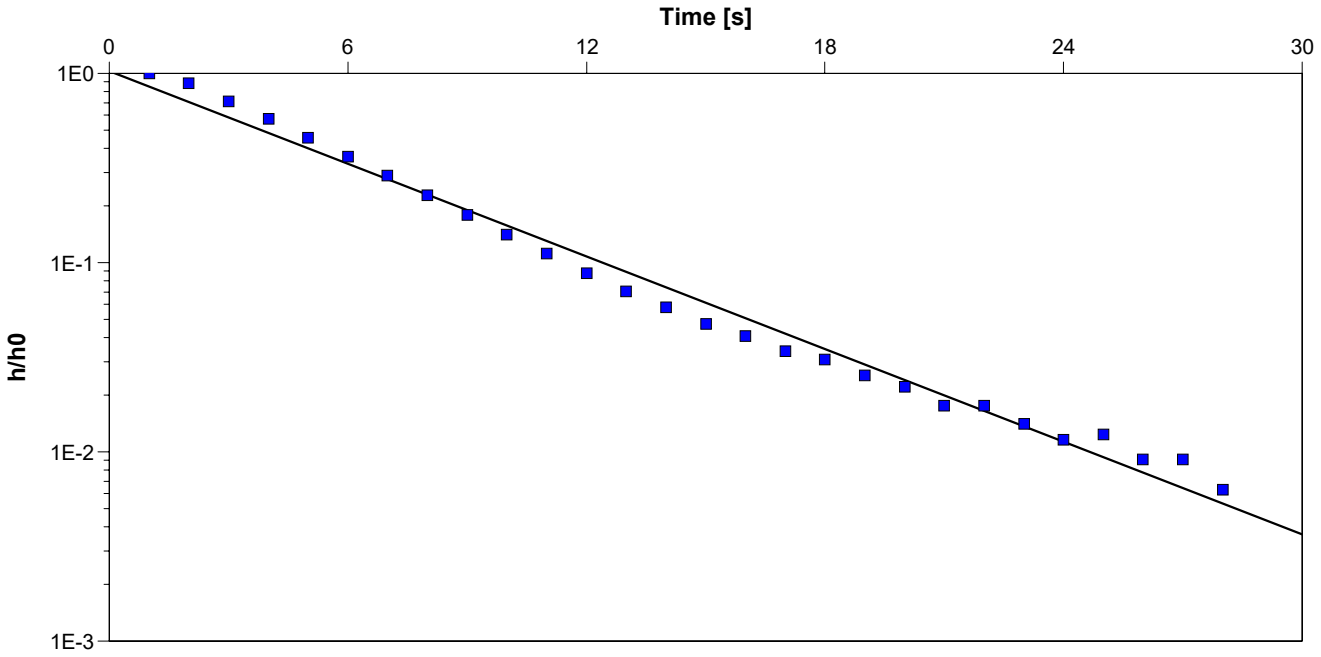
Slug Test Analysis Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

Client: The Regional Municipality of Niagara

Location: Port Colborne	Slug Test: BH 5	Test Well: BH 5
Test Conducted by: MYB		Test Date: 9/16/2020
Analysis Performed by: SD	Hvorslev	Analysis Date: 11/2/2020
Aquifer Thickness: 10.80 m		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH 5	2.96×10^{-4}	

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

Slug Test - Analyses Report

Project: Eastside SPS Forcemain Replacement

Number: 1-20-0288

Client: The Regional Municipality of Niagara

Location: Port Colborne	Slug Test: BH 5	Test Well: BH 5
Test Conducted by: MYB		Test Date: 9/16/2020
Aquifer Thickness: 10.80 m		

	Analysis Name	Analysis Performed by	Analysis Date	Method name	Well	T [m²/s]	K [m/s]	S
1	Bouwer & Rice	SD	11/2/2020	Bouwer & Rice	BH 5		2.27×10^{-4}	
2	Hvorslev	SD	11/2/2020	Hvorslev	BH 5		2.96×10^{-4}	
					Average		2.62×10^{-4}	

APPENDIX C3
CERCHAR Abrasivity and Slake Durability Test Results

Geomechanica Inc.
Suite 900 – 390 Bay St.
Toronto Ontario
Canada M5H 2Y2

October 1, 2020

Ms. Sepideh D-Monfared
Terraprobe Inc.
11 Indell Lane
Brampton, ON
Canada, L6T 3Y3

Re: CERCHAR Abrasivity and Slake Durability testing
(1-20-0288)

Dear Ms. D-Monfared
:

On September 11th, 2020, a series of eight (8) HQ-sized core samples were received by Geomechanica Inc. via drop-off by Terraprobe personnel. These samples were identified as being from Terraprobe project 1-20-0288 (Niagara SPS Forcemain Replacement) located in Port Colborne, Ontario. From these samples, four (4) CERCHAR abrasivity tests and four (4) Slake Durability tests were completed.

Details regarding the steps of specimen preparation and testing along with the test results are presented in the accompanying laboratory report and spreadsheets.

Sincerely,



Bryan Tatone Ph.D., P. Eng.

Geomechanica Inc.
Tel: (647) 478-9767
Email: bryan.tatone@geomechanica.com

GEOMECHANICA

Rock Laboratory Testing Results

A report submitted to:

Sepideh D-Monfared
Terraprobe Inc.
11 Indell Lane
Brampton, ON
Canada, L6T 3Y3

Prepared by:

Bryan Tatone, PhD, PEng

Omid Mahabadi, PhD, PEng
Geomechanica Inc.
#900-390 Bay St.
Toronto ON
M5H 2Y2 Canada
Tel: +1-647-478-9767
lab@geomechanica.com

October 1, 2020
Project number: 1-20-0288

Abstract

This document summarizes the results of rock laboratory testing, including 4 CERCHAR Abrasivity tests and 4 Slake Durability test. The results for each test type are provided in separate sub-sections herein.

In this document:

1 CERCHAR Abrasivity Tests 1
2 Slake Durability 5

Disclaimer: This report was prepared by Geomechanica Inc. for Terraprobe Inc.. The material herein reflects Geomechanica Inc.'s best judgment given the information available at the time of preparation. Any use which a third party makes of this report, any reliance on or decision to be made based on it, are the responsibility of such third parties. Geomechanica Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

1 CERCHAR Abrasivity Tests

1.1 Overview

This section summarizes the results of CERCHAR abrasivity testing. The tests were performed using a Type-2 CERCHAR apparatus as shown in Figure 1a. The tips of the styluses were sharpened to a conical angle of 90° using the setup shown in Figure 1b. The styluses used to perform the tests are shown in Figure 1c-d (Rockwell hardness 55±1). A static force of 70 N was applied on top of the stylus by using a combination of weights. The testing procedure for each sample, which adhered to ASTM D7625-10, included the following:

1. The tips of the five styluses are sharpened using the grinding apparatus (Figure 1b).
2. The styluses are placed under a microscope and three scaled photos (120° apart) are captured before the test is conducted to ensure the 90° point has been properly formed.
3. The test specimen is obtained by breaking the core sample to expose a fresh fracture surface.
4. The specimen is secured in the cross-slide vise of the testing apparatus and the stylus carefully lowered on to the surface of the rock.
5. A scratch measuring 10 mm in length is created over a duration of 10 seconds. This process was repeated with all five styluses on undisturbed parts of the specimen surface (e.g., Figure 2a).
6. Lastly, the worn tips are re-examined under the microscope. From three scaled photos (120° apart), the wear flat, d, is measured (e.g., Figure 2c).

The length or the diameter of the wear flat, d, was measured from scaled microscope images using the image processing software Fiji (e.g., Figure 2b-c). The mean wear of the tip is calculated by taking the average d of all styluses. The CERCHAR-Abrasivity-Index (CAI) of the sample is subsequently calculated by taking the mean wear and multiplying it by 10.

1.2 Results

The results of the CERCHAR abrasivity tests are summarized in Table 1. Further specimen and testing details are included in the summary spreadsheet that accompanies this report.

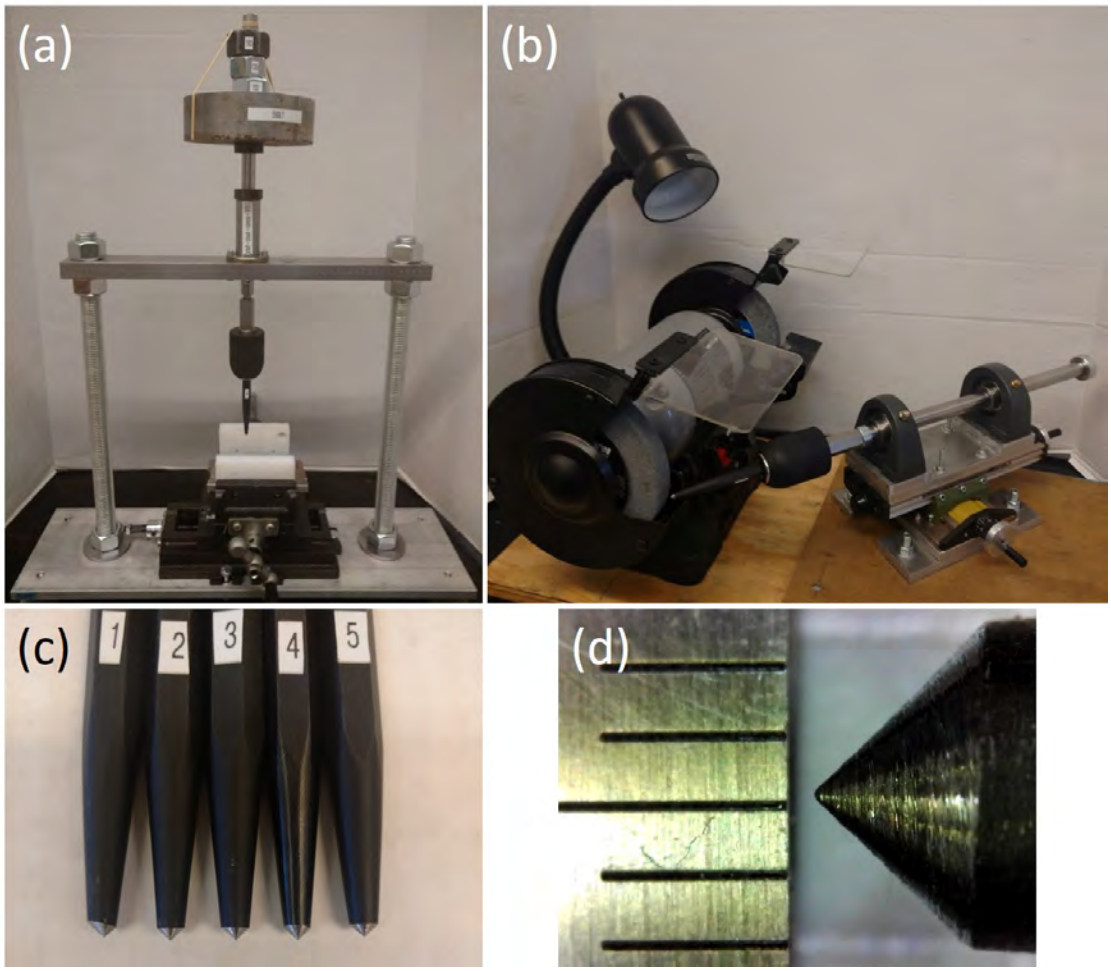


Figure 1: Photos showing (a) the CERCHAR apparatus, (b) tip sharpening setup, (c) the five styluses used to perform the test and (d) a microscope image of one of the stylus tips.

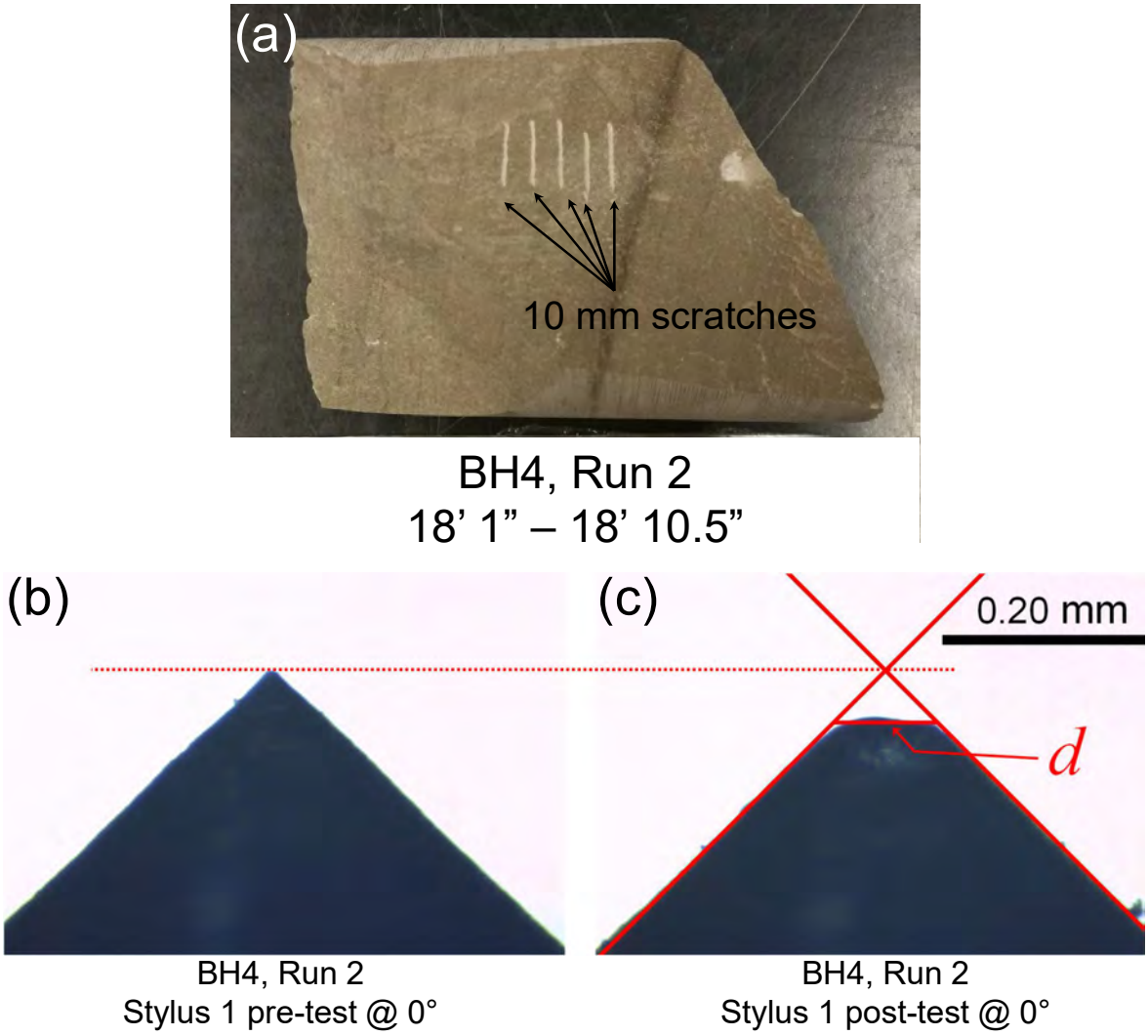


Figure 2: (a) Photograph showing an example of the five 10 mm scratches on a select test specimen; (b) microscope image of select stylus prior to testing at the noted position; and (c) microscope image of the same stylus at the same position following testing with the wear flat, d, denoted.

Table 1: Summary of CERCHAR abrasivity test results.

Sample	Depth (ft' in")	Test 1 Mean (mm)	Test 2 Mean (mm)	Test 3 Mean (mm)	Test 4 Mean (mm)	Test 5 Mean (mm)	Mean Wear (mm)	CAI	Lithology	ASTM Classification
BH4, Run 2	18'1" - 18'10.5"	0.102	0.122	0.115	0.115	0.112	0.113	1.133	[1]	Medium
BH4, Run 11	63'3" - 65'7.5"	0.051	0.069	0.038	0.065	0.063	0.057	0.573	[1]	Low
BH5, Run 2	12'4.5" - 12'8.5"	0.093	0.129	0.108	0.145	0.137	0.122	1.224	[2]	Medium
BH5, Run 11	56'4.5" - 57'4.5"	0.018	0.018	0.016	0.037	0.015	0.021	0.207	[1]	$<$ Very Low

[1] Shaley limestone, grey to dark grey

[2] Dolomitic limestone, greyish brown, medium to coarse grained; including very thin shaley lamination

2 Slake Durability

2.1 Overview

This section summarizes the results of slake durability testing. The tests were performed using an M&L Testing Equipment Slake Durability apparatus capable of simultaneously performing four slake durability tests (Figure 3). The test was conducted using the following procedure:

1. The core was broken using a hammer and point load testing apparatus into 40-60 g lumps. The sharp edges of the lumps were removed by lightly hammering and/or filing the edges.
2. Approximately 10 lumps weighing 450-550 g were inserted into the drum and dried in the oven at 110 °C until reaching a constant mass.
3. The drum was removed from the oven and allowed to cool to room temperature, weighed, and subsequently rotated in room temperature distilled water at 20 revolutions per minute for 10 minutes.
4. The drum was returned to the oven to dry for approximately one day and weighed again.
5. Steps 3 and 4 were then repeated for a second cycle.
6. The drum was thoroughly cleaned, dried, and weighed.

The above slake durability testing procedure adhered to ASTM D4644-16.

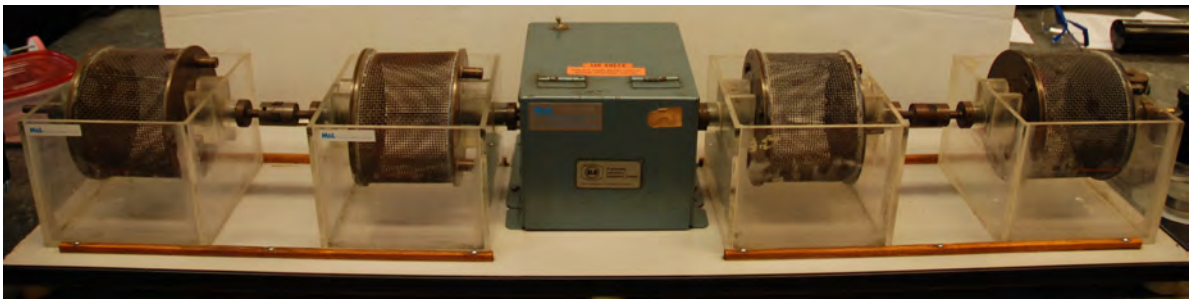


Figure 3: Test setup showing the slake durability apparatus.

2.2 Results

The results of the tests are summarized in Table 2. Additional measurements and sample descriptions are provided the summary spreadsheet that accompanies this report. The slake durability index after one and two cycles was calculated as follows, respectively:

$$I_{d1} = \frac{B - D}{A - D} \times 100\% \quad (1)$$

$$I_{d2} = \frac{C - D}{A - D} \times 100\% \quad (2)$$

where A is the mass of the specimen and drum before the first test cycle, B is the mass of the specimen and drum after oven drying the first cycle, C is the mass of the specimen and drum after oven drying the second cycle and D is the mass of the drum.

Table 2: Summary of slake durability testing results.

Sample	Depth (ft' in")	Moisture content (%)	Pre-First Cycle, A (g)	Post-First Cycle, B (g)	Post-Second Cycle, C (g)	Mass of Drum, D (g)	Slake Durability Index , (1st Cycle) I_{d1} (%)	Slake Durability Index (2nd Cycle), I_{d2} (%)	Lithology
BH4, Run 3	21' 7.5" - 22' 3"	0.24	2401.75	2396.77	2392.39	1897.00	99.01	98.15	Shaley Limestone
BH4, Run 5	34' 3" - 35' 3"	0.26	2324.78	2321.48	2313.77	1859.22	99.29	97.64	Shaley Limestone
BH5, Run 4	24' 7" - 25' 3.5"	0.20	2478.31	2476.06	2478.11	1951.92	99.57	99.96	Shaley Limestone
BH5, Run 10	51' 8" - 52' 4"	0.31	2323.83	2319.52	2316.01	1844.64	99.10	98.37	Shaley Limestone

2.3 Specimen Photographs

Photographs of the specimens before testing and after testing are shown in Figure 4.



Figure 4: Photographs of slake durability specimens before and after testing.

APPENDIX C4
Bedrock Property Data

Lithology & Major Features

TCR (%)

SCR (%)

RQD (%)

Natural Fractures Frequency

UCS (MPa)

Hydraulic Conductivity (m/s)

Elevation (m)

174 173 172 171 170 169 168 167 166 165 164 163 162 161 160 159 158 157 156 155 154 153 152 151

RUBBLE ZONE/ CORE LOSS

NO TAKE

0% 25% 50% 75% 100%

0 2 4 6 8 10

0 25 50 75 100 125 150 175 200

1.E-03 1.E-04 1.E-05 1.E-06 1.E-07

LITHOLOGY:

- Dolomitic Limestone
- Shaley Limestone
- Shaley Limestone Containing Gypsum Inclusions

MAJOR FEATURES:

- Core Loss
- Rubble Zone

0% - 25% VERY POOR

25% - 50% POOR

50% - 75% FAIR

75% 90% GOOD

90% 100% EXCELLENT

- Point Load Test - Diametral
- Point Load Test - Axial
- UCS Test

- Packer Test
- Packer Test - NO Take
- Slug Test

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
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11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

EASTSIDE SPS FORCEMAIN REPLACEMENT
Bedrock Property Data at BH4 Location

Location BH 4	Date: November 2020
SUBM'D: SD	CHKD: RA
File No: 1-20-0288	Figure: C4-1

Lithology & Major Features

TCR (%)

SCR (%)

RQD (%)

Natural Fractures Frequency

UCS (MPa)

Hydraulic Conductivity (m/s)

Elevation (m)

175 174 173 172 171 170 169 168 167 166 165 164 163 162 161 160 159 158 157 156 155 154 153 152 151

0% 25% 50% 75% 100%

0% 25% 50% 75% 100%

0% 25% 50% 75% 100%

0 2 4 6 8 10

0 25 50 75 100 125 150 175 200

1.E-03 1.E-04 1.E-05 1.E-06 1.E-07

NO TAKE

0% - 25% | 25% - 50% | 50% - 75% | 75% - 90% | 90% - 100%

VERY POOR | POOR | FAIR | GOOD | EXCELLENT

LITHOLOGY:

- Dolomitic Limestone
- Shaley Limestone
- Shaley Limestone Containing Gypsum Inclusions

MAJOR FEATURES:

- Rubble Zone

- Point Load Test - Diametral
- Point Load Test - Axial
- UCS Test
- Packer Test
- Packer Test - NO Take
- Slug Test

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Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650

EASTSIDE SPS FORCEMAIN REPLACEMENT
Bedrock Property Data at BH5 Location

Location	BH 5	Date:	November 2020
SUBM'D:	SD	CHKD:	RA
File No:	1-20-0288	Figure:	C4-2

APPENDIX D
Certificates of Analysis

APPENDIX D1
Soil Chemistry





FINAL REPORT

CA15913-SEP20 R

1-20-0288, SPS Foreman Replacement Port Colborne

Prepared for

Terraprobe Inc

FINAL REPORT

CA15913-SEP20 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Terraprobe Inc	Project Specialist	Jill Campbell, B.Sc.,GISAS
		Laboratory	SGS Canada Inc.
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Sepideh D_Monfared	Telephone	2165
Telephone	(905) 796-2650	Facsimile	705-652-6365
Facsimile	(905) 796-2250	Email	jill.campbell@sgs.com
Email	smonfared@terraprobe.ca	SGS Reference	CA15913-SEP20
Project	1-20-0288, SPS Foreman Replacement Port Colborne	Received	09/02/2020
Order Number		Approved	09/10/2020
Samples	Soil (5)	Report Number	CA15913-SEP20 R
		Date Reported	09/10/2020

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

- nC6 and nC10 response factors within 30% of response factor for toluene: YES
- nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES
- C50 response factors within 70% of nC10 + nC16 + nC34 average: YES
- Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Benzo(b)fluoranthene results for comparison to the standard are reported as benzo(b+j)fluoranthene. Benzo(b)fluoranthene and benzo(j)fluoranthene co-elute and cannot be reported individually by the analytical method used.

Temperature of Sample upon Receipt: 7 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:010941

SIGNATORIES

Jill Campbell, B.Sc.,GISAS



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Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number					17
Sample Name					BH4-SS3-(4'-6')
Sample Matrix					Soil
Sample Date					01/09/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**
BTEX					
Benzene	µg/g	0.02	0.02	0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	0.05	< 0.05
Toluene	µg/g	0.05	0.2	0.2	< 0.05
Xylene (total)	µg/g	0.05	0.05	0.05	< 0.05
m/p-xylene	µg/g	0.05			< 0.05
o-xylene	µg/g	0.05			< 0.05

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number					13	14	15	16
Sample Name					BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')
Sample Matrix					Soil	Soil	Soil	Soil
Sample Date					24/08/2020	24/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Hydrides								
Antimony	µg/g	0.8	1	1.3	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	11	18	3.9	5.1	5.9	3.5
Selenium	µg/g	0.7	1.2	1.5	< 0.7	< 0.7	< 0.7	< 0.7

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number					13	14	15	16	17
Sample Name					BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')	BH4-SS3-(4'-6')
Sample Matrix					Soil	Soil	Soil	Soil	Soil
Sample Date					24/08/2020	24/08/2020	27/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics									
Moisture Content	%	-			25.7	23.1	5.4	24.8	21.0
Barium	µg/g	0.1	210	220	200	340	46	160	
Beryllium	µg/g	0.02	2.5	2.5	0.75	1.0	0.35	0.83	
Boron	µg/g	1	36	36	11	10	10	11	
Cadmium	µg/g	0.02	1	1.2	0.14	0.17	0.41	0.27	
Chromium	µg/g	0.5	67	70	22	28	16	30	
Cobalt	µg/g	0.01	19	21	14	16	8.4	13	
Copper	µg/g	0.1	62	92	47	26	39	32	
Lead	µg/g	0.1	45	120	12	12	140	17	
Molybdenum	µg/g	0.1	2	2	1.3	1.1	2.4	1.1	
Nickel	µg/g	0.5	37	82	44	34	110	37	
Silver	µg/g	0.05	0.5	0.5	< 0.05	< 0.05	0.11	0.06	
Thallium	µg/g	0.02	1	1	0.15	0.17	0.22	0.22	
Uranium	µg/g	0.002	1.9	2.5	0.67	0.86	0.70	1.4	
Vanadium	µg/g	3	86	86	29	42	15	36	
Zinc	µg/g	0.7	290	290	56	66	56	82	
Water Soluble Boron	µg/g	0.5			< 0.5	< 0.5	< 0.5	< 0.5	

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

					Sample Number	13	14	15	16
					Sample Name	BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')
					Sample Matrix	Soil	Soil	Soil	Soil
					Sample Date	24/08/2020	24/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Other (ORP)								
Mercury	µg/g	0.05	0.16	0.27	**0.18**	< 0.05	0.10	0.06
Sodium Adsorption Ratio	No unit	0.2	1	2.4	0.3	0.3	**2.1**	**3.1**
SAR Calcium	mg/L	0.09			52.6	66.2	14.2	39.9
SAR Magnesium	mg/L	0.02			7.3	11.2	4.5	3.9
SAR Sodium	mg/L	0.15			8.0	9.3	34.9	83.3
Conductivity	mS/cm	0.002	0.47	0.57	0.37	0.47	0.27	**0.54**
pH	pH Units	0.05			7.79	7.65	8.06	7.60
Chromium VI	µg/g	0.2	0.66	0.66	< 0.2	< 0.2	0.3	< 0.2
Free Cyanide	µg/g	0.05	0.051	0.051	< 0.05	< 0.05	< 0.05	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - PAHs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
PAHs					
Acenaphthene	µg/g	0.05	0.05	0.072	< 0.05
Acenaphthylene	µg/g	0.05	0.093	0.093	< 0.05
Anthracene	µg/g	0.05	0.05	0.16	< 0.05
Benzo(a)anthracene	µg/g	0.05	0.095	0.36	< 0.05
Benzo(a)pyrene	µg/g	0.05	0.05	0.3	< 0.05
Benzo(b+j)fluoranthene	µg/g	0.05	0.3	0.47	< 0.05
Benzo(ghi)perylene	µg/g	0.1	0.2	0.68	< 0.1
Benzo(k)fluoranthene	µg/g	0.05	0.05	0.48	< 0.05
Chrysene	µg/g	0.05	0.18	2.8	< 0.05
Dibenzo(a,h)anthracene	µg/g	0.06	0.1	0.1	< 0.06
Fluoranthene	µg/g	0.05	0.24	0.56	< 0.05
Fluorene	µg/g	0.05	0.05	0.12	< 0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.1	0.11	0.23	< 0.1
1-Methylnaphthalene	µg/g	0.05			< 0.05
2-Methylnaphthalene	µg/g	0.05			< 0.05
Methylnaphthalene, 2-(1-)	µg/g	0.05	0.05	0.59	< 0.05
Naphthalene	µg/g	0.05	0.05	0.09	< 0.05
Phenanthrene	µg/g	0.05	0.19	0.69	< 0.05
Pyrene	µg/g	0.05	0.19	1	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - PHCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
PHCs					
F1 (C6-C10)	µg/g	10	17	25	< 10
F1-BTEX (C6-C10)	µg/g	10			< 10
F2 (C10-C16)	µg/g	10	10	10	< 10
F3 (C16-C34)	µg/g	50	240	240	< 50
F4 (C34-C50)	µg/g	50	120	120	< 50
Chromatogram returned to baseline at nC50	Yes / No	-			YES

PACKAGE: **REG153 - SVOC Surrogates** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
SVOC Surrogates					
Surr Nitrobenzene-d5	Surr Rec %	-			87
Surr 2-Fluorobiphenyl	Surr Rec %	-			79
Surr 4-Terphenyl-d14	Surr Rec %	-			94
Surr 2-Fluorophenol	Surr Rec %	-			88
Surr Phenol-d6	Surr Rec %	-			90
Surr 2,4,6-Tribromophenol	Surr Rec %	-			87

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
THMs (VOC)					
Bromodichloromethane	µg/g	0.05	0.05	0.05	< 0.05
Bromoform	µg/g	0.05	0.05	0.05	< 0.05
Dibromochloromethane	µg/g	0.05	0.05	0.05	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
VOC Surrogates					
Surr 1,2-Dichloroethane-d4	Surr Rec %	-			100
Surr 4-Bromofluorobenzene	Surr Rec %	-			95
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-			89

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
VOCs					
Acetone	µg/g	0.5	0.5	0.5	< 0.5
Bromomethane	µg/g	0.05	0.05	0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	0.05	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

VOCs (continued)

Parameter	Units	RL	L1	L2	Result
Chlorobenzene	µg/g	0.05	0.05	0.05	< 0.05
Chloroform	µg/g	0.05	0.05	0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	0.05	0.05	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	0.05	0.05	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.05	0.05	< 0.05
Dichlorodifluoromethane	µg/g	0.05	0.05	0.05	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.05	0.05	< 0.05
1,2-Dichloroethane	µg/g	0.05	0.05	0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.05	0.05	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	0.05	0.05	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03			< 0.03
trans-1,3-dichloropropene	µg/g	0.03			< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	0.05	< 0.05
n-Hexane	µg/g	0.05	0.05	0.05	< 0.05
Methyl ethyl ketone	µg/g	0.5	0.5	0.5	< 0.5
Methyl isobutyl ketone	µg/g	0.5	0.5	0.5	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.05	0.05	< 0.05
Methylene Chloride	µg/g	0.05	0.05	0.05	< 0.05
Styrene	µg/g	0.05	0.05	0.05	< 0.05
Tetrachloroethylene	µg/g	0.05	0.05	0.05	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

VOCs (continued)

Parameter	Units	RL	L1	L2	Result
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.05	0.05	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.05	0.05	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.05	0.05	< 0.05
Trichlorofluoromethane	µg/g	0.05	0.05	0.25	< 0.05
Vinyl Chloride	µg/g	0.02	0.02	0.02	< 0.02

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 1 - Agricultural/Other - UNDEFINED L1	REG153 / SOIL / COARSE - TABLE 1 - Residential/Parkland/Industrial - UNDEFINED L2
BH5-SS1-(0'-2')					
Nickel	EPA 3050/EPA 200.8	µg/g	44	37	
Mercury	EPA 7471A/EPA 245	µg/g	0.18	0.16	
BH5-SS2-(2'-4')					
Barium	EPA 3050/EPA 200.8	µg/g	340	210	220
BH4-SS1-(0'-2')					
Lead	EPA 3050/EPA 200.8	µg/g	140	45	120
Molybdenum	EPA 3050/EPA 200.8	µg/g	2.4	2	2
Nickel	EPA 3050/EPA 200.8	µg/g	110	37	82
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	2.1	1	
BH4-SS2-(2'-4')					
Conductivity	EPA 6010/SM 2510	mS/cm	0.54	0.47	
Sodium Adsorption Ratio	MOE 4696e01/EPA 6010	No unit	3.1	1	2.4

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0112-SEP20	mS/cm	0.002	<0.002	3	10	100	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5008-SEP20	µg/g	0.05	<0.05	ND	20	104	80	120	88	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-IENVISKA-LAK-AN-012

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	SKA5022-SEP20	ug/g	0.2	<0.2	ND	20	94	80	120	89	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0017-SEP20	µg/g	0.05	<0.05	2	20	105	80	120	99	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0017-SEP20	mg/L	0.09	<0.09	2	20	101	80	120	99	70	130
SAR Magnesium	ESG0017-SEP20	mg/L	0.02	<0.02	6	20	98	80	120	101	70	130
SAR Sodium	ESG0017-SEP20	mg/L	0.15	<0.15	8	20	99	80	120	101	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENVISPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0017-SEP20	ug/g	0.05	<0.05	ND	20	100	70	130	102	70	130
Arsenic	EMS0017-SEP20	µg/g	0.5	<0.5	3	20	99	70	130	95	70	130
Barium	EMS0017-SEP20	ug/g	0.1	<0.1	4	20	109	70	130	98	70	130
Beryllium	EMS0017-SEP20	µg/g	0.02	<0.02	2	20	102	70	130	98	70	130
Boron	EMS0017-SEP20	µg/g	1	<1	4	20	103	70	130	94	70	130
Cadmium	EMS0017-SEP20	µg/g	0.02	<0.02	5	20	98	70	130	106	70	130
Cobalt	EMS0017-SEP20	µg/g	0.01	<0.01	4	20	96	70	130	104	70	130
Chromium	EMS0017-SEP20	µg/g	0.5	<0.5	2	20	95	70	130	104	70	130
Copper	EMS0017-SEP20	µg/g	0.1	<0.1	1	20	97	70	130	98	70	130
Molybdenum	EMS0017-SEP20	µg/g	0.1	<0.1	7	20	93	70	130	101	70	130
Nickel	EMS0017-SEP20	ug/g	0.5	<0.5	1	20	95	70	130	102	70	130
Lead	EMS0017-SEP20	ug/g	0.1	<0.1	3	20	103	70	130	95	70	130
Antimony	EMS0017-SEP20	µg/g	0.8	<0.8	ND	20	99	70	130	102	70	130
Selenium	EMS0017-SEP20	µg/g	0.7	<0.7	ND	20	100	70	130	101	70	130
Thallium	EMS0017-SEP20	µg/g	0.02	<0.02	9	20	107	70	130	102	70	130
Uranium	EMS0017-SEP20	µg/g	0.002	<0.002	16	20	99	70	130	89	70	130
Vanadium	EMS0017-SEP20	µg/g	3	<3	4	20	96	70	130	103	70	130
Zinc	EMS0017-SEP20	µg/g	0.7	<0.7	1	20	100	70	130	98	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0055-SEP20	µg/g	10	<10	ND	30	84	80	120	93	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0061-SEP20	µg/g	10	<10	ND	30	116	80	120	NV	60	140
F3 (C16-C34)	GCM0061-SEP20	µg/g	50	<50	ND	30	116	80	120	NV	60	140
F4 (C34-C50)	GCM0061-SEP20	µg/g	50	<50	ND	30	116	80	120	NV	60	140

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0008-SEP20	pH Units	0.05		0	20	100	80	120			

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENVIGC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1-Methylnaphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	104	50	140
2-Methylnaphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	102	50	140	102	50	140
Acenaphthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	102	50	140
Acenaphthylene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	103	50	140	102	50	140
Anthracene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	105	50	140
Benzo(a)anthracene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140
Benzo(a)pyrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	108	50	140
Benzo(b+j)fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	108	50	140
Benzo(ghi)perylene	GCM0111-SEP20	µg/g	0.1	< 0.1	ND	40	102	50	140	99	50	140
Benzo(k)fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	104	50	140
Chrysene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	108	50	140	106	50	140
Dibenzo(a,h)anthracene	GCM0111-SEP20	µg/g	0.06	< 0.06	ND	40	101	50	140	103	50	140
Fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140
Fluorene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	101	50	140
Indeno(1,2,3-cd)pyrene	GCM0111-SEP20	µg/g	0.1	< 0.1	ND	40	102	50	140	103	50	140
Naphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	99	50	140	99	50	140
Phenanthrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	103	50	140
Pyrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	94	50	140
1,1,1-Trichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	93	60	130	89	50	140
1,1,2,2-Tetrachloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	85	50	140
1,1,2-Trichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	92	50	140
1,1-Dichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
1,1-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	91	50	140
1,2-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	88	50	140
1,2-Dichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	89	50	140
1,2-Dichloropropane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	93	50	140
1,3-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	89	50	140
1,4-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	88	50	140
Acetone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	96	50	140	84	50	140
Benzene	GCM0054-SEP20	µg/g	0.02	< 0.02	ND	50	96	60	130	92	50	140
Bromodichloromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	89	50	140
Bromoform	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	85	50	140
Bromomethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	57	50	140	75	50	140
Carbon tetrachloride	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	90	50	140
Chlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	92	50	140
Chloroform	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
cis-1,2-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	91	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0054-SEP20	µg/g	0.03	< 0.03	ND	50	98	60	130	86	50	140
Dibromochloromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	88	50	140
Dichlorodifluoromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	74	50	140	60	50	140
Ethylbenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	92	50	140
Ethylenedibromide	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	91	50	140
n-Hexane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	77	50	140
m/p-xylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
Methyl ethyl ketone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	98	50	140	87	50	140
Methyl isobutyl ketone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	102	50	140	91	50	140
Methyl-t-butyl Ether	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	100	60	130	95	50	140
Methylene Chloride	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	87	50	140
o-xylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	91	50	140
Styrene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	90	50	140
Tetrachloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	91	50	140
Toluene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	93	50	140
trans-1,2-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	89	50	140
trans-1,3-dichloropropene	GCM0054-SEP20	µg/g	0.03	< 0.03	ND	50	102	60	130	89	50	140
Trichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	95	50	140
Trichlorofluoromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	88	50	140	82	50	140
Vinyl Chloride	GCM0054-SEP20	µg/g	0.02	< 0.02	ND	50	84	50	140	83	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 15 3/04 | Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0010-SEP20	µg/g	0.5	<0.5	ND	20	95	80	120	112	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --





FINAL REPORT

CA15913-SEP20 R1

1-20-0288, SPS Foreman Replacement Port Colborne

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
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Project	1-20-0288, SPS Foreman Replacement Port Colborne
Order Number	
Samples	Soil (5)

LABORATORY DETAILS

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SGS Reference	CA15913-SEP20
Received	09/02/2020
Approved	09/10/2020
Report Number	CA15913-SEP20 R1
Date Reported	09/10/2020

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES

nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES

C50 response factors within 70% of nC10 + nC16 + nC34 average: YES

Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Benzo(b)fluoranthene results for comparison to the standard are reported as benzo(b+j)fluoranthene. Benzo(b)fluoranthene and benzo(j)fluoranthene co-elute and cannot be reported individually by the analytical method used.

Temperature of Sample upon Receipt: 7 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:010941

SIGNATORIES

Jill Campbell, B.Sc.,GISAS



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Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number					17
Sample Name					BH4-SS3-(4'-6')
Sample Matrix					Soil
Sample Date					01/09/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**
BTEX					
Benzene	µg/g	0.02	0.21	0.21	< 0.02
Ethylbenzene	µg/g	0.05	1.1	1.1	< 0.05
Toluene	µg/g	0.05	2.3	2.3	< 0.05
Xylene (total)	µg/g	0.05	3.1	3.1	< 0.05
m/p-xylene	µg/g	0.05			< 0.05
o-xylene	µg/g	0.05			< 0.05

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number					13	14	15	16
Sample Name					BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')
Sample Matrix					Soil	Soil	Soil	Soil
Sample Date					24/08/2020	24/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Hydrides								
Antimony	µg/g	0.8	7.5	7.5	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	11	18	3.9	5.1	5.9	3.5
Selenium	µg/g	0.7	2.4	2.4	< 0.7	< 0.7	< 0.7	< 0.7

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

	Sample Number	13	14	15	16	17			
	Sample Name	BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')	BH4-SS3-(4'-6')			
	Sample Matrix	Soil	Soil	Soil	Soil	Soil			
	Sample Date	24/08/2020	24/08/2020	27/08/2020	27/08/2020	27/08/2020			
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics									
Moisture Content	%	-			25.7	23.1	5.4	24.8	21.0
Barium	µg/g	0.1	390	390	200	340	46	160	
Beryllium	µg/g	0.02	4	4	0.75	1.0	0.35	0.83	
Boron	µg/g	1	120	120	11	10	10	11	
Cadmium	µg/g	0.02	1	1.2	0.14	0.17	0.41	0.27	
Chromium	µg/g	0.5	160	160	22	28	16	30	
Cobalt	µg/g	0.01	22	22	14	16	8.4	13	
Copper	µg/g	0.1	140	140	47	26	39	32	
Lead	µg/g	0.1	45	120	12	12	140	17	
Molybdenum	µg/g	0.1	6.9	6.9	1.3	1.1	2.4	1.1	
Nickel	µg/g	0.5	100	100	44	34	110	37	
Silver	µg/g	0.05	20	20	< 0.05	< 0.05	0.11	0.06	
Thallium	µg/g	0.02	1	1	0.15	0.17	0.22	0.22	
Uranium	µg/g	0.002	23	23	0.67	0.86	0.70	1.4	
Vanadium	µg/g	3	86	86	29	42	15	36	
Zinc	µg/g	0.7	340	340	56	66	56	82	
Water Soluble Boron	µg/g	0.5	1.5	1.5	< 0.5	< 0.5	< 0.5	< 0.5	

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

				Sample Number	13	14	15	16
				Sample Name	BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Date	24/08/2020	24/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Other (ORP)								
Mercury	µg/g	0.05	0.25	0.27	0.18	< 0.05	0.10	0.06
Sodium Adsorption Ratio	No unit	0.2	5	5	0.3	0.3	2.1	3.1
SAR Calcium	mg/L	0.09			52.6	66.2	14.2	39.9
SAR Magnesium	mg/L	0.02			7.3	11.2	4.5	3.9
SAR Sodium	mg/L	0.15			8.0	9.3	34.9	83.3
Conductivity	mS/cm	0.002	0.7	0.7	0.37	0.47	0.27	0.54
pH	pH Units	0.05			7.79	7.65	8.06	7.60
Chromium VI	µg/g	0.2	8	8	< 0.2	< 0.2	0.3	< 0.2
Free Cyanide	µg/g	0.05	0.051	0.051	< 0.05	< 0.05	< 0.05	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - PAHs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
PAHs					
Acenaphthene	µg/g	0.05	7.9	7.9	< 0.05
Acenaphthylene	µg/g	0.05	0.15	0.15	< 0.05
Anthracene	µg/g	0.05	0.67	0.67	< 0.05
Benzo(a)anthracene	µg/g	0.05	0.5	0.5	< 0.05
Benzo(a)pyrene	µg/g	0.05	0.078	0.3	< 0.05
Benzo(b+j)fluoranthene	µg/g	0.05	0.78	0.78	< 0.05
Benzo(ghi)perylene	µg/g	0.1	6.6	6.6	< 0.1
Benzo(k)fluoranthene	µg/g	0.05	0.78	0.78	< 0.05
Chrysene	µg/g	0.05	7	7	< 0.05
Dibenzo(a,h)anthracene	µg/g	0.06	0.1	0.1	< 0.06
Fluoranthene	µg/g	0.05	0.69	0.69	< 0.05
Fluorene	µg/g	0.05	62	62	< 0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.1	0.38	0.38	< 0.1
1-Methylnaphthalene	µg/g	0.05			< 0.05
2-Methylnaphthalene	µg/g	0.05			< 0.05
Methylnaphthalene, 2-(1-)	µg/g	0.05	0.99	0.99	< 0.05
Naphthalene	µg/g	0.05	0.6	0.6	< 0.05
Phenanthrene	µg/g	0.05	6.2	6.2	< 0.05
Pyrene	µg/g	0.05	78	78	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - PHCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
PHCs					
F1 (C6-C10)	µg/g	10	55	55	< 10
F1-BTEX (C6-C10)	µg/g	10			< 10
F2 (C10-C16)	µg/g	10	98	98	< 10
F3 (C16-C34)	µg/g	50	300	300	< 50
F4 (C34-C50)	µg/g	50	2800	2800	< 50
Chromatogram returned to baseline at nC50	Yes / No	-			YES

PACKAGE: **REG153 - SVOC Surrogates** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
SVOC Surrogates					
Surr Nitrobenzene-d5	Surr Rec %	-			87
Surr 2-Fluorobiphenyl	Surr Rec %	-			79
Surr 4-Terphenyl-d14	Surr Rec %	-			94
Surr 2-Fluorophenol	Surr Rec %	-			88
Surr Phenol-d6	Surr Rec %	-			90
Surr 2,4,6-Tribromophenol	Surr Rec %	-			87

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
THMs (VOC)					
Bromodichloromethane	µg/g	0.05	1.5	1.5	< 0.05
Bromoform	µg/g	0.05	0.27	0.27	< 0.05
Dibromochloromethane	µg/g	0.05	2.3	2.3	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
VOC Surrogates					
Surr 1,2-Dichloroethane-d4	Surr Rec %	-			100
Surr 4-Bromofluorobenzene	Surr Rec %	-			95
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-			89

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	L2	Result
VOCs					
Acetone	µg/g	0.5	16	16	< 0.5
Bromomethane	µg/g	0.05	0.05	0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	0.05	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

VOCs (continued)

Parameter	Units	RL	L1	L2	Result
Chlorobenzene	µg/g	0.05	2.4	2.4	< 0.05
Chloroform	µg/g	0.05	0.05	0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	1.2	1.2	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	4.8	4.8	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.083	0.083	< 0.05
Dichlorodifluoromethane	µg/g	0.05	16	16	< 0.05
1,1-Dichloroethane	µg/g	0.05	0.47	0.47	< 0.05
1,2-Dichloroethane	µg/g	0.05	0.05	0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.084	0.084	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	1.9	1.9	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03			< 0.03
trans-1,3-dichloropropene	µg/g	0.03			< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	0.05	< 0.05
n-Hexane	µg/g	0.05	2.8	2.8	< 0.05
Methyl ethyl ketone	µg/g	0.5	16	16	< 0.5
Methyl isobutyl ketone	µg/g	0.5	1.7	1.7	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.75	0.75	< 0.05
Methylene Chloride	µg/g	0.05	0.1	0.1	< 0.05
Styrene	µg/g	0.05	0.7	0.7	< 0.05
Tetrachloroethylene	µg/g	0.05	0.28	0.28	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED

L2 = REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

VOCs (continued)

Parameter	Units	RL	L1	L2	Result
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.058	0.058	< 0.05
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.38	0.38	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.061	0.061	< 0.05
Trichlorofluoromethane	µg/g	0.05	4	4	< 0.05
Vinyl Chloride	µg/g	0.02	0.02	0.02	< 0.02

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 2 - Agricultural/Other - UNDEFINED L1	REG153 / SOIL / COARSE - TABLE 2 - Residential/Parkland - UNDEFINED L2
BH4-SS1-(0'-2')					
Lead	EPA 3050/EPA 200.8	µg/g	140	45	120
Nickel	EPA 3050/EPA 200.8	µg/g	110	100	100

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0112-SEP20	mS/cm	0.002	<0.002	3	10	100	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5008-SEP20	µg/g	0.05	<0.05	ND	20	104	80	120	88	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-IENVISKA-LAK-AN-012

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	SKA5022-SEP20	ug/g	0.2	<0.2	ND	20	94	80	120	89	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0017-SEP20	µg/g	0.05	<0.05	2	20	105	80	120	99	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0017-SEP20	mg/L	0.09	<0.09	2	20	101	80	120	99	70	130
SAR Magnesium	ESG0017-SEP20	mg/L	0.02	<0.02	6	20	98	80	120	101	70	130
SAR Sodium	ESG0017-SEP20	mg/L	0.15	<0.15	8	20	99	80	120	101	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENVISPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0017-SEP20	ug/g	0.05	<0.05	ND	20	100	70	130	102	70	130
Arsenic	EMS0017-SEP20	µg/g	0.5	<0.5	3	20	99	70	130	95	70	130
Barium	EMS0017-SEP20	ug/g	0.1	<0.1	4	20	109	70	130	98	70	130
Beryllium	EMS0017-SEP20	µg/g	0.02	<0.02	2	20	102	70	130	98	70	130
Boron	EMS0017-SEP20	µg/g	1	<1	4	20	103	70	130	94	70	130
Cadmium	EMS0017-SEP20	µg/g	0.02	<0.02	5	20	98	70	130	106	70	130
Cobalt	EMS0017-SEP20	µg/g	0.01	<0.01	4	20	96	70	130	104	70	130
Chromium	EMS0017-SEP20	µg/g	0.5	<0.5	2	20	95	70	130	104	70	130
Copper	EMS0017-SEP20	µg/g	0.1	<0.1	1	20	97	70	130	98	70	130
Molybdenum	EMS0017-SEP20	µg/g	0.1	<0.1	7	20	93	70	130	101	70	130
Nickel	EMS0017-SEP20	ug/g	0.5	<0.5	1	20	95	70	130	102	70	130
Lead	EMS0017-SEP20	ug/g	0.1	<0.1	3	20	103	70	130	95	70	130
Antimony	EMS0017-SEP20	µg/g	0.8	<0.8	ND	20	99	70	130	102	70	130
Selenium	EMS0017-SEP20	µg/g	0.7	<0.7	ND	20	100	70	130	101	70	130
Thallium	EMS0017-SEP20	µg/g	0.02	<0.02	9	20	107	70	130	102	70	130
Uranium	EMS0017-SEP20	µg/g	0.002	<0.002	16	20	99	70	130	89	70	130
Vanadium	EMS0017-SEP20	µg/g	3	<3	4	20	96	70	130	103	70	130
Zinc	EMS0017-SEP20	µg/g	0.7	<0.7	1	20	100	70	130	98	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0055-SEP20	µg/g	10	<10	ND	30	84	80	120	93	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0061-SEP20	µg/g	10	<10	ND	30	116	80	120	NV	60	140
F3 (C16-C34)	GCM0061-SEP20	µg/g	50	<50	ND	30	116	80	120	NV	60	140
F4 (C34-C50)	GCM0061-SEP20	µg/g	50	<50	ND	30	116	80	120	NV	60	140

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0008-SEP20	pH Units	0.05		0	20	100	80	120			

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENVIGC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1-Methylnaphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	104	50	140
2-Methylnaphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	102	50	140	102	50	140
Acenaphthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	102	50	140
Acenaphthylene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	103	50	140	102	50	140
Anthracene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	105	50	140
Benzo(a)anthracene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140
Benzo(a)pyrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	108	50	140
Benzo(b+j)fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	108	50	140
Benzo(ghi)perylene	GCM0111-SEP20	µg/g	0.1	< 0.1	ND	40	102	50	140	99	50	140
Benzo(k)fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	104	50	140
Chrysene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	108	50	140	106	50	140
Dibenzo(a,h)anthracene	GCM0111-SEP20	µg/g	0.06	< 0.06	ND	40	101	50	140	103	50	140
Fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140
Fluorene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	101	50	140
Indeno(1,2,3-cd)pyrene	GCM0111-SEP20	µg/g	0.1	< 0.1	ND	40	102	50	140	103	50	140
Naphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	99	50	140	99	50	140
Phenanthrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	103	50	140
Pyrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	94	50	140
1,1,1-Trichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	93	60	130	89	50	140
1,1,2,2-Tetrachloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	85	50	140
1,1,2-Trichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	92	50	140
1,1-Dichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
1,1-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	91	50	140
1,2-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	88	50	140
1,2-Dichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	89	50	140
1,2-Dichloropropane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	93	50	140
1,3-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	89	50	140
1,4-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	88	50	140
Acetone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	96	50	140	84	50	140
Benzene	GCM0054-SEP20	µg/g	0.02	< 0.02	ND	50	96	60	130	92	50	140
Bromodichloromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	89	50	140
Bromoform	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	85	50	140
Bromomethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	57	50	140	75	50	140
Carbon tetrachloride	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	90	50	140
Chlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	92	50	140
Chloroform	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
cis-1,2-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	91	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0054-SEP20	µg/g	0.03	< 0.03	ND	50	98	60	130	86	50	140
Dibromochloromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	88	50	140
Dichlorodifluoromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	74	50	140	60	50	140
Ethylbenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	92	50	140
Ethylenedibromide	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	91	50	140
n-Hexane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	77	50	140
m/p-xylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
Methyl ethyl ketone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	98	50	140	87	50	140
Methyl isobutyl ketone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	102	50	140	91	50	140
Methyl-t-butyl Ether	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	100	60	130	95	50	140
Methylene Chloride	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	87	50	140
o-xylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	91	50	140
Styrene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	90	50	140
Tetrachloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	91	50	140
Toluene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	93	50	140
trans-1,2-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	89	50	140
trans-1,3-dichloropropene	GCM0054-SEP20	µg/g	0.03	< 0.03	ND	50	102	60	130	89	50	140
Trichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	95	50	140
Trichlorofluoromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	88	50	140	82	50	140
Vinyl Chloride	GCM0054-SEP20	µg/g	0.02	< 0.02	ND	50	84	50	140	83	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 15 3/04 | Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0010-SEP20	µg/g	0.5	<0.5	ND	20	95	80	120	112	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --





FINAL REPORT

CA15913-SEP20 R1

1-20-0288, SPS Foreman Replacement Port Colborne

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
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Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
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Email	smonfared@terraprobe.ca
Project	1-20-0288, SPS Foreman Replacement Port Colborne
Order Number	
Samples	Soil (5)

LABORATORY DETAILS

Project Specialist	Jill Campbell, B.Sc.,GISAS
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
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Email	jill.campbell@sgs.com
SGS Reference	CA15913-SEP20
Received	09/02/2020
Approved	09/10/2020
Report Number	CA15913-SEP20 R1
Date Reported	09/10/2020

COMMENTS

CCME Method Compliance: Analyses were conducted using analytical procedures that comply with the Reference Method for the CWS for Petroleum Hydrocarbons in Soil and have been validated for use at the SGS laboratory, Lakefield, ON site.

Quality Compliance: Instrument performance / calibration quality criteria were met and extraction and analysis limits for holding times were met.

nC6 and nC10 response factors within 30% of response factor for toluene: YES

nC10, nC16 and nC34 response factors within 10% of the average response for the three compounds: YES

C50 response factors within 70% of nC10 + nC16 + nC34 average: YES

Linearity is within 15%: YES

F4G - gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
The results for F4 and F4G are both reported and the greater of the two values is to be used in application to the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

Benzo(b)fluoranthene results for comparison to the standard are reported as benzo(b+j)fluoranthene. Benzo(b)fluoranthene and benzo(j)fluoranthene co-elute and cannot be reported individually by the analytical method used.

Temperature of Sample upon Receipt: 7 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:010941

SIGNATORIES

Jill Campbell, B.Sc.,GISAS



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Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - BTEX** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	Result
BTEX				
Benzene	µg/g	0.02	0.21	< 0.02
Ethylbenzene	µg/g	0.05	2	< 0.05
Toluene	µg/g	0.05	2.3	< 0.05
Xylene (total)	µg/g	0.05	3.1	< 0.05
m/p-xylene	µg/g	0.05		< 0.05
o-xylene	µg/g	0.05		< 0.05

PACKAGE: **REG153 - Hydrides** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	13	14	15	16
Sample Name	BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')
Sample Matrix	Soil	Soil	Soil	Soil
Sample Date	24/08/2020	24/08/2020	27/08/2020	27/08/2020

Parameter	Units	RL	L1	Result	Result	Result	Result
Hydrides							
Antimony	µg/g	0.8	7.5	< 0.8	< 0.8	< 0.8	< 0.8
Arsenic	µg/g	0.5	18	3.9	5.1	5.9	3.5
Selenium	µg/g	0.7	2.4	< 0.7	< 0.7	< 0.7	< 0.7

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - Metals and Inorganics** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number				13	14	15	16	17
Sample Name				BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')	BH4-SS3-(4'-6')
Sample Matrix				Soil	Soil	Soil	Soil	Soil
Sample Date				24/08/2020	24/08/2020	27/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics								
Moisture Content	%	-		25.7	23.1	5.4	24.8	21.0
Barium	µg/g	0.1	390	200	340	46	160	
Beryllium	µg/g	0.02	4	0.75	1.0	0.35	0.83	
Boron	µg/g	1	120	11	10	10	11	
Cadmium	µg/g	0.02	1.2	0.14	0.17	0.41	0.27	
Chromium	µg/g	0.5	160	22	28	16	30	
Cobalt	µg/g	0.01	22	14	16	8.4	13	
Copper	µg/g	0.1	140	47	26	39	32	
Lead	µg/g	0.1	120	12	12	140	17	
Molybdenum	µg/g	0.1	6.9	1.3	1.1	2.4	1.1	
Nickel	µg/g	0.5	100	44	34	110	37	
Silver	µg/g	0.05	20	< 0.05	< 0.05	0.11	0.06	
Thallium	µg/g	0.02	1	0.15	0.17	0.22	0.22	
Uranium	µg/g	0.002	23	0.67	0.86	0.70	1.4	
Vanadium	µg/g	3	86	29	42	15	36	
Zinc	µg/g	0.7	340	56	66	56	82	
Water Soluble Boron	µg/g	0.5	1.5	< 0.5	< 0.5	< 0.5	< 0.5	

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - Other (ORP)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number				13	14	15	16
Sample Name				BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')
Sample Matrix				Soil	Soil	Soil	Soil
Sample Date				24/08/2020	24/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Other (ORP)							
Mercury	µg/g	0.05	0.27	0.18	< 0.05	0.10	0.06
Sodium Adsorption Ratio	No unit	0.2	5	0.3	0.3	2.1	3.1
SAR Calcium	mg/L	0.09		52.6	66.2	14.2	39.9
SAR Magnesium	mg/L	0.02		7.3	11.2	4.5	3.9
SAR Sodium	mg/L	0.15		8.0	9.3	34.9	83.3
Conductivity	mS/cm	0.002	0.7	0.37	0.47	0.27	0.54
pH	pH Units	0.05		7.79	7.65	8.06	7.60
Chromium VI	µg/g	0.2	8	< 0.2	< 0.2	0.3	< 0.2
Free Cyanide	µg/g	0.05	0.051	< 0.05	< 0.05	< 0.05	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - PAHs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

PAHs

Parameter	Units	RL	L1	Result
Acenaphthene	µg/g	0.05	7.9	< 0.05
Acenaphthylene	µg/g	0.05	0.15	< 0.05
Anthracene	µg/g	0.05	0.67	< 0.05
Benzo(a)anthracene	µg/g	0.05	0.5	< 0.05
Benzo(a)pyrene	µg/g	0.05	0.3	< 0.05
Benzo(b+j)fluoranthene	µg/g	0.05	0.78	< 0.05
Benzo(ghi)perylene	µg/g	0.1	6.6	< 0.1
Benzo(k)fluoranthene	µg/g	0.05	0.78	< 0.05
Chrysene	µg/g	0.05	7	< 0.05
Dibenzo(a,h)anthracene	µg/g	0.06	0.1	< 0.06
Fluoranthene	µg/g	0.05	0.69	< 0.05
Fluorene	µg/g	0.05	62	< 0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.1	0.38	< 0.1
1-Methylnaphthalene	µg/g	0.05		< 0.05
2-Methylnaphthalene	µg/g	0.05		< 0.05
Methylnaphthalene, 2-(1-)	µg/g	0.05	0.99	< 0.05
Naphthalene	µg/g	0.05	0.6	< 0.05
Phenanthrene	µg/g	0.05	6.2	< 0.05
Pyrene	µg/g	0.05	78	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - PHCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

PHCs

Parameter	Units	RL	L1	Result
F1 (C6-C10)	µg/g	10	55	< 10
F1-BTEX (C6-C10)	µg/g	10		< 10
F2 (C10-C16)	µg/g	10	98	< 10
F3 (C16-C34)	µg/g	50	300	< 50
F4 (C34-C50)	µg/g	50	2800	< 50
Chromatogram returned to baseline at nC50	Yes / No	-		YES

PACKAGE: **REG153 - SVOC Surrogates** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

SVOC Surrogates

Parameter	Units	RL	L1	Result
Surr Nitrobenzene-d5	Surr Rec %	-		87
Surr 2-Fluorobiphenyl	Surr Rec %	-		79
Surr 4-Terphenyl-d14	Surr Rec %	-		94
Surr 2-Fluorophenol	Surr Rec %	-		88
Surr Phenol-d6	Surr Rec %	-		90
Surr 2,4,6-Tribromophenol	Surr Rec %	-		87

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - THMs (VOC)** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	Result
THMs (VOC)				
Bromodichloromethane	µg/g	0.05	13	< 0.05
Bromoform	µg/g	0.05	0.27	< 0.05
Dibromochloromethane	µg/g	0.05	9.4	< 0.05

PACKAGE: **REG153 - VOC Surrogates** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	Result
VOC Surrogates				
Surr 1,2-Dichloroethane-d4	Surr Rec %	-		100
Surr 4-Bromofluorobenzene	Surr Rec %	-		95
Surr 2-Bromo-1-Chloropropane	Surr Rec %	-		89

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

Parameter	Units	RL	L1	Result
VOCs				
Acetone	µg/g	0.5	16	< 0.5
Bromomethane	µg/g	0.05	0.05	< 0.05
Carbon tetrachloride	µg/g	0.05	0.05	< 0.05
Chlorobenzene	µg/g	0.05	2.4	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

VOCs (continued)

Parameter	Units	RL	L1	Result
Chloroform	µg/g	0.05	0.05	< 0.05
1,2-Dichlorobenzene	µg/g	0.05	3.4	< 0.05
1,3-Dichlorobenzene	µg/g	0.05	4.8	< 0.05
1,4-Dichlorobenzene	µg/g	0.05	0.083	< 0.05
Dichlorodifluoromethane	µg/g	0.05	16	< 0.05
1,1-Dichloroethane	µg/g	0.05	3.5	< 0.05
1,2-Dichloroethane	µg/g	0.05	0.05	< 0.05
1,1-Dichloroethylene	µg/g	0.05	0.05	< 0.05
trans-1,2-Dichloroethylene	µg/g	0.05	0.084	< 0.05
cis-1,2-Dichloroethylene	µg/g	0.05	3.4	< 0.05
1,2-Dichloropropane	µg/g	0.05	0.05	< 0.05
cis-1,3-dichloropropene	µg/g	0.03		< 0.03
trans-1,3-dichloropropene	µg/g	0.03		< 0.03
1,3-dichloropropene (total)	µg/g	0.05	0.05	< 0.05
Ethylenedibromide	µg/g	0.05	0.05	< 0.05
n-Hexane	µg/g	0.05	2.8	< 0.05
Methyl ethyl ketone	µg/g	0.5	16	< 0.5
Methyl isobutyl ketone	µg/g	0.5	1.7	< 0.5
Methyl-t-butyl Ether	µg/g	0.05	0.75	< 0.05
Methylene Chloride	µg/g	0.05	0.1	< 0.05
Styrene	µg/g	0.05	0.7	< 0.05
Tetrachloroethylene	µg/g	0.05	0.28	< 0.05
1,1,1,2-Tetrachloroethane	µg/g	0.05	0.058	< 0.05

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replacement Port Colborne

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **REG153 - VOCs** (SOIL)

L1 = REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED

Sample Number	17
Sample Name	BH4-SS3-(4'-6')
Sample Matrix	Soil
Sample Date	01/09/2020

VOCs (continued)

Parameter	Units	RL	L1	Result
1,1,2,2-Tetrachloroethane	µg/g	0.05	0.05	< 0.05
1,1,1-Trichloroethane	µg/g	0.05	0.38	< 0.05
1,1,2-Trichloroethane	µg/g	0.05	0.05	< 0.05
Trichloroethylene	µg/g	0.05	0.061	< 0.05
Trichlorofluoromethane	µg/g	0.05	4	< 0.05
Vinyl Chloride	µg/g	0.02	0.02	< 0.02

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	REG153 / SOIL / COARSE - TABLE 3 - Residential/Parkland - UNDEFINED L1
BH4-SS1-(0'-2')				
Lead	EPA 3050/EPA 200.8	µg/g	140	120
Nickel	EPA 3050/EPA 200.8	µg/g	110	100

QC SUMMARY

Conductivity

Method: EPA 6010/SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0112-SEP20	mS/cm	0.002	<0.002	3	10	100	90	110	NA		

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-IENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Free Cyanide	SKA5008-SEP20	µg/g	0.05	<0.05	ND	20	104	80	120	88	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A | Internal ref.: ME-CA-IENVISKA-LAK-AN-012

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	SKA5022-SEP20	ug/g	0.2	<0.2	ND	20	94	80	120	89	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/EPA 245 | Internal ref.: ME-CA-IENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EMS0017-SEP20	µg/g	0.05	<0.05	2	20	105	80	120	99	70	130

Metals in aqueous samples - ICP-OES

Method: MOE 4696e01/EPA 6010 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
SAR Calcium	ESG0017-SEP20	mg/L	0.09	<0.09	2	20	101	80	120	99	70	130
SAR Magnesium	ESG0017-SEP20	mg/L	0.02	<0.02	6	20	98	80	120	101	70	130
SAR Sodium	ESG0017-SEP20	mg/L	0.15	<0.15	8	20	99	80	120	101	70	130

QC SUMMARY

Metals in Soil - Aqua-regia/ICP-MS

Method: EPA 3050/EPA 200.8 | Internal ref.: ME-CA-[ENVISPE-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0017-SEP20	ug/g	0.05	<0.05	ND	20	100	70	130	102	70	130
Arsenic	EMS0017-SEP20	µg/g	0.5	<0.5	3	20	99	70	130	95	70	130
Barium	EMS0017-SEP20	ug/g	0.1	<0.1	4	20	109	70	130	98	70	130
Beryllium	EMS0017-SEP20	µg/g	0.02	<0.02	2	20	102	70	130	98	70	130
Boron	EMS0017-SEP20	µg/g	1	<1	4	20	103	70	130	94	70	130
Cadmium	EMS0017-SEP20	µg/g	0.02	<0.02	5	20	98	70	130	106	70	130
Cobalt	EMS0017-SEP20	µg/g	0.01	<0.01	4	20	96	70	130	104	70	130
Chromium	EMS0017-SEP20	µg/g	0.5	<0.5	2	20	95	70	130	104	70	130
Copper	EMS0017-SEP20	µg/g	0.1	<0.1	1	20	97	70	130	98	70	130
Molybdenum	EMS0017-SEP20	µg/g	0.1	<0.1	7	20	93	70	130	101	70	130
Nickel	EMS0017-SEP20	ug/g	0.5	<0.5	1	20	95	70	130	102	70	130
Lead	EMS0017-SEP20	ug/g	0.1	<0.1	3	20	103	70	130	95	70	130
Antimony	EMS0017-SEP20	µg/g	0.8	<0.8	ND	20	99	70	130	102	70	130
Selenium	EMS0017-SEP20	µg/g	0.7	<0.7	ND	20	100	70	130	101	70	130
Thallium	EMS0017-SEP20	µg/g	0.02	<0.02	9	20	107	70	130	102	70	130
Uranium	EMS0017-SEP20	µg/g	0.002	<0.002	16	20	99	70	130	89	70	130
Vanadium	EMS0017-SEP20	µg/g	3	<3	4	20	96	70	130	103	70	130
Zinc	EMS0017-SEP20	µg/g	0.7	<0.7	1	20	100	70	130	98	70	130

QC SUMMARY

Petroleum Hydrocarbons (F1)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F1 (C6-C10)	GCM0055-SEP20	µg/g	10	<10	ND	30	84	80	120	93	60	140

Petroleum Hydrocarbons (F2-F4)

Method: CCME Tier 1 I Internal ref.: ME-CA-[ENVIGC-LAK-AN-010

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
F2 (C10-C16)	GCM0061-SEP20	µg/g	10	<10	ND	30	116	80	120	NV	60	140
F3 (C16-C34)	GCM0061-SEP20	µg/g	50	<50	ND	30	116	80	120	NV	60	140
F4 (C34-C50)	GCM0061-SEP20	µg/g	50	<50	ND	30	116	80	120	NV	60	140

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	ARD0008-SEP20	pH Units	0.05		0	20	100	80	120			

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3541/8270D | Internal ref.: ME-CA-[ENVIGC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1-Methylnaphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	104	50	140
2-Methylnaphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	102	50	140	102	50	140
Acenaphthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	102	50	140
Acenaphthylene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	103	50	140	102	50	140
Anthracene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	105	50	140
Benzo(a)anthracene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140
Benzo(a)pyrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	108	50	140
Benzo(b+j)fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	108	50	140
Benzo(ghi)perylene	GCM0111-SEP20	µg/g	0.1	< 0.1	ND	40	102	50	140	99	50	140
Benzo(k)fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	104	50	140
Chrysene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	108	50	140	106	50	140
Dibenzo(a,h)anthracene	GCM0111-SEP20	µg/g	0.06	< 0.06	ND	40	101	50	140	103	50	140
Fluoranthene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140
Fluorene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	101	50	140
Indeno(1,2,3-cd)pyrene	GCM0111-SEP20	µg/g	0.1	< 0.1	ND	40	102	50	140	103	50	140
Naphthalene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	99	50	140	99	50	140
Phenanthrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	104	50	140	103	50	140
Pyrene	GCM0111-SEP20	µg/g	0.05	< 0.05	ND	40	105	50	140	106	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-[ENV]GC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	94	50	140
1,1,1-Trichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	93	60	130	89	50	140
1,1,2,2-Tetrachloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	85	50	140
1,1,2-Trichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	92	50	140
1,1-Dichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
1,1-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	91	50	140
1,2-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	88	50	140
1,2-Dichloroethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	89	50	140
1,2-Dichloropropane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	93	50	140
1,3-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	89	50	140
1,4-Dichlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	88	50	140
Acetone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	96	50	140	84	50	140
Benzene	GCM0054-SEP20	µg/g	0.02	< 0.02	ND	50	96	60	130	92	50	140
Bromodichloromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	89	50	140
Bromoform	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	85	50	140
Bromomethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	57	50	140	75	50	140
Carbon tetrachloride	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	90	50	140
Chlorobenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	92	50	140
Chloroform	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
cis-1,2-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	91	50	140

QC SUMMARY

Volatile Organics (continued)

Method: EPA 5035A/5030B/8260C | Internal ref.: ME-CA-IENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
cis-1,3-dichloropropene	GCM0054-SEP20	µg/g	0.03	< 0.03	ND	50	98	60	130	86	50	140
Dibromochloromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	88	50	140
Dichlorodifluoromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	74	50	140	60	50	140
Ethylbenzene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	92	50	140
Ethylenedibromide	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	91	50	140
n-Hexane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	99	60	130	77	50	140
m/p-xylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	95	60	130	91	50	140
Methyl ethyl ketone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	98	50	140	87	50	140
Methyl isobutyl ketone	GCM0054-SEP20	µg/g	0.5	< 0.5	ND	50	102	50	140	91	50	140
Methyl-t-butyl Ether	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	100	60	130	95	50	140
Methylene Chloride	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	87	50	140
o-xylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	91	50	140
Styrene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	90	50	140
Tetrachloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	98	60	130	91	50	140
Toluene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	97	60	130	93	50	140
trans-1,2-Dichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	94	60	130	89	50	140
trans-1,3-dichloropropene	GCM0054-SEP20	µg/g	0.03	< 0.03	ND	50	102	60	130	89	50	140
Trichloroethylene	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	96	60	130	95	50	140
Trichlorofluoromethane	GCM0054-SEP20	µg/g	0.05	< 0.05	ND	50	88	50	140	82	50	140
Vinyl Chloride	GCM0054-SEP20	µg/g	0.02	< 0.02	ND	50	84	50	140	83	50	140

QC SUMMARY

Water Soluble Boron

Method: O.Reg. 15 3/04 | Internal ref.: ME-CA-[ENV] SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Water Soluble Boron	ESG0010-SEP20	µg/g	0.5	<0.5	ND	20	95	80	120	112	70	130

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --





FINAL REPORT

CA14469-SEP20 R

1-20-0288 SOS Forcemain Replacement, Port Colbourne

Prepared for

Terraprobe Inc

FINAL REPORT

CA14469-SEP20 R

First Page

CLIENT DETAILS		LABORATORY DETAILS	
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Project	1-20-0288 SOS Forcemain Replacement, Port Colbourne	Received	09/16/2020
Order Number		Approved	09/23/2020
Samples	Leachate (4)	Report Number	CA14469-SEP20 R
		Date Reported	09/23/2020

COMMENTS

Temperature of Sample upon Receipt: 6 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:016713

TCLP metals reported at 10x DL

RL raised for nits due to sample matrix

SIGNATORIES

Jill Campbell, B.Sc.,GISAS



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PACKAGE: **REG558 - Acid rock Drainage**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Sample Number 6	7	8	9
				Sample Name BH4 SS1 & SS2 (0'-4')	BH4 SS3 (4'-6')	BH5 SS1 (0'-2')	BH5 SS3 (4'-4.3/4')
				Sample Matrix Leachate	Leachate	Leachate	Leachate
				Sample Date 27/08/2020	27/08/2020	24/08/2020	24/08/2020
Acid rock Drainage							
Final pH	no unit	0.01		5.13	6.16	5.43	6.05

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Sample Number 6	7	8	9
				Sample Name BH4 SS1 & SS2 (0'-4')	BH4 SS3 (4'-6')	BH5 SS1 (0'-2')	BH5 SS3 (4'-4.3/4')
				Sample Matrix Leachate	Leachate	Leachate	Leachate
				Sample Date 27/08/2020	27/08/2020	24/08/2020	24/08/2020
Metals and Inorganics							
Sample weight	g	0.001		100	100	100	100
Ext Fluid	#1 or #2	0.01		2	2	2	2
^ Ext Volume	mL	0.01		2000	2000	2000	2000
Nitrite (as N)	as N mg/L	0.03		< 0.3↑	< 0.3↑	< 0.3↑	< 0.3↑
Nitrate (as N)	as N mg/L	0.06		< 0.6↑	< 0.6↑	< 0.6↑	< 0.6↑
Nitrate + Nitrite (as N)	as N mg/L	0.06	1000	< 0.6↑	< 0.6↑	< 0.6↑	< 0.6↑
Fluoride	mg/L	0.06	150	0.40	0.42	0.70	0.71
Cyanide (total)	mg/L	0.01	20	< 0.01	< 0.01	< 0.01	< 0.01
Arsenic	mg/L	0.002	2.5	0.004	0.006	0.004	0.004
Silver	mg/L	0.0005	5	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Barium	mg/L	0.0002	100	0.748	0.995	0.827	1.11
Boron	mg/L	0.02	500	0.20	0.20	0.27	0.11
Cadmium	mg/L	0.00003	0.5	0.00260	0.00272	0.00157	0.00485

Client: Terraprobe Inc
Project: 1-20-0288 SOS Forcemain Replacem
Project Manager: Sepideh D_Monfared
Samplers: Mohamed Bournes

PACKAGE: **REG558 - Metals and Inorganics** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

				Sample Number	6	7	8	9
				Sample Name	BH4 SS1 & SS2 (0'-4')	BH4 SS3 (4'-6')	BH5 SS1 (0'-2')	BH5 SS3 (4'-4.3/4')
				Sample Matrix	Leachate	Leachate	Leachate	Leachate
				Sample Date	27/08/2020	27/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)								
Chromium	mg/L	0.0008	5		0.0060	< 0.0008	0.0023	0.0015
Lead	mg/L	0.0001	5		0.0069	0.0049	0.0056	0.0146
Selenium	mg/L	0.0004	1		0.0007	0.0006	0.0008	< 0.0004
Uranium	mg/L	0.00002	10		0.00220	0.00627	0.00243	0.00481

PACKAGE: **REG558 - Other (ORP)** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

				Sample Number	6	7	8	9
				Sample Name	BH4 SS1 & SS2 (0'-4')	BH4 SS3 (4'-6')	BH5 SS1 (0'-2')	BH5 SS3 (4'-4.3/4')
				Sample Matrix	Leachate	Leachate	Leachate	Leachate
				Sample Date	27/08/2020	27/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**	**Result**	**Result**
Other (ORP)								
Mercury	mg/L	0.00001	0.1		< 0.00001	< 0.00001	< 0.00001	< 0.00001

PACKAGE: **REG558 - PCBs** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

				Sample Number	6	7	8	9
				Sample Name	BH4 SS1 & SS2 (0'-4')	BH4 SS3 (4'-6')	BH5 SS1 (0'-2')	BH5 SS3 (4'-4.3/4')
				Sample Matrix	Leachate	Leachate	Leachate	Leachate
				Sample Date	27/08/2020	27/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**	**Result**	**Result**
PCBs								
Polychlorinated Biphenyls (PCBs) - Total	mg/L	0.001	0.3		< 0.001	< 0.001	< 0.001	< 0.001

Client: Terraprobe Inc
Project: 1-20-0288 SOS Forcemain Replacem
Project Manager: Sepideh D_Monfared
Samplers: Mohamed Bournes

PACKAGE: **REG558 - SVOCs - PAHs** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Sample Number 6 Result	7 Result	8 Result	9 Result
				Sample Name: BH4 SS1 & SS2 (0'-4')	BH4 SS3 (4'-6')	BH5 SS1 (0'-2')	BH5 SS3 (4'-4.3/4')
				Sample Matrix: Leachate	Leachate	Leachate	Leachate
				Sample Date: 27/08/2020	27/08/2020	24/08/2020	24/08/2020
SVOCs - PAHs							
Benzo(a)pyrene	mg/L	0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001

PACKAGE: **REG558 - VOCs** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Sample Number 6 Result	7 Result	8 Result	9 Result
				Sample Name: BH4 SS1 & SS2 (0'-4')	BH4 SS3 (4'-6')	BH5 SS1 (0'-2')	BH5 SS3 (4'-4.3/4')
				Sample Matrix: Leachate	Leachate	Leachate	Leachate
				Sample Date: 27/08/2020	27/08/2020	24/08/2020	24/08/2020
VOCs							
Methyl ethyl ketone	mg/L	0.8	200	< 0.8	< 0.8	< 0.8	< 0.8
Vinyl Chloride	mg/L	0.008	0.2	< 0.008	< 0.008	< 0.008	< 0.008
Dichloromethane	mg/L	0.02	5	< 0.02	< 0.02	< 0.02	< 0.02
Chloroform	mg/L	0.02	10	< 0.02	< 0.02	< 0.02	< 0.02
Trichloroethylene	mg/L	0.02	5	< 0.02	< 0.02	< 0.02	< 0.02
Tetrachloroethene	mg/L	0.02		< 0.02	< 0.02	< 0.02	< 0.02
Monochlorobenzene	mg/L	0.02	8	< 0.02	< 0.02	< 0.02	< 0.02
Carbon tetrachloride	mg/L	0.008	0.5	< 0.008	< 0.008	< 0.008	< 0.008
1,2-Dichlorobenzene	mg/L	0.02	20	< 0.02	< 0.02	< 0.02	< 0.02
1,4-Dichlorobenzene	mg/L	0.02	0.5	< 0.02	< 0.02	< 0.02	< 0.02
1,2-Dichloroethane	mg/L	0.02	0.5	< 0.02	< 0.02	< 0.02	< 0.02
1,1-Dichloroethylene	mg/L	0.02	1.4	< 0.02	< 0.02	< 0.02	< 0.02

Client: Terraprobe Inc

Project: 1-20-0288 SOS Forcemain Replacem

Project Manager: Sepideh D_Monfared

Samplers: Mohamed Bournes

PACKAGE: **REG558 - VOCs - BTEX** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number				6	7	8	9
Sample Name				BH4 SS1 & SS2 (0'-4')	BH4 SS3 (4'-6')	BH5 SS1 (0'-2')	BH5 SS3 (4'-4.3/4')
Sample Matrix				Leachate	Leachate	Leachate	Leachate
Sample Date				27/08/2020	27/08/2020	24/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
VOCs - BTEX							
Benzene	mg/L	0.02	0.5	< 0.02	< 0.02	< 0.02	< 0.02

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Nitrate + Nitrite (as N)	DIO0267-SEP20	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0267-SEP20	mg/L	0.03	<0.03								
Nitrate (as N)	DIO0267-SEP20	mg/L	0.06	<0.06								
Nitrate + Nitrite (as N)	DIO0293-SEP20	mg/L	0.06	<0.06	NA		NA			NA		
Nitrite (as N)	DIO0293-SEP20	mg/L	0.03	<0.03	ND	20	100	80	120	102	75	125
Nitrate (as N)	DIO0293-SEP20	mg/L	0.06	<0.06	ND	20	101	80	120	103	75	125

Cyanide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
Cyanide (total)	SKA5075-SEP20	mg/L	0.01	<0.01	ND	10	93	90	110	105	75	125

QC SUMMARY

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0313-SEP20	mg/L	0.06	<0.06	5	10	100	90	110	97	75	125

Inorganics-General

Method: EPA 7471A/SM 3112B I Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0020-SEP20	mg/L	0.00001	< 0.00001	0	20	91	80	120	95	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 I Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0118-SEP20	mg/L	0.0005	<0.00005	ND	20	105	90	110	104	70	130
Arsenic	EMS0118-SEP20	mg/L	0.002	<0.0002	6	20	101	90	110	104	70	130
Barium	EMS0118-SEP20	mg/L	0.0002	<0.00002	4	20	100	90	110	120	70	130
Boron	EMS0118-SEP20	mg/L	0.02	<0.002	2	20	102	90	110	NV	70	130
Cadmium	EMS0118-SEP20	mg/L	0.00003	<0.000003	2	20	103	90	110	110	70	130
Chromium	EMS0118-SEP20	mg/L	0.0008	<0.00008	9	20	104	90	110	93	70	130
Lead	EMS0118-SEP20	mg/L	0.0001	<0.00001	2	20	102	90	110	104	70	130
Selenium	EMS0118-SEP20	mg/L	0.0004	<0.00004	2	20	96	90	110	100	70	130
Uranium	EMS0118-SEP20	mg/L	0.00002	<0.000002	2	20	96	90	110	96	70	130

Polychlorinated Biphenyls

Method: MOE E3400/EPA 8082A I Internal ref.: ME-CA-IENVIGC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Polychlorinated Biphenyls (PCBs) - Total	GCM0320-SEP20	mg/L	0.001	< 0.001	ND	30	97	60	140	112	60	140

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Benzo(a)pyrene	GCM0323-SEP20	mg/L	0.001	< 0.001	NSS	30	87	50	140	NSS	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1-Dichloroethylene	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	99	60	130	100	50	140
1,2-Dichlorobenzene	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	98	60	130	97	50	140
1,2-Dichloroethane	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	99	60	130	98	50	140
1,4-Dichlorobenzene	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	97	60	130	96	50	140
Benzene	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	101	60	130	99	50	140
Carbon tetrachloride	GCM0304-SEP20	mg/L	0.008	<0.008	ND	30	101	60	130	101	50	140
Chloroform	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	99	60	130	99	50	140
Dichloromethane	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	101	60	130	100	50	140
Methyl ethyl ketone	GCM0304-SEP20	mg/L	0.8	<0.8	ND	30	101	50	140	97	50	140
Monochlorobenzene	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	102	60	130	99	50	140
Tetrachloroethene	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	101	60	130	98	50	140
Trichloroethylene	GCM0304-SEP20	mg/L	0.02	<0.02	ND	30	98	60	130	86	50	140
Vinyl Chloride	GCM0304-SEP20	mg/L	0.008	<0.008	ND	30	107	50	140	111	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --





FINAL REPORT

CA15915-SEP20 R1

1-20-0288, SPS Foremain Replacement Port Colborne

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
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Email	smonfared@terraprobe.ca
Project	1-20-0288, SPS Foremain Replacement Port Colborne
Order Number	
Samples	Soil (5)

LABORATORY DETAILS

Project Specialist	Brad Moore Hon. B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
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SGS Reference	CA15915-SEP20
Received	09/02/2020
Approved	09/09/2020
Report Number	CA15915-SEP20 R1
Date Reported	09/14/2020

COMMENTS

Temperature of Sample upon Receipt: 7 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:010941

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Brad Moore Hon. B.Sc

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Client: Terraprobe Inc

Project: 1-20-0288, SPS Foremain Replaceme

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **- Corrosivity Index** (SOIL)

			Sample Number	5	6	7	8	9
			Sample Name	BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')	BH4-SS5-(10'-12')
			Sample Matrix	Soil	Soil	Soil	Soil	Soil
			Sample Date	24/08/2020	24/08/2020	27/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**
Corrosivity Index								
Soil Redox Potential	mV	-		262	260	270	236	175
Sulphide (Na2CO3)	%	0.04		< 0.04	< 0.04	0.09	< 0.04	< 0.04
pH	pH Units	0.05		7.86	8.09	8.99	8.30	8.49
Resistivity (calculated)	ohms.cm	-9999		4830	3660	4290	3920	3100

PACKAGE: **- General Chemistry** (SOIL)

			Sample Number	5	6	7	8	9
			Sample Name	BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')	BH4-SS5-(10'-12')
			Sample Matrix	Soil	Soil	Soil	Soil	Soil
			Sample Date	24/08/2020	24/08/2020	27/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**
General Chemistry								
Conductivity	uS/cm	2		207	273	233	255	323

PACKAGE: **- Metals and Inorganics** (SOIL)

			Sample Number	5	6	7	8	9
			Sample Name	BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')	BH4-SS5-(10'-12')
			Sample Matrix	Soil	Soil	Soil	Soil	Soil
			Sample Date	24/08/2020	24/08/2020	27/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics								
Moisture Content	%	0.1		17.7	20.4	3.3	20.3	25.1
Sulphate	µg/g	0.4		170	270	60	25	170

Client: Terraprobe Inc

Project: 1-20-0288, SPS Foremain Replacem

Project Manager: Sepideh D_Monfared

Samplers: Sepideh D_Monfared

PACKAGE: **- Other (ORP)** (SOIL)

Sample Number			5	6	7	8	9
Sample Name			BH5-SS1-(0'-2')	BH5-SS2-(2'-4')	BH4-SS1-(0'-2')	BH4-SS2-(2'-4')	BH4-SS5-(10'-12')
Sample Matrix			Soil	Soil	Soil	Soil	Soil
Sample Date			24/08/2020	24/08/2020	27/08/2020	27/08/2020	27/08/2020
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**	**Result**	**Result**
Other (ORP)							
Chloride	µg/g	0.4	10	8.8	34	120	97

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0088-SEP20	µg/g	0.4	<0.4	9	20	96	80	120	94	75	125
Sulphate	DIO0088-SEP20	µg/g	0.4	<0.4	10	20	98	80	120	95	75	125

Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-[ENV]ARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide (Na2CO3)	ECS0008-SEP20	%	0.04	< 0.04	ND	20	94	80	120			

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0052-SEP20	uS/cm	2	< 2	0	20	99	90	110	NA		

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0052-SEP20	pH Units	0.05	NA	0		100			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

APPENDIX D2
Rock Chemistry





FINAL REPORT

CA14470-SEP20 R1

1-20-0288 SPS Forcemain Replacement, Port Colbourne

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	smonfared@terraprobe.ca
Project	1-20-0288 SPS Forcemain Replacement, Port Colbourne
Order Number	
Samples	Leachate (2)

LABORATORY DETAILS

Project Specialist	Brad Moore Hon. B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
Facsimile	705-652-6365
Email	brad.moore@sgs.com
SGS Reference	CA14470-SEP20
Received	09/16/2020
Approved	09/23/2020
Report Number	CA14470-SEP20 R1
Date Reported	10/06/2020

COMMENTS

Temperature of Sample upon Receipt: 6 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number: 016713

Metals reported at 10x the DL

SIGNATORIES

Brad Moore Hon. B.Sc

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Client: Terraprobe Inc
Project: 1-20-0288 SPS Forcemain Replacem
Project Manager: Sepideh D_Monfared
Samplers: Mohamed Bournes

PACKAGE: **REG558 - Acid rock Drainage** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Sample Number 8	Sample Number 9
				Sample Name: BH4-Run10 (60'00"-60'05"0	Sample Name: BH5-Run6 (33'06"-34'00")
				Sample Matrix: Leachate	Sample Matrix: Leachate
				Sample Date: 28/08/2020	Sample Date: 24/08/2020
Acid rock Drainage					
Final pH	no unit	0.01		8.41	9.10

PACKAGE: **REG558 - Hydrides** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Sample Number 8	Sample Number 9
				Sample Name: BH4-Run10 (60'00"-60'05"0	Sample Name: BH5-Run6 (33'06"-34'00")
				Sample Matrix: Leachate	Sample Matrix: Leachate
				Sample Date: 28/08/2020	Sample Date: 24/08/2020
Hydrides					
Antimony	µg/L	0.9		< 0.9	< 0.9
Arsenic	µg/L	2	2500	< 2	< 2
Selenium	µg/L	0.4	1000	< 0.4	< 0.4

PACKAGE: **REG558 - Metals and Inorganics** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Parameter	Units	RL	L1	Sample Number 8	Sample Number 9
				Sample Name: BH4-Run10 (60'00"-60'05"0	Sample Name: BH5-Run6 (33'06"-34'00")
				Sample Matrix: Leachate	Sample Matrix: Leachate
				Sample Date: 28/08/2020	Sample Date: 24/08/2020
Metals and Inorganics					
Sample weight	g	0.001		200	200
Ext Fluid	#1 or #2	0.01		2	2

Client: Terraprobe Inc
Project: 1-20-0288 SPS Forcemain Replacem
Project Manager: Sepideh D_Monfared
Samplers: Mohamed Bournes

PACKAGE: **REG558 - Metals and Inorganics**
(LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

	Sample Number			8	9
	Sample Name			BH4-Run10 (60'00"-60'05"0	BH5-Run6 (33'06"-34'00")
	Sample Matrix			Leachate	Leachate
	Sample Date			28/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Metals and Inorganics (continued)					
^ Ext Volume	mL	0.01		4000	4000
Barium	µg/L	0.2	100000	25.5	43.8
Beryllium	µg/L	0.07		< 0.07	< 0.07
Boron	µg/L	20	500000	484	476
Cadmium	µg/L	0.03	500	< 0.03	< 0.03
Chromium	µg/L	0.8	5000	< 0.8	< 0.8
Cobalt	µg/L	0.04		0.15	0.05
Copper	µg/L	2		< 2	< 2
Lead	µg/L	0.1	5000	1.9	0.3
Molybdenum	µg/L	0.4		1.0	0.5
Nickel	µg/L	1		2	1
Silver	µg/L	0.05	5000	< 0.05	< 0.05
Thallium	µg/L	0.05		0.05	< 0.05
Uranium	µg/L	0.02	10000	0.33	0.17
Vanadium	µg/L	0.1		0.2	1.8
Zinc	µg/L	20		< 20	< 20

PACKAGE: **REG558 - PCBs** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

				Sample Number	8	9
				Sample Name	BH4-Run10 (60'00"-60'05"0	BH5-Run6 (33'06"-34'00")
				Sample Matrix	Leachate	Leachate
				Sample Date	28/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**
PCBs						
Polychlorinated Biphenyls (PCBs) - Total	mg/L	0.001	0.3		< 0.001	< 0.001

PACKAGE: **REG558 - SVOCs - PAHs** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

				Sample Number	8	9
				Sample Name	BH4-Run10 (60'00"-60'05"0	BH5-Run6 (33'06"-34'00")
				Sample Matrix	Leachate	Leachate
				Sample Date	28/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**
SVOCs - PAHs						
Benzo(a)pyrene	mg/L	0.001	0.001		< 0.001	< 0.001

PACKAGE: **REG558 - UNDEFINED** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

				Sample Number	8	9
				Sample Name	BH4-Run10 (60'00"-60'05"0	BH5-Run6 (33'06"-34'00")
				Sample Matrix	Leachate	Leachate
				Sample Date	28/08/2020	24/08/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**
UNDEFINED						
Weight	g	0.01			1002	1223

PACKAGE: **REG558 - VOCs** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

				Sample Number	8	9
				Sample Name	BH4-Run10 (60'00"-60'05"0	BH5-Run6 (33'06"-34'00")
				Sample Matrix	Leachate	Leachate

Client: Terraprobe Inc
Project: 1-20-0288 SPS Forcemain Replacem
Project Manager: Sepideh D_Monfared
Samplers: Mohamed Bournes

PACKAGE: **REG558 - VOCs** (LEACHATE)

L1 = REG558 / LEACHATE / - - SCHEDULE 4 - -

Sample Number	8	9
Sample Name	BH4-Run10 (60'00"-60'05"0	BH5-Run6 (33'06"-34'00")
Sample Matrix	Leachate	Leachate
Sample Date	28/08/2020	24/08/2020

Parameter	Units	RL	L1	Result	Result
VOCs					
Bromomethane	µg/L	0.5		< 0.5	< 0.5
Carbon tetrachloride	µg/L	0.2	500	< 0.2	< 0.2
Chloroform	µg/L	0.5	10000	< 0.5	< 0.5
1,2-Dichlorobenzene	µg/L	0.5		< 0.5	< 0.5
1,4-Dichlorobenzene	µg/L	0.5	500	< 0.5	< 0.5
1,1-Dichloroethane	µg/L	0.5		< 0.5	< 0.5
1,2-Dichloroethane	µg/L	0.5	500	< 0.5	< 0.5
1,1-Dichloroethylene	µg/L	0.5	1400	< 0.5	< 0.5
cis-1,2-Dichloroethylene	µg/L	0.5		< 0.5	< 0.5
trans-1,2-Dichloroethylene	µg/L	0.5		< 0.5	< 0.5
1,2-Dichloropropane	µg/L	0.5		< 0.5	< 0.5
1,3-dichloropropene (total)	µg/L	0.5		< 0.5	< 0.5
Ethylenedibromide	µg/L	0.2		< 0.2	< 0.2
1,1,1,2-Tetrachloroethane	µg/L	0.5		< 0.5	< 0.5
1,1,2,2-Tetrachloroethane	µg/L	0.5		< 0.5	< 0.5
Tetrachloroethylene	µg/L	0.5		< 0.5	< 0.5
1,1,2-Trichloroethane	µg/L	0.5		< 0.5	< 0.5
Trichloroethylene	µg/L	0.5	5000	< 0.5	< 0.5

EXCEEDANCE SUMMARY

No exceedances are present above the regulatory limit(s) indicated

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0126-SEP20	ug/L	0.05	<0.00005	ND	20	102	90	110	101	70	130
Arsenic	EMS0126-SEP20	ug/L	2	<0.0002	2	20	100	90	110	102	70	130
Barium	EMS0126-SEP20	ug/L	0.2	<0.00002	4	20	98	90	110	116	70	130
Beryllium	EMS0126-SEP20	ug/L	0.07	<0.000007	0	20	94	90	110	95	70	130
Boron	EMS0126-SEP20	ug/L	20	<0.002	3	20	98	90	110	NV	70	130
Cadmium	EMS0126-SEP20	ug/L	0.03	<0.000003	0	20	100	90	110	102	70	130
Cobalt	EMS0126-SEP20	ug/L	0.04	<0.000004	3	20	99	90	110	98	70	130
Chromium	EMS0126-SEP20	ug/L	0.8	<0.00008	1	20	103	90	110	106	70	130
Copper	EMS0126-SEP20	ug/L	2	<0.0002	1	20	101	90	110	105	70	130
Molybdenum	EMS0126-SEP20	ug/L	0.4	<0.00004	0	20	105	90	110	107	70	130
Nickel	EMS0126-SEP20	ug/L	1	<0.0001	2	20	99	90	110	101	70	130
Lead	EMS0126-SEP20	ug/L	0.1	<0.00001	2	20	100	90	110	100	70	130
Antimony	EMS0126-SEP20	ug/L	0.9	<0.0009	3	20	99	90	110	124	70	130
Selenium	EMS0126-SEP20	ug/L	0.4	<0.00004	1	20	105	90	110	108	70	130
Thallium	EMS0126-SEP20	ug/L	0.05	<0.000005	8	20	92	90	110	90	70	130
Uranium	EMS0126-SEP20	ug/L	0.02	<0.000002	4	20	91	90	110	93	70	130
Vanadium	EMS0126-SEP20	ug/L	0.1	<0.00001	2	20	100	90	110	101	70	130
Zinc	EMS0126-SEP20	ug/L	20	<0.002	2	20	101	90	110	120	70	130

QC SUMMARY

Polychlorinated Biphenyls

Method: MOE E3400/EPA 8082A | Internal ref.: ME-CA-IENVIGC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Polychlorinated Biphenyls (PCBs) - Total	GCM0341-SEP20	mg/L	0.001	< 0.001	NSS	30	91	60	140	100	60	140

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-IENVIGC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Benzo(a)pyrene	GCM0345-SEP20	mg/L	0.001	< 0.001	NSS	30	103	50	140	NSS	50	140

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,1,1,2-Tetrachloroethane	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	100	60	130	98	50	140
1,1,2,2-Tetrachloroethane	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	92	60	130	96	50	140
1,1,2-Trichloroethane	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	101	60	130	99	50	140
1,1-Dichloroethane	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	102	60	130	101	50	140
1,1-Dichloroethylene	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	106	60	130	103	50	140
1,2-Dichlorobenzene	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	98	60	130	95	50	140
1,2-Dichloroethane	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	99	60	130	98	50	140
1,2-Dichloropropane	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	99	60	130	97	50	140
1,4-Dichlorobenzene	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	98	60	130	95	50	140
Bromomethane	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	103	50	140	100	50	140
Carbon tetrachloride	GCM0357-SEP20	ug/L	0.2	<0.2	ND	30	102	60	130	100	50	140
Chloroform	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	101	60	130	98	50	140
cis-1,2-Dichloroethylene	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	103	60	130	101	50	140
Ethylenedibromide	GCM0357-SEP20	ug/L	0.2	<0.2	ND	30	99	60	130	97	50	140
Tetrachloroethylene	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	103	60	130	98	50	140
trans-1,2-Dichloroethylene	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	103	60	130	102	50	140
Trichloroethylene	GCM0357-SEP20	ug/L	0.5	<0.5	ND	30	102	60	130	95	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --

APPENDIX D3
Ground Water Chemistry





FINAL REPORT

CA14518-SEP20 R1

1-20-0288, SPS Foreman Replacement, Port Colborne

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terraprobe Inc
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada
Contact	Sepideh D_Monfared
Telephone	(905) 796-2650
Facsimile	(905) 796-2250
Email	smonfared@terraprobe.ca
Project	1-20-0288, SPS Foreman Replacement, Port Colborne
Order Number	
Samples	(4) Water (4)

LABORATORY DETAILS

Project Specialist	Jill Campbell, B.Sc.,GISAS
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	2165
Facsimile	705-652-6365
Email	jill.campbell@sgs.com
SGS Reference	CA14518-SEP20
Received	09/17/2020
Approved	10/02/2020
Report Number	CA14518-SEP20 R1
Date Reported	10/02/2020

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
NR - Not reportable under applicable Provincial drinking water regulations as per client.
UAL - Unreliable: Sample Age Exceeds Normal Limit
NDOGT - No Data: Overgrown with Target Bacteria

Temperature of Sample upon Receipt: 4 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:009818

SIGNATORIES

Jill Campbell, B.Sc.,GISAS



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Client: Terraprobe Inc

Project: 1-20-0288, SPS Foreman Replaceme

Project Manager: Sepideh D_Monfared

Samplers: ,

PACKAGE: **- Metals and Inorganics** ()

Sample Number			11	12	13	14
Sample Name			BH4 reassayed	BH4 Dissolved reassayed	BH5 reassayed	BH5 Dissolved reassay
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics						
Hardness	mg/L as CaCO3	0.05	1780	1780	1010	1010
Aluminum	µg/L	1	36	12	53	43
Arsenic	µg/L	0.2	1.4	1.3	0.3	0.3
Boron	µg/L	2	2020	1990	190	151
Barium	µg/L	0.02	31.9	30.2	30.0	28.6
Beryllium	µg/L	0.007	0.014	< 0.007	0.015	< 0.007
Bismuth	µg/L	0.007	< 0.007	0.012	< 0.007	0.009
Cobalt	µg/L	0.004	0.188	0.177	0.186	0.150
Calcium	mg/L	0.01	635	637	367	370
Cadmium	µg/L	0.003	0.004	< 0.003	0.009	0.004
Copper	µg/L	0.2	0.5	0.4	0.6	0.7
Chromium	µg/L	0.08	< 0.08	< 0.08	< 0.08	0.17
Iron	ug/L	7	37	11	50	34
Potassium	mg/L	0.009	18.0	17.9	5.04	5.08
Magnesium	mg/L	0.001	46.7	45.3	22.4	21.3
Manganese	µg/L	0.01	27.0	26.1	28.5	22.7
Molybdenum	µg/L	0.04	5.86	6.03	5.77	6.24
Nickel	µg/L	0.1	0.8	0.8	1.1	1.2
Sodium	mg/L	0.01	75.9	72.9	19.9	19.1
Phosphorus	mg/L	0.003	0.009	0.005	0.003	0.004
Lead	µg/L	0.01	0.10	0.03	0.18	0.07
Silicon	ug/L	20	4580	4370	3690	3650
Silver	µg/L	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Strontium	µg/L	0.02	9230	9260	5390	5500
Thallium	µg/L	0.005	< 0.005	< 0.005	0.007	0.008

Client: Terraprobe Inc
Project: 1-20-0288, SPS Foreman Replaceme
Project Manager: Sepideh D_Monfared
Samplers: ,

PACKAGE: **- Metals and Inorganics** ()

			Sample Number	11	12	13	14
			Sample Name	BH4 reassayed	BH4 Dissolved reassayed	BH5 reassayed	BH5 Dissolved reassay
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)							
Tin	µg/L	0.06		1.06	0.82	0.32	0.27
Titanium	ug/L	0.05		0.37	< 0.05	2.06	0.36
Antimony	µg/L	0.09		1.59	2.92	0.58	1.85
Selenium	µg/L	0.04		0.30	0.28	0.13	0.16
Uranium	µg/L	0.002		1.63	1.58	1.46	1.41
Vanadium	µg/L	0.01		0.14	0.11	0.20	0.17
Zinc	µg/L	2		< 2	< 2	3	3

PACKAGE: **PWQO - General Chemistry** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	9	
			Sample Name	BH4	BH5	
			Sample Matrix	Water	Water	
			Sample Date	16/09/2020	16/09/2020	
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	
General Chemistry						
UV Transmittance	%T	-		74.4	93.6	
Alkalinity	mg/L as CaCO3	2		165	140	
Bicarbonate	mg/L as CaCO3	2		165	140	
Carbonate	mg/L as CaCO3	2		< 2	< 2	
OH	mg/L as CaCO3	2		< 2	< 2	
Colour	TCU	3		3	3	
Conductivity	uS/cm	2		2680	1610	
Total Suspended Solids	mg/L	2		7	9	

Client: Terraprobe Inc
Project: 1-20-0288, SPS Foreman Replaceme
Project Manager: Sepideh D_Monfared
Samplers: Cicily Patel

PACKAGE: **PWQO - General Chemistry** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	9
			Sample Name	BH4	BH5
			Sample Matrix	Water	Water
			Sample Date	16/09/2020	16/09/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
General Chemistry (continued)					
Turbidity	NTU	0.10		1.21	2.03
Organic Nitrogen	mg/L	0.05		0.11	0.08
Total Kjeldahl Nitrogen (N)	as N mg/L	0.05		2.40	0.17
Ammonia+Ammonium (N)	as N mg/L	0.04		2.29	0.09
Dissolved Organic Carbon	mg/L	1		2	2
Total Organic Carbon	mg/L	1		2	2
Sulphide	µg/L	6		< 6	< 6

PACKAGE: **PWQO - Metals and Inorganics** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

				Sample Number	7	8	9	10
				Sample Name	BH4	BH4 Dissolved	BH5	BH5 Dissolved
				Sample Matrix	Water	Water	Water	Water
				Sample Date	16/09/2020	16/09/2020	16/09/2020	16/09/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**	**Result**	**Result**
Metals and Inorganics								
Fluoride	mg/L	0.06			1.06		0.57	
Bromide	mg/L	0.05			<0.05		<0.05	
Nitrite (as N)	as N mg/L	0.003			<0.003		0.008	
Nitrate (as N)	as N mg/L	0.006			<0.006		0.014	
Sulphate	mg/L	0.04			1400		940	
Mercury	µg/L	0.01	0.2		< 0.01	< 0.01	< 0.01	< 0.01
Hardness	mg/L as CaCO3	0.05			1750	1670	1130	1170
Aluminum	µg/L	1	15		40	182	9	18
Arsenic	µg/L	0.2	5		1.5	1.6	0.5	0.6

Client: Terraprobe Inc
Project: 1-20-0288, SPS Foreman Replaceme
Project Manager: Sepideh D_Monfared
Samplers: Cicily Patel

PACKAGE: **PWQO - Metals and Inorganics** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	8	9	10
			Sample Name	BH4	BH4 Dissolved	BH5	BH5 Dissolved
			Sample Matrix	Water	Water	Water	Water
			Sample Date	16/09/2020	16/09/2020	16/09/2020	16/09/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)							
Boron	µg/L	2	200	2480	2290	188	198
Barium	µg/L	0.02		30.8	30.3	31.8	32.3
Beryllium	µg/L	0.007	11	0.007	0.019	< 0.007	< 0.007
Bismuth	µg/L	0.007		< 0.007	< 0.007	< 0.007	< 0.007
Cobalt	µg/L	0.004	0.9	0.172	0.295	0.126	0.137
Calcium	mg/L	0.01		627	590	410	422
Cadmium	µg/L	0.003	0.1	0.004	0.008	0.006	0.008
Copper	µg/L	0.2	1	0.3	0.8	0.4	0.3
Chromium	µg/L	0.08		0.12	0.35	< 0.08	< 0.08
Iron	ug/L	7	300	57	257	28	36
Potassium	mg/L	0.009		18.0	17.3	5.40	5.37
Magnesium	mg/L	0.001		46.0	46.8	27.0	28.2
Manganese	µg/L	0.01		29.9	38.8	23.1	23.7
Molybdenum	µg/L	0.04	40	5.44	5.21	5.79	4.81
Nickel	µg/L	0.1	25	0.8	1.3	1.1	1.2
Sodium	mg/L	0.01		65.5	64.7	12.2	11.8
Phosphorus	mg/L	0.003	0.01	< 0.003	0.013	< 0.003	< 0.003
Lead	µg/L	0.01	1	0.15	0.93	0.04	0.06
Silicon	ug/L	20		4480	4240	3340	3400
Silver	µg/L	0.05	0.1	< 0.05	< 0.05	< 0.05	< 0.05
Strontium	µg/L	0.02		9570	9640	6710	6850
Thallium	µg/L	0.005	0.3	< 0.005	< 0.005	0.005	0.006
Tin	µg/L	0.06		1.10	0.84	0.11	< 0.06
Titanium	ug/L	0.05		1.23	5.82	0.48	0.58

PACKAGE: **PWQO - Metals and Inorganics** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

				Sample Number	7	8	9	10
				Sample Name	BH4	BH4 Dissolved	BH5	BH5 Dissolved
				Sample Matrix	Water	Water	Water	Water
				Sample Date	16/09/2020	16/09/2020	16/09/2020	16/09/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)								
Antimony	µg/L	0.09	20		0.87	0.67	0.11	0.10
Selenium	µg/L	0.04	100		0.30	0.35	0.18	0.18
Uranium	µg/L	0.002	5		1.59	1.61	1.15	1.20
Vanadium	µg/L	0.01	6		0.15	0.46	0.15	0.14
Zinc	µg/L	2	20		< 2	3	< 2	< 2

PACKAGE: **PWQO - Microbiology** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

				Sample Number	7	9
				Sample Name	BH4	BH5
				Sample Matrix	Water	Water
				Sample Date	16/09/2020	16/09/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**
Microbiology						
Total Coliform	cfu/100mL	-			2	#NDOGT#UAL
E. Coli	cfu/100mL	-	100		0	#NDOGT#UAL
Heterotrophic Plate Count (HPC)	cfu/1mL	-			>2000	>2000##UAL

Client: Terraprobe Inc
Project: 1-20-0288, SPS Foreman Replaceme
Project Manager: Sepideh D_Monfared
Samplers: Cicily Patel

PACKAGE: **PWQO - Other (ORP)** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

				Sample Number	7	9
				Sample Name	BH4	BH5
				Sample Matrix	Water	Water
				Sample Date	16/09/2020	16/09/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**
Other (ORP)						
pH	No unit	0.05	8.5		7.84	7.97
Chloride	mg/L	0.04			67	19

PACKAGE: **PWQO - Phenols** (WATER)

L1 = PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E

				Sample Number	7	9
				Sample Name	BH4	BH5
				Sample Matrix	Water	Water
				Sample Date	16/09/2020	16/09/2020
Parameter	**Units**	**RL**	**L1**		**Result**	**Result**
Phenols						
4AAP-Phenolics	mg/L	0.002	0.001		< 0.002	0.004

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	PWQO / WATER / - - Table 2 - General - July 1999 PIBS 3303E L1
BH4				
Aluminum	SM 3030/EPA 200.8	µg/L	40	15
Boron	SM 3030/EPA 200.8	µg/L	2480	200
4AAP-Phenolics	SM 5530B-D	mg/L	< 0.002	0.001
BH4 Dissolved				
Aluminum	SM 3030/EPA 200.8	µg/L	182	15
Boron	SM 3030/EPA 200.8	µg/L	2290	200
Phosphorus	SM 3030/EPA 200.8	µg/L	0.013	0.01
BH5				
4AAP-Phenolics	SM 5530B-D	mg/L	0.004	0.001
BH5 Dissolved				
Aluminum	SM 3030/EPA 200.8	µg/L	18	15

QC SUMMARY

Alkalinity

Method: SM 2320 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0297-SEP20	mg/L as CaCO3	2	< 2	1	20	106	80	120	NA		

Ammonia by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0163-SEP20	mg/L	0.04	0.05	6	10	97	90	110	99	75	125
Ammonia+Ammonium (N)	SKA0170-SEP20	mg/L	0.04	<0.04	4	10	98	90	110	104	75	125

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0274-SEP20	mg/L	0.05	<0.05	ND	20	96	80	120	97	75	125
Nitrite (as N)	DIO0274-SEP20	mg/L	0.003	<0.003	ND	20	101	80	120	107	75	125
Nitrate (as N)	DIO0274-SEP20	mg/L	0.006	<0.006	ND	20	101	80	120	104	75	125
Chloride	DIO0325-SEP20	mg/L	0.04	<0.04	4	20	97	80	120	108	75	125
Sulphate	DIO0325-SEP20	mg/L	0.04	<0.04	NV	20	96	80	120	NV	75	125

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-IENVISFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Dissolved Organic Carbon	SKA0177-SEP20	mg/L	1	<1	1	10	95	90	110	90	75	125
Total Organic Carbon	SKA0177-SEP20	mg/L	1	<1	1	10	95	90	110	90	75	125

QC SUMMARY

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0297-SEP20	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0297-SEP20	mg/L as CaCO3	2	< 2	1	10	NA	90	110	NA		
OH	EWL0297-SEP20	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

Colour

Method: SM 2120 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0289-SEP20	TCU	3	< 3	ND	10	100	80	120	NA		

QC SUMMARY

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0297-SEP20	uS/cm	2	< 2	1	20	99	90	110	NA		

Fluoride by Specific Ion Electrode

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0313-SEP20	mg/L	0.06	<0.06	5	10	100	90	110	97	75	125
Fluoride	EWL0324-SEP20	mg/L	0.06	<0.06	0	10	96	90	110	92	75	125

Mercury by CVAAS

Method: SM3112/EPA 245 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0020-SEP20	ug/L	0.01	0.006	0	20	91	80	120	95	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0125-SEP20	ug/L	0.05	<0.05	ND	20	102	90	110	101	70	130
Aluminum	EMS0125-SEP20	ug/L	1	<1	2	20	96	90	110	116	70	130
Arsenic	EMS0125-SEP20	ug/L	0.2	<0.2	1	20	100	90	110	102	70	130
Barium	EMS0125-SEP20	ug/L	0.02	<0.02	1	20	98	90	110	116	70	130
Beryllium	EMS0125-SEP20	ug/L	0.007	<0.007	ND	20	94	90	110	95	70	130
Boron	EMS0125-SEP20	ug/L	2	<2	3	20	98	90	110	NV	70	130
Bismuth	EMS0125-SEP20	ug/L	0.007	2	ND	20	94	90	110	84	70	130
Calcium	EMS0125-SEP20	mg/L	0.01	<0.01	2	20	101	90	110	104	70	130
Cadmium	EMS0125-SEP20	ug/L	0.003	<0.003	ND	20	100	90	110	102	70	130
Cobalt	EMS0125-SEP20	ug/L	0.004	<0.004	0	20	99	90	110	98	70	130
Chromium	EMS0125-SEP20	ug/L	0.08	<0.08	6	20	103	90	110	106	70	130
Copper	EMS0125-SEP20	ug/L	0.2	<0.2	1	20	101	90	110	105	70	130
Iron	EMS0125-SEP20	ug/L	7	<7	ND	20	105	90	110	NV	70	130
Potassium	EMS0125-SEP20	mg/L	0.009	<0.009	1	20	110	90	110	NV	70	130
Magnesium	EMS0125-SEP20	mg/L	0.001	<0.001	1	20	109	90	110	99	70	130
Manganese	EMS0125-SEP20	ug/L	0.01	<0.01	ND	20	101	90	110	106	70	130
Molybdenum	EMS0125-SEP20	ug/L	0.04	<0.04	1	20	105	90	110	107	70	130
Sodium	EMS0125-SEP20	mg/L	0.01	<0.01	1	20	97	90	110	94	70	130
Nickel	EMS0125-SEP20	ug/L	0.1	<0.1	4	20	99	90	110	101	70	130
Lead	EMS0125-SEP20	ug/L	0.01	<0.01	ND	20	100	90	110	100	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus	EMS0125-SEP20	mg/L	0.003	<0.003	4	20	101	90	110	NV	70	130
Antimony	EMS0125-SEP20	ug/L	0.09	14	1	20	99	90	110	124	70	130
Selenium	EMS0125-SEP20	ug/L	0.04	<0.04	ND	20	105	90	110	108	70	130
Silicon	EMS0125-SEP20	ug/L	20	<0.02	3	20	97	90	110	NV	70	130
Tin	EMS0125-SEP20	ug/L	0.06	<0.06	ND	20	100	90	110	NV	70	130
Strontium	EMS0125-SEP20	ug/L	0.02	<0.02	0	20	99	90	110	102	70	130
Titanium	EMS0125-SEP20	ug/L	0.05	<0.05	7	20	105	90	110	NV	70	130
Thallium	EMS0125-SEP20	ug/L	0.005	<0.005	10	20	92	90	110	90	70	130
Uranium	EMS0125-SEP20	ug/L	0.002	<0.002	13	20	91	90	110	93	70	130
Vanadium	EMS0125-SEP20	ug/L	0.01	<0.01	1	20	100	90	110	101	70	130
Zinc	EMS0125-SEP20	ug/L	2	<2	ND	20	101	90	110	120	70	130
Boron	EMS0136-SEP20	ug/L	2	<2	6	20	97	90	110	NV	70	130
Silver	EMS0175-SEP20	ug/L	0.05	<0.00005	ND	20	100	90	110	90	70	130
Aluminum	EMS0175-SEP20	ug/L	1	<0.001	9	20	94	90	110	109	70	130
Arsenic	EMS0175-SEP20	ug/L	0.2	<0.0002	2	20	99	90	110	100	70	130
Barium	EMS0175-SEP20	ug/L	0.02	<0.00002	0	20	97	90	110	115	70	130
Beryllium	EMS0175-SEP20	ug/L	0.007	<0.000007	ND	20	98	90	110	97	70	130
Boron	EMS0175-SEP20	ug/L	2	<0.002	1	20	101	90	110	102	70	130
Bismuth	EMS0175-SEP20	ug/L	0.007	<0.000007	ND	20	96	90	110	82	70	130
Calcium	EMS0175-SEP20	mg/L	0.01	<0.01	7	20	99	90	110	102	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cadmium	EMS0175-SEP20	ug/L	0.003	<0.000003	ND	20	96	90	110	94	70	130
Cobalt	EMS0175-SEP20	ug/L	0.004	<0.000004	12	20	94	90	110	96	70	130
Chromium	EMS0175-SEP20	ug/L	0.08	<0.00008	15	20	95	90	110	96	70	130
Copper	EMS0175-SEP20	ug/L	0.2	< 0.2	6	20	95	90	110	99	70	130
Iron	EMS0175-SEP20	ug/L	7	<0.007	11	20	97	90	110	NV	70	130
Potassium	EMS0175-SEP20	mg/L	0.009	<0.009	6	20	98	90	110	103	70	130
Magnesium	EMS0175-SEP20	mg/L	0.001	<0.001	3	20	102	90	110	106	70	130
Manganese	EMS0175-SEP20	ug/L	0.01	<0.00001	5	20	94	90	110	94	70	130
Molybdenum	EMS0175-SEP20	ug/L	0.04	<0.00004	12	20	98	90	110	102	70	130
Sodium	EMS0175-SEP20	mg/L	0.01	<0.01	4	20	103	90	110	109	70	130
Nickel	EMS0175-SEP20	ug/L	0.1	<0.0001	9	20	95	90	110	96	70	130
Lead	EMS0175-SEP20	ug/L	0.01	<0.00001	5	20	96	90	110	97	70	130
Phosphorus	EMS0175-SEP20	mg/L	0.003	<0.003	0	20	100	90	110	NV	70	130
Antimony	EMS0175-SEP20	ug/L	0.09	<0.0009	ND	20	106	90	110	91	70	130
Selenium	EMS0175-SEP20	ug/L	0.04	<0.00004	17	20	96	90	110	99	70	130
Silicon	EMS0175-SEP20	ug/L	20	<0.02	5	20	104	90	110	NV	70	130
Tin	EMS0175-SEP20	ug/L	0.06	<0.00006	ND	20	95	90	110	NV	70	130
Strontium	EMS0175-SEP20	ug/L	0.02	<0.00002	6	20	94	90	110	96	70	130
Titanium	EMS0175-SEP20	ug/L	0.05	<0.00005	ND	20	93	90	110	NV	70	130
Thallium	EMS0175-SEP20	ug/L	0.005	<0.000005	0	20	99	90	110	101	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Uranium	EMS0175-SEP20	ug/L	0.002	<0.000002	5	20	91	90	110	91	70	130
Vanadium	EMS0175-SEP20	ug/L	0.01	<0.00001	7	20	96	90	110	101	70	130
Zinc	EMS0175-SEP20	ug/L	2	<0.002	ND	20	95	90	110	116	70	130

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Hardness	EMS0125-SEP20	mg/L as CaCO3	0.05	<0.01	2	20	101	90	110	104	70	130
Hardness	EMS0175-SEP20	mg/L as CaCO3	0.05		7	20						

QC SUMMARY

Microbiology

Method: OMOE MICROMFDC-E3407A | Internal ref.: ME-CA-IENVIMIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
E. Coli	BAC9325-SEP20	cfu/100mL	-	ACCEPTED	ACCEPTED							
Heterotrophic Plate Count (HPC)	BAC9325-SEP20	cfu/1mL	-	ACCEPTED	ACCEPTED							
Total Coliform	BAC9325-SEP20	cfu/100mL	-	ACCEPTED	SEE NOTE							

pH

Method: SM 4500 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High	Spike Recovery (%)	Recovery Limits (%) Low	Recovery Limits (%) High
pH	EWL0297-SEP20	No unit	0.05	NA	0		100			NA		

QC SUMMARY

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0173-SEP20	mg/L	0.002	<0.002	5	10	103	80	120	NV	75	125
4AAP-Phenolics	SKA0184-SEP20	mg/L	0.002	<0.002	ND	10	110	80	120	119	75	125

Sulphide by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	SKA0194-SEP20	ug/L	6	<0.006	ND	20	97	80	120	NA	75	125

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0305-SEP20	mg/L	2	< 2	1	10	101	90	110	NA		

QC SUMMARY

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen (N)	SKA0167-SEP20	mg/L	0.05	<0.05	2	10	103	90	110	98	75	125
Total Kjeldahl Nitrogen (N)	SKA0176-SEP20	mg/L	0.05	0.092	1	10	107	90	110	80	75	125

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0279-SEP20	NTU	0.10	< 0.10	9	10	100	90	110	NA		
Turbidity	EWL0303-SEP20	NTU	0.10	< 0.10	ND	10	101	90	110	NA		

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --

APPENDIX F: EVALUATION CRITERIA & DETAILED EVALUATION MATRIX SCORING

Table F.1 below details the scoring scale used for the detailed evaluation, while Table F.2 details the rationale behind the scoring of each alternative against each sub-criterion.

Table F.1 – Detailed Evaluation Scoring

Scoring Scale	Impact Score	Symbol
Major Positive	5	
Minor Positive	4	
Neutral	3	
Minor Negative	2	
Major Negative	1	

Table F.2 – Detailed Evaluation Matrix

Criteria	Sub-Criteria	Alternatives					
		2. Barrick Road Crossing – Elm Street		3. Barrick Road Crossing – Seaway		4. North Island Crossing	
Technical Constructability	Constructability Risk	Alternative 4. North Island Crossing scored the lowest due to the requirement of two canal crossings.					
			2		2		1
	Existing/Planned Infrastructure	Alternative 2 Barrick Road Crossing – Elm Street would result in the largest disruption to existing services due to the significant road work required.					
			2		4		4
	Existing Utilities	Alternative 2. Barrick Road Crossing – Elm Street scored the lowest due the significant road work required and the existing utilities in this area.					
			2		3		3
	Crossings	All alternatives would require crossings of the canal, but mitigation measures can be implemented to reduce impact.					

Criteria	Sub-Criteria	Alternatives					
		2. Barrick Road Crossing – Elm Street		3. Barrick Road Crossing – Seaway		4. North Island Crossing	
			2		2		2
	Accessibility	All alternatives to a reasonable degree follow the road allowance, minimize construction in areas with limited access and provide accessibility and safety.					
			2		2		2
	Technical Constructability Summary (25)		**10**		**13**		**12**
Technical Flexibility	Compatibility with Existing and Future Infrastructure	Alternative 3 and Alternative 4 scored highest as a crossing at this location would accommodate a Regional watermain and similar to Alternative 2 could support additional utility canal crossing.					
			2		5		5
	Capacity for Future Growth	All alternatives hold the ability to meet future servicing needs, however Alternative 2 proposes a longer forcemain alignment reducing future system flexibility.					
			4		5		5
	System Security	Alternative 2 scored the lowest due to the proposed alignment is the longest therefore has an increased chance of failure.					
			3		4		4
	Operations and Maintenance	Alternative 3 scored the highest as the majority of the route is located on Regional owned land and only requires one canal crossing which increases ease of access and emergency access for operation and maintenance activities.					
			3		4		3
	Technical Flexibility Summary (20)		**12**		**18**		**17**
Environment	Environmentally Sensitive Features	All alternatives received the same score due to the routes encountering a similar level environmentally sensitive features (i.e., wetlands, woodlands etc.) but noted that mitigation measures can be utilized to limit impact.					
			2		2		2

Criteria	Sub-Criteria	Alternatives					
		2. Barrick Road Crossing – Elm Street		3. Barrick Road Crossing – Seaway		4. North Island Crossing	
	Climate Change	All alternatives received the same score as the designs have capacity to incorporate climate change adaptation measures. Additionally, the designs can ensure that the forcemains can withstand climate change effects and reduce any additional contributions to the climate change effect (i.e. GHG emissions).					
			4		4		4
	Species at Risk	All alternatives received the same score as mitigation measures can be implemented to reduce impact to any species at risk.					
			2		2		2
	Soil/Land Contamination Considerations	All alternatives are subject to the same level of soil/land contamination review, investigation and remediation in which mitigation measures can be implemented to reduce contamination.					
			2		2		2
	Water Features / Resources	All alternatives are subject to the same level of anticipated impact to the surface water features and mitigation measures to minimize impact on surrounding source water protection areas.					
			2		2		2
	Geology, Hydrogeology Considerations	Alternative 4 scored the lowest due to the alignment requiring two canal crossings.					
			3		3		2
	Air Quality	All alternatives received the same score as they hold the same ability to minimize potential lifecycle impacts on air quality associated with overall servicing strategy.					
			2		2		2
	Environmental Risk	All alternatives received the same score as they all hold the same ability to minimize environmental risk during construction through construction techniques and mitigation measures.					
			2		2		2
	Environmental Summary (40)		**19**		**19**		**18**

Criteria	Sub-Criteria	Alternatives					
		2. Barrick Road Crossing – Elm Street		3. Barrick Road Crossing – Seaway		4. North Island Crossing	
Socio/Cultural	Community Impact (Residents and Local Businesses)	Alternative 2 scored the lowest as it has the longest forcemain length. The route on the west side of the canal extends into additional residential areas which will be indirectly impacted in terms of traffic, noise and dust.					
			1		2		2
	Existing Infrastructure	Alternative 2 scored the lowest as it would cause a significant disruption to the existing road network along Elm Street.					
			1		3		3
	Noise, Vibration, Odour and Dust Impact	Alternative 3 scored the highest as its route does not follow an existing roadway or require two canal crossings.					
			1		2		1
	Built Heritage / Cultural Impact	All alternatives received the same score as they all potentially have indirect impact on built heritage/cultural sites. These impacts can be mitigated through monitoring vibrations throughout the construction process.					
			2		2		2
	Archaeological Impact	Alternative 4 scored the highest as the route will encounter the least instances of areas with archaeological potential. It should be noted that a Stage II Archeological Assessment was completed on Alternative 3 in which no archeological sites were found.					
			2		2		3
	Traffic & Canal Operations Impact	Alternative 2 scored the lowest as the route follows Elm Street and will impact traffic along this road.					
			1		2		2
	Socio/Cultural Summary (30)		**8**		**13**		**13**
Financial	Capital Cost	All alternatives scored the same as there were only marginal differences in the estimated capital costs.					
			2		2		2
	Operations and Maintenance Cost	All alternatives scored the same as there were only marginal differences in the estimated capital costs.					
			2		2		2

Criteria	Sub-Criteria	Alternatives					
		2. Barrick Road Crossing – Elm Street		3. Barrick Road Crossing – Seaway		4. North Island Crossing	
	Financial Risk	Alternative 4 scored the lowest due to the requirement for two canal crossings.					
			2		2		1
	Financial Summary (15)		**6**		**6**		**5**
Legal/ Jurisdictional	Property Acquisition	All alternatives received the same score as property acquisitions would be required for each alternative.					
			2		2		2
	Compliance with Applicable Planning Policies	All alternatives received the same score as they are all complaint with applicable planning policies and regulations.					
			3		3		3
	Legal / Jurisdictional Summary (10)		**5**		**5**		**5**
Total Points	**150**	**60**		**74**		**70**	
% Ranking	**100**	**40%**		**49%**		**47%**	