THE CORPORATION OF THE CITY OF BRANTFORD
PUBLIC WORKS

BRANEIDA STORMWATER MANAGEMENT FACILITY RETROFIT AND DOWNSTREAM CHANNEL REMEDIATION MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

MARCH 2021

VOLUME 2: APPENDICES

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

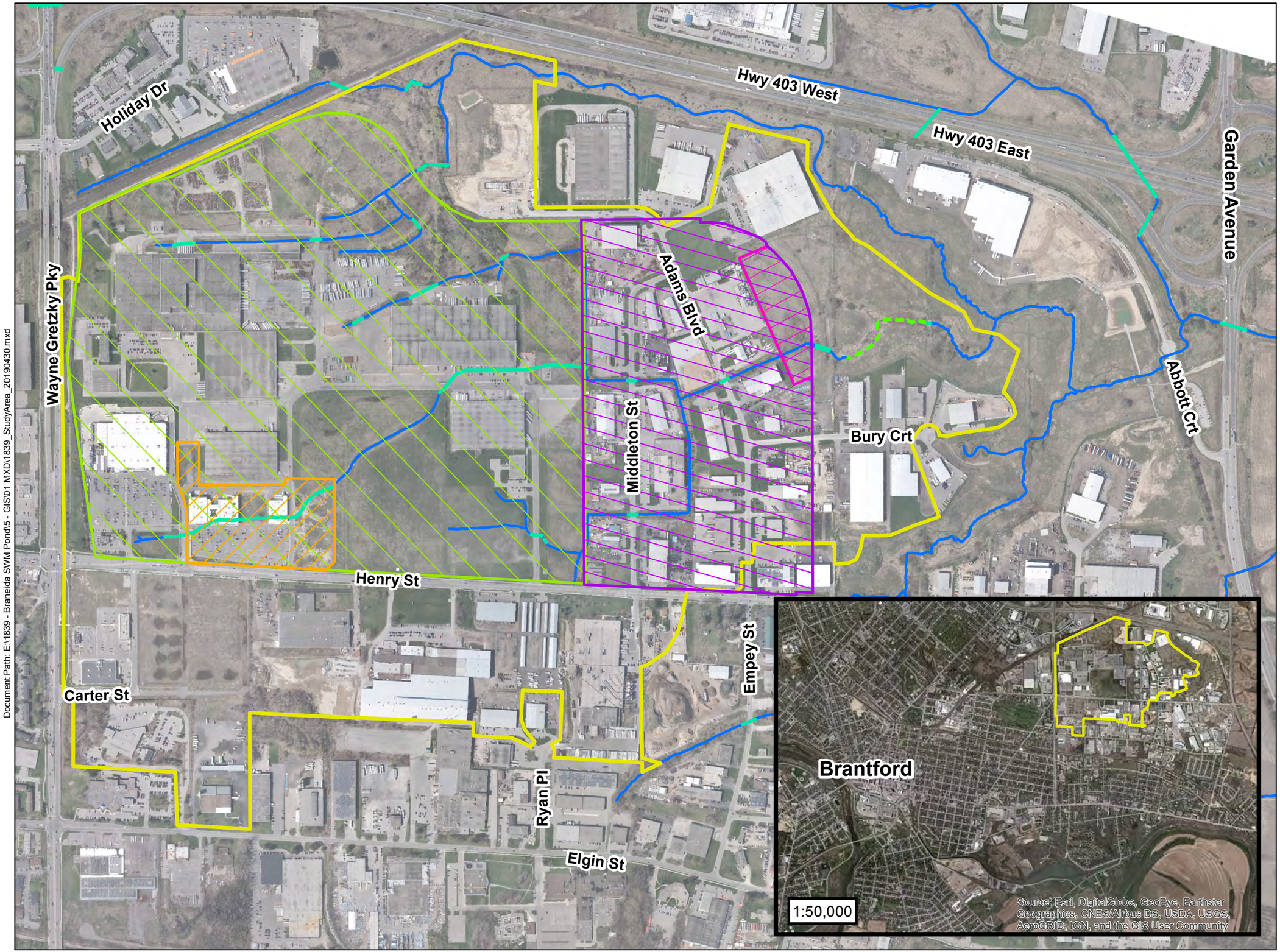
Prepared by: Ecosystem Recovery Inc.
80 Courtland Ave. East, Unit 2
Kitchener, Ontario, N2G 2T8
Phone: 519.621.1500
www.ecosystemrecovery.ca

Appendix A

Supporting Maps and Figures

Braneida Park SWM Facility Class EA

Figure 1
Study Area



Legend

- Trade Winds Development Boundary (1990)*
- Brantford Power Centre Development Boundary (2009)*
- Kylin Developments Boundary (2017)*
- Braneida SWM Facility
- Study Area
- Stormwater Culvert (ERI)
- Watercourse
- Proposed Channel Rehabilitation

*Study report year used to generate development boundary

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 100 200 400
Meters

NAD 1983 UTM 17N	1:7,500

Project: 1839 Braneida Park SWM Facility Class EA
Date: 2019/05

N W E S

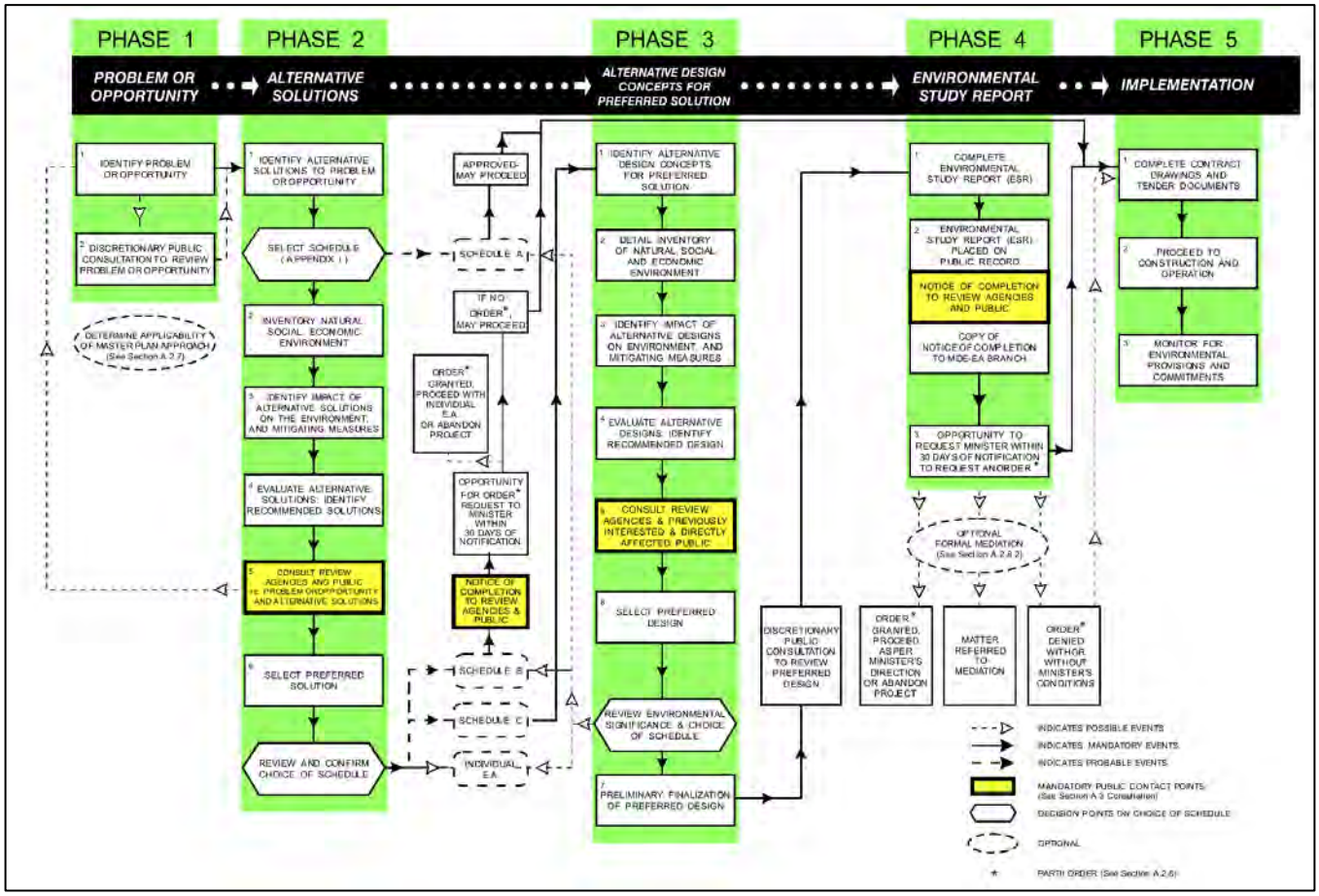


Figure 2. Municipal Class EA Process

Braneida Park SWM Facility Class EA

Figure 3
Existing Catchments (Minor)

Legend

- Flow Direction (Major Flow)
- Stormwater Culvert (ERI)
- Watercourses (ERI)
- Braneida SWM Facility

Existing Catchments by Drainage System

- Braneida Facility
- External
- On-site controls

101
39.6 | 80.0
- Catchment Name
- Impervious Area (%)
- Total Area (ha)

Catchments 1001, 1002, and 1003 have on-site runoff controls for the 2 year through Regulatory event

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 100 200 400
Meters

NAD 1983 UTM 17N	1:7,500
Project: 1839 Braneida Park SWM Facility Class EA Date: 2019/05	N W E S

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\1839_ExistingCatchmentsMinor_20190513.mxd

Highway 403
Garden Ave Tributary
Garden Avenue
Henry St
Elgin St
Wayne Gretzky Pkwy

104 16.7 | 25.0
105 1.0 | 5.0
101 39.6 | 80.0
1002 5.9 | 93.0
1001 0.8 | 50.0
1003 5.6 | 93.0
102 7.9 | 5.0
103 8.7 | 10.0
140 3.1 | 99.0
142 8.5 | 40.0
143 6.3 | 50.0
144 9.9 | 60.0
148 1.7 | 99.0
146 9.5 | 90.0
147 2.3 | 80.0
141 0.5 | 99.0
145 12.7 | 90.0
151 9.4 | 60.0
152 2.2 | 5.0
150 3.2 | 80.0
149 0.9 | 99.0
154 7.1 | 5.0
153 9.1 | 80.0

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\1839_ExistingCatchmentsMajor_20190513.mxd

Highway 403

Garden Ave Tributary

Garden Avenue

Henry St

Elgin St

Wayne Gretzky Pkwy

104
16.7 | 25.0

105
1.0 | 5.0

101
39.6 | 80.0

1002
5.9 | 93.0

1001
0.8 | 50.0

1003
5.6 | 93.0

102
7.9 | 5.0

103
8.7 | 10.0

140
3.1 | 99.0

142
8.5 | 40.0

143
6.3 | 50.0

144
9.9 | 60.0

141
0.5 | 99.0

148
1.7 | 99.0

146
9.5 | 90.0

147
2.3 | 80.0

145
12.7 | 90.0

151
9.4 | 60.0

152
2.2 | 5.0

150
3.2 | 80.0

149
0.9 | 99.0

154
7.1 | 5.0

153
9.1 | 80.0

Braneida Park SWM Facility Class EA

Figure 4
Existing Catchments (Major)

Legend

- Flow Direction (Major Flow)
- Stormwater Culvert (ERI)
- Watercourses (ERI)
- Braneida SWM Facility

Existing Catchments by Drainage System

- Braneida Facility
- External
- On-site controls

101 → Catchment Name
39.6 | 80.0 → Impervious Area (%)
Total Area (ha)

Catchments 1001, 1002, and 1003 have on-site runoff controls for the 2 year through Regulatory event

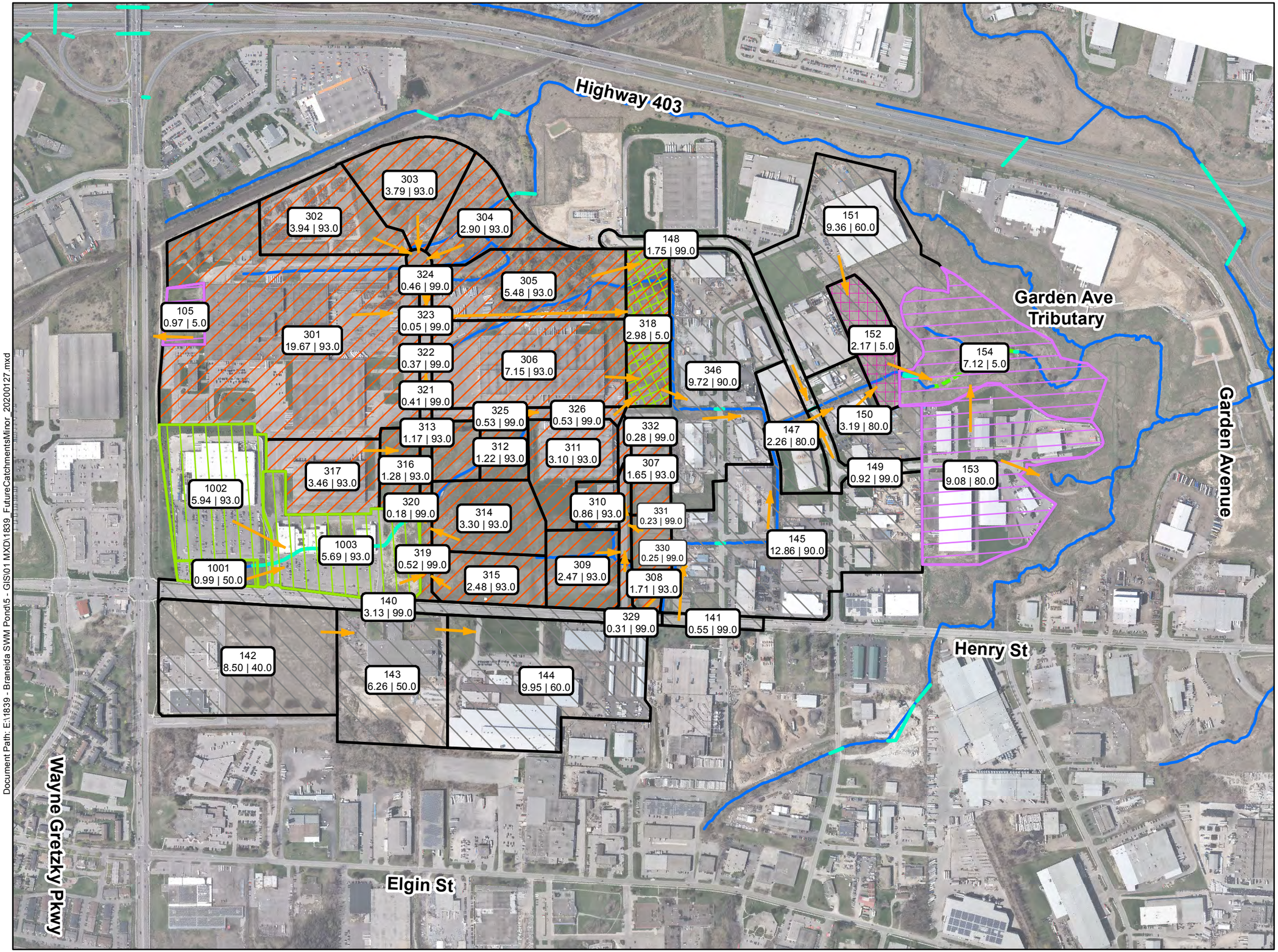
ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 100 200 400
Meters

NAD 1983 UTM 17N	1:7,500
Project: 1839 Braneida Park SWM Facility Class EA Date: 2019/05	N W E S

Braneida Park SWM Facility Class EA

Figure 5
Future Catchments (Minor)



Legend

- Flow Direction (Minor Flow)
- Culvert (Future)
- Watercourse
- Proposed Channel Rehabilitation
- Braneida SWM Facility
- Proposed SWM Pond (Kylin Developments Inc.)

Future Catchments by Drainage System

- Braneida Facility
- External
- Kylin Proposed Facility
- On-site controls

101 → Catchment Name
39.6 | 80.0 → Impervious Area (%)
Total Area (ha)

Catchments 1001, 1002, and 1003 have on-site runoff controls for the 2 year through Regulatory event

ecosystem recovery inc. PROFESSIONAL ENGINEERS

0 100 200 400
Meters

NAD 1983 UTM 17N	1:7,500
Project: 1839 Braneida Park SWM Facility Class EA Date: 2020/01	N W E S

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\1839_FutureCatchmentsMinor_20200127.mxd

Braneida Park SWM Facility Class EA

Figure 6
Future Catchments (Major)

Legend

- Flow Direction (Major Flow)
- Culvert (Future)
- Watercourse
- Proposed Channel Rehabilitation
- Braneida SWM Facility
- Proposed SWM Pond (Kylin Developments Inc.)

Future Catchments by Drainage System

- Braneida Facility
- External
- Kylin Proposed Facility
- On-site controls

101 — Catchment Name
39.6 | 80.0 — Impervious Area (%)
Total Area (ha)

Catchments 1001, 1002, and 1003 have on-site runoff controls for the 2 year through Regulatory event

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 100 200 400
Meters

NAD 1983 UTM 17N	1:7,500

Project: 1839 Braneida Park SWM Facility Class EA
Date: 2020/01

N W E S

Highway 403
Garden Ave Tributary
Garden Avenue
Henry St
Elgin St
Wayne Gretzky Pkwy

303 3.79 | 93.0
302 3.94 | 93.0
304 2.90 | 93.0
148 1.75 | 99.0
151 9.36 | 60.0
324 0.46 | 99.0
305 5.48 | 93.0
105 0.97 | 5.0
323 0.05 | 99.0
318 2.98 | 5.0
301 19.67 | 93.0
152 2.17 | 5.0
154 7.12 | 5.0
322 0.37 | 99.0
306 7.15 | 93.0
346 9.72 | 90.0
321 0.41 | 99.0
325 0.53 | 99.0
326 0.53 | 99.0
150 3.19 | 80.0
313 1.17 | 93.0
332 0.28 | 99.0
147 2.26 | 80.0
312 1.22 | 93.0
311 3.10 | 93.0
307 1.65 | 93.0
149 0.92 | 99.0
153 9.08 | 80.0
1002 5.94 | 93.0
316 1.28 | 93.0
317 3.46 | 93.0
320 0.18 | 99.0
314 3.30 | 93.0
310 0.86 | 93.0
331 0.23 | 99.0
330 0.25 | 99.0
145 12.86 | 90.0
1003 5.69 | 93.0
319 0.52 | 99.0
1001 0.99 | 50.0
315 2.48 | 93.0
309 2.47 | 93.0
308 1.71 | 93.0
140 3.13 | 99.0
329 0.31 | 99.0
141 0.55 | 99.0
142 8.50 | 40.0
143 6.26 | 50.0
144 9.95 | 60.0

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\1839_FutureCatchmentsMajor_20200127.mxd

Braneida Park SWM Facility Class EA

Figure 7
Potential Easement Locations

Legend

- Potential Easement
- Braneida Existing SWM Facility
- Hydro Utility Corridor
- Hydro Poles
- Watercourse

Properties by Ownership

- City
- Private

SWM Facility
Adams Blvd
Middleton St
Bury Ct
Garden Ave Tributary
Existing Twin CSP (2 x 2.00m OD)
1
2
3
4
5
10
150
132
143
122
111
112
105
96
90
76
66
71
75
38
46
47
59
35
48
60

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 25 50 100
Meters

NAD 1983 UTM 17N	1:2,000
Project: 1839 Braneida Park SWM Facility Class EA Date: 2019/05	N W E S

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\1839_EasementPotentialLocations_20190403.mxd

Braneida Park SWM Facility Class EA

Figure 8
Alternative 1 - Do Nothing
(Existing SWMF)

Legend

- Stormwater Culvert (ERI)
- Existing Watercourse
- Existing Contours from Survey (0.5m)
- Braneida Existing SWM Facility

Existing Twin CSP
(2 x 2.00m OD)

Existing Concrete
Rectangular Weir
Outlet Structure

Pond Inlet

Main Cell

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 12.5 25 50
Meters

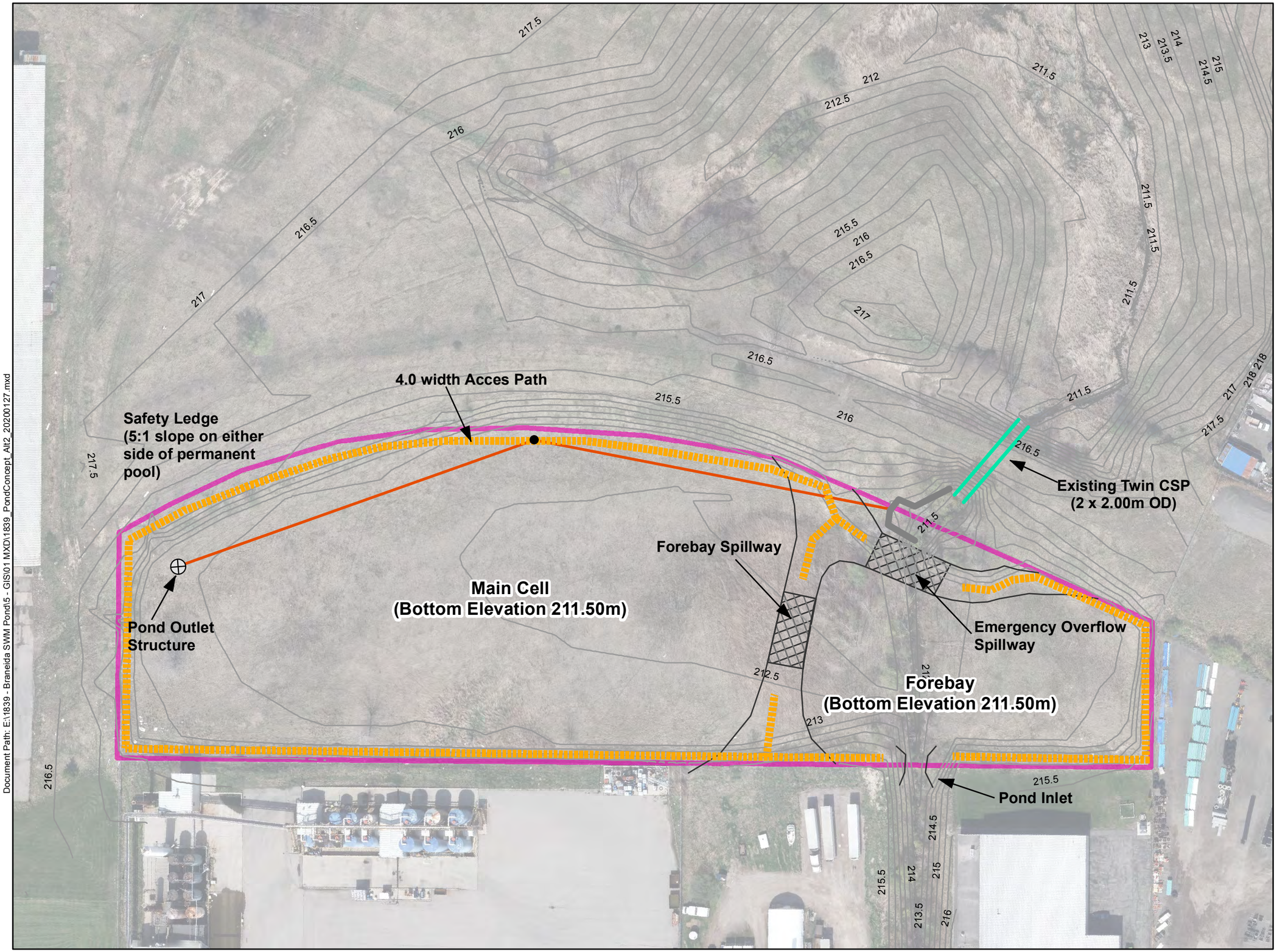
NAD 1983 UTM 17N	1:1,000

Project: 1839 Braneida Park
SWM Facility Class EA
Date: 2019/05

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\1839_PondConcept_Alt1_20190513.mxd

Braneida Park SWM Facility Class EA

Figure 9
Alternative 2 - Pond Retrofit



Legend

- Outlet Connection
- Pond Outlet Structure
- Stormwater Culvert (ERI)
- Concept Linework
- Outlet Pipe
- Headwall
- Access Path
- Existing Contours from Survey (0.5m)
- Overflow Structure
- Braneida Existing SWM Facility

Pond Invert	211.50m
Permanent Pool	212.50m
Extended Detention	213.23m
100-year Level	214.56m

Stage-Storage Curve (DRAFT)

Elevation	Volume (1000 m3)
211.50m	0.00
212.50m	13.97
213.00m	22.00
213.50m	30.66
214.00m	39.94
214.50m	49.84
215.00m	60.36

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 12.5 25 50
Meters

NAD 1983 UTM 17N | 1:1,000

Project: 1839 Braneida Park
SWM Facility Class EA
Date: 2020/01

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\1839_PondConcept_Alt2_20200127.mxd

Braneida Park SWM Facility Class EA

Figure 10
Alternative 3 - Pond Expansion

Pond Outlet Structure

4.0 width Acces Path

Safety Ledge (5:1 slope on either side of permanent pool)

Main Cell (Bottom Elevation 210.0m)

Forebay Spillway

Emergency Overflow Spillway

Forebay (Bottom Elevation 210.0m)

Existing Twin CSP (2 x 2.00m OD)

Pond Inlet

Legend

- Outlet Connection
- Pond Outlet Structure
- Stormwater Culvert (ERI)
- Concept Linework
- Outlet Pipe
- Headwall
- Access Path
- Existing Contours from Survey (0.5m)
- Overflow Structure
- Braneida Existing SWM Facility
- Expanded Pond Outline (Alternative 3)

Pond Invert	210.00m
Permanent Pool	211.50m
Extended Detention	212.50m
100-year Level	213.75m

Stage-Storage Curve (DRAFT)

Elevation	Volume (1000 m3)
210.00m	0.00
211.00m	15.99
211.50m	25.09
212.50m	44.69
213.00m	54.81
213.50m	65.00
213.75m	70.10
214.50m	85.39

ecosystem recovery inc. PROFESSIONAL ENGINEERS

0 12.5 25 50
Meters

NAD 1983 UTM 17N | 1:1,000

Project: 1839 Braneida Park SWM Facility Class EA
Date: 2019/05

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\1839_PondConcept_Alt3_20190513.mxd

Appendix B

Public Consultation Documentation

Notice of Commencement
Agency Contact List
PIC Presentation
Record of Communications with Agencies and Members of the Public

NOTICE OF STUDY COMMENCEMENT AND VIRTUAL PUBLIC INFORMATION CENTRE

Braneida Stormwater Management Facility Retrofit and Downstream Channel Remediation Municipal Class Environmental Assessment

The Study

The City of Brantford has initiated a Municipal Class Environmental Assessment (Class EA) Schedule 'B' for the retrofit of the existing Braneida Stormwater Management Facility (SWMF) and to remediate the erosion hazard of the downstream channel. Ecosystem Recovery Inc. has been retained by the City of Brantford to complete the study.

The existing Braneida SWMF was constructed in the 1990s and does not meet current standards. The proposed retrofits will provide for water quality and quantity control in compliance with current provincial standards. The study is intended to identify and evaluate retrofit alternatives and downstream watercourse rehabilitation opportunities.

The Process

The study is being conducted in compliance with Schedule 'B' requirements of the Municipal Engineers Association "Municipal Class Environmental Assessment," (October 2000, as amended 2007 & 2011) as approved under the Ontario Environmental Assessment Act. A key component of the study will be consultation with interested stakeholders (public, landowners and agencies).

Virtual Public Information Centre

Due to the COVID-19 pandemic, this Public Information Centre will be carried out virtually.

As part of the project, this virtual public engagement has been arranged to allow residents and interested members of the public an opportunity to review and comment on the proposed recommendations, including the preferred alternatives, the evaluation process, and the next steps in the study process.

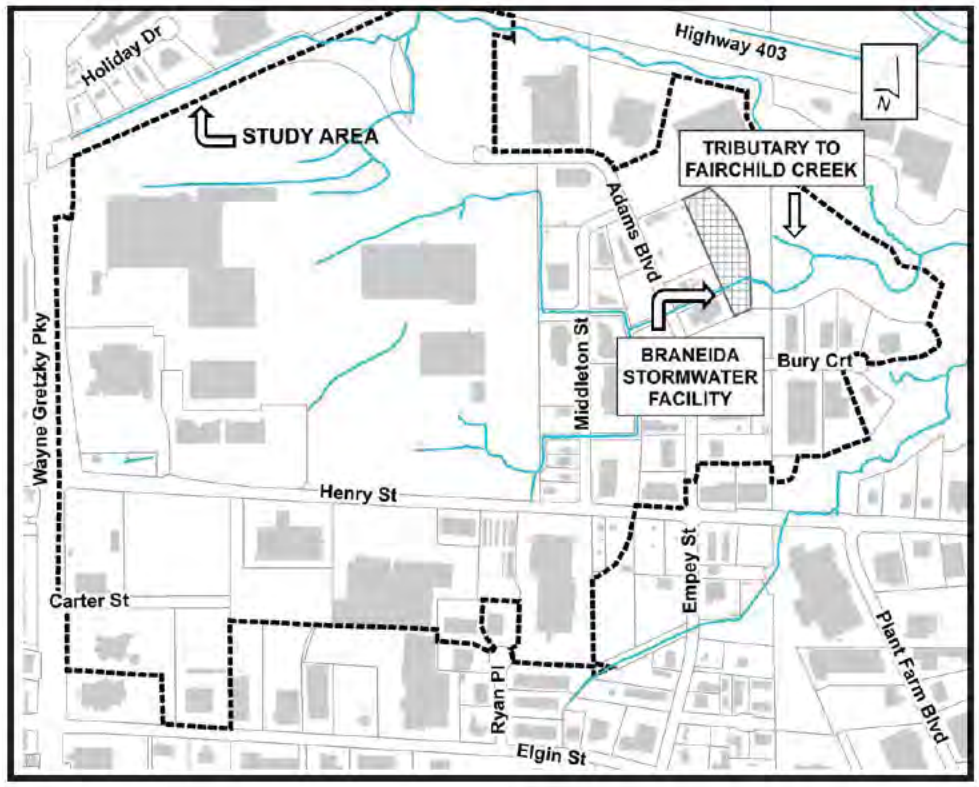
The purpose of the PIC is to share information with interested community members, to inform and identify priorities and interests that should be considered in project planning and execution. At the PIC the City will:

- Share information regarding the Study purpose and objectives
- Provide summaries of the existing conditions assessments
- Present alternative solutions, evaluation criteria and preferred solutions for the pond retrofit, easement location and downstream channel remediation
- Identify next steps

We are interested in hearing any comments or concerns that you may have about this study. Comments and information regarding the study are being collected to assist the City of Brantford in meeting the requirements of the Environmental Assessment Act.

This material will be maintained on file for use during the project and may be included in project documentation. With the exception of personal information, all comments will become part of the public record.

Study Area



Your input is important!

Display boards and a comment sheet will be made available to the public on the City of Brantford's website at **brantford.ca/BraneidaEA**

Please provide your comments by December 14, 2020.

Engagement with the community, agencies and Indigenous groups is considered a key part of any Class EA. To submit a comment or question, or to receive additional information related to the Class EA, or if you have accessibility requirements to participate in this Study, please contact one of the representatives below:

Nahed Ghbn P.Eng.
Senior Project Manager, City of Brantford
Tel: 519-759-4150 ext. 5262 I Email: NGhbn@brantford.ca

Chris Moon, P. Eng
Senior Project Manager, Ecosystem Recovery Inc.
Phone: 519-621-1500 I Email: chris.moon@ecosystemrecovery.ca

All information collected will be used in accordance with the Freedom of Information and Protection of Privacy Act. RSO, 1990, c.F.31. With the exception of personal information, all comments will become part of the public record.

All information collected will be used in accordance with the Municipal Freedom of Information and Protection of Privacy Act. RSO, 1990, s. 10(1). With the exception of personal information, all comments will become part of the public record.

THE CORPORATION OF THE CITY OF BRANTFORD

NOTICE OF STUDY COMMENCEMENT and VIRTUAL PUBLIC INFORMATION CENTRE

Braneida Stormwater Management Facility Retrofit and Downstream Channel Remediation Municipal Class Environmental Assessment

The Study

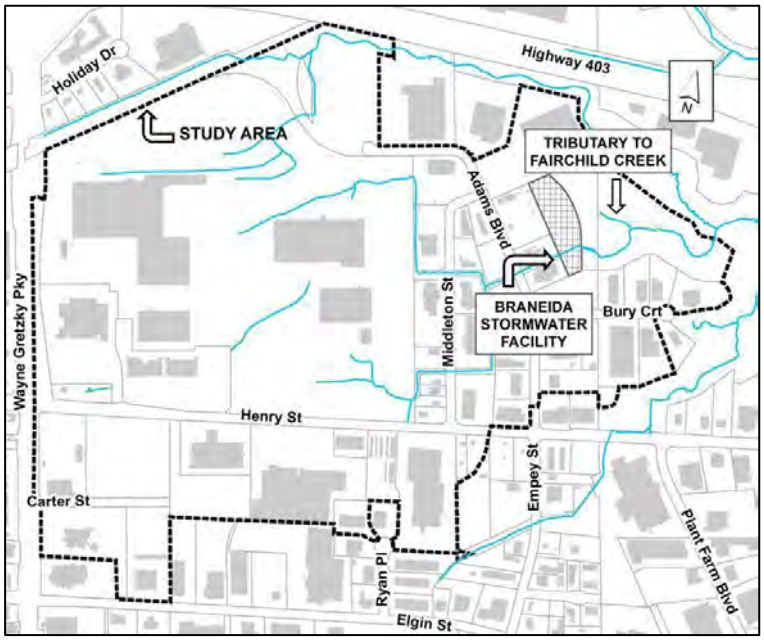
The City of Brantford has initiated a Municipal Class Environmental Assessment (Class EA) Schedule 'B' for the retrofit of the existing Braneida Stormwater Management Facility (SWMF) and to remediate the erosion hazard of the downstream channel. Ecosystem Recovery Inc. has been retained by the City of Brantford to complete the study.

The existing Braneida SWMF was constructed in the 1990s and does not meet current standards. The proposed retrofits will provide for water quality and quantity control in compliance with current provincial standards. The study is intended to identify and evaluate retrofit alternatives and downstream watercourse rehabilitation opportunities.

The Process

The study is being conducted in compliance with Schedule 'B' requirements of the Municipal Engineers Association "Municipal Class Environmental Assessment," (October 2000, as amended 2007 & 2011) as approved under the Ontario Environmental Assessment Act. A key component of the study will be consultation with interested stakeholders (public, landowners and agencies).

Study Area



Virtual Public Information Centre

Due to the COVID-19 pandemic, this Public Information Centre will be carried out virtually.

As part of the project, this virtual public engagement has been arranged to allow residents and interested members of the public an opportunity to review and comment on the proposed recommendations, including the preferred alternatives, the evaluation process, and the next steps in the study process.

The purpose of the PIC is to share information with interested community members, to inform and identify priorities and interests that should be considered in project planning and execution. At the PIC the City will:

- Share information regarding the Study purpose and objectives
- Provide summaries of the existing conditions assessments
- Present alternative solutions, evaluation criteria and preferred solutions for the pond retrofit, easement location and downstream channel remediation
- Identify next steps

We are interested in hearing any comments or concerns that you may have about this study. Comments and information regarding the study are being collected to assist the City of Brantford in meeting the requirements of the Environmental Assessment Act.

This material will be maintained on file for use during the project and may be included in project documentation. With the exception of personal information, all comments will become part of the public record.

Your input is important!

Display boards and a comment sheet will be made available to the public on the City of Brantford's website at **brantford.ca/BraneidaEA**

Please provide your comments by December 14, 2020.

Engagement with the community, agencies and Indigenous groups is considered a key part of any Class EA. To submit a comment or question, or to receive additional information related to the Class EA, or if you have accessibility requirements to participate in this Study, please contact one of the representatives below:

Nahed Ghbn P.Eng.
Senior Project Manager
City of Brantford
Tel: 519-759-4150 ext. 5262
Email: NGhbn@brantford.ca

Chris Moon, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
Phone: 519-621-1500
Email: chris.moon@ecosystemrecovery.ca

All information collected will be used in accordance with the Freedom of Information and Protection of Privacy Act. RSO, 1990, c.F.31. With the exception of personal information, all comments will become part of the public record.

All information collected will be used in accordance with the Municipal Freedom of Information and Protection of Privacy Act. RSO, 1990, s. 10(1). With the exception of personal information, all comments will become part of the public record.

BRANTFORD

BRANEIDA STORMWATER MANAGEMENT FACILITY RETROFIT AND DOWNSTREAM CHANNEL REMEDIATION

AGENCY CONTACT LIST FOR E.A.'s

	Agency Name	Contact Person
A. Provincial Agencies		
1	Ministry of the Environment, Conservation and Parks Ellen Fairclough Bldg 119 King Street West, 12th Floor Hamilton, Ontario L8P 4Y7 Tel: 905-521-7864 Fax: 905-521-7820	Ms. Barbara Slattery Environmental Resource Planner & EA Coordinator Email: barbara.slattery@ontario.ca
2	Ministry of Natural Resources and Forestry Guelph District Office 1 Stone Road West Guelph, Ontario N1G 4Y2 Tel: 519-826-4931 Fax: 519-826-4929	Ms. Tammy Verhaeghe District Manager Email: tammy.verhaeghe@ontario.ca
3	Ministry of Heritage, Sport, Tourism and Culture Industries 401 Bay St. Suite 1700 Toronto, Ontario M7A 0A7	James Hamilton Manager of Heritage Program Unit Email: james.hamilton@ontario.ca James Tel: 416-212-7505 Katherine Kirzati Heritage Planner Programs and Services Branch Ministry of Heritage, Sport, Tourism and Culture Industries 401 Bay St, Suite 1700 Toronto, ON M7A 0A7 Tel: 416.314.7643
4	Ministry of Transportation 659 Exeter Road London, Ontario N6E 1L3 Tel: 519-873-4100	Neil Zohorsky Regional Director, West Region Email: neil.zohorsky@ontario.ca
5	Ministry of Municipal Affairs and Housing Western Municipal Services Office 659 Exeter Rd 2nd Floor London Ontario	Ian Kerr Regional Director Email: ian.kerr@ontario.ca

	Agency Name	Contact Person
	N6E 1L3 Tel: 519-873-4020 Fax: 416-585-6470	
	Federal Agencies	
1	Indigenous and Northern Affairs Canada 10 Wellington, North Tower Gatineau, QC K1A 0H4 Tel: 1-800-567-9604 Fax: 1-866-817-3977	Hon. Carolyn Bennett Minister Email: minister@aadnc-aandc.gc.ca
2	Indigenous Services Canada 25 St. Clair Avenue East, Toronto, Ontario M4T 1M2	Hon. Jane Philpott Minister of Indigenous Services
3	Fisheries and Oceans Canada Central and Arctic Region 520 Exmouth Street Sarnia, ON, N7T 8B1 Toll-free: 1-866-290-3731 Telephone: 519-383-1809 Fax: 519-464-5128 Email: info@dfo-mpo.gc.ca	Regional Manager
	Municipalities	
1	Brant County Health Unit 194 Terrace Hill Street Brantford, Ontario N3R 1G7 Tel: (519) 753-4937 Fax: (519) 753-5942	Dr. Malcolm Lock Medical Officer of Health Ext. 221
2	County of Brant 26 Park Avenue PO Box 160 Burford, Ontario N0E 1A0 Phone: (519)449-2451	The Clerk

Other Agencies		
1	Grand River Conservation Authority 400 Clyde Road P.O. Box 729 Cambridge, Ontario N1R 5W6 Tel: 519-621-2763 x.2325 Fax: 519-621-4844	Jan Ivey Subwatershed Planning Coordinator Engineering Division. Email: jivey@grandriver.ca
2	Grand Erie District School Board 349 Erie Avenue Brantford, Ontario N3T 5V3 Tel: 519-756-6301 Fax: 519-756-9181	Brenda Blancher Director of Education
3	Brant Haldimand Norfolk Catholic District School Board P.O. Box 217 322 Fairview Drive Brantford, Ontario N3T 5M8 Tel: (519) 756-6369 Fax: (519) 756-9913 Email: info@bhncdsb.ca	Chris N. Roehrig, Director of Education Office Phone: (519) 756-6505 Email: directorsoffice@bhncdsb.ca
4	Brantford Christian School 7 Calvin Street Brantford, Ontario N3S 3E4	Justin DeMoor, Principal
5	Six Nations of the Grand River 1695 Chiefswood Road P.O. Box 5000 Ohsweken, Ontario N0A 1M0 Tel: 519-445-2201	Chief Mark Hill
~~6~~	Six Nations of the Grand River 1695 Chiefswood Road P.O. Box 5000 Ohsweken, Ontario N0A 1M0 Tel: 519-445-2201	Weylin Bomberry weylin.bomberry@sixnations.~~ca~~

7	Mississaugas of the Credit Department of Consultation & Accommodation 4065 Hwy 6 Hagersville, Ontario N0A 1H0 Tel: 905-768-4260 Fax: 905-768-9751	Ms. Fawn Sault Consultation Manager Email: fawn.sault@newcreditfirstnation.com

	Utilities	
1.	Bell Canada P.O. Box 938 86 Market Street Brantford, Ontario N3T 5S5	Christine Telfer
2.	Rogers Cable 85 Grand Crest Place P.0. Box 488 Kitchener, Ontario N2G 4A8 Tel: (519) 894-8138 Fax: (519) 893-6463	Richard Bolliger Municipal & Utility Relations
3.	Union Gas P.O. Box 340 603 Kumpf Drive Waterloo, Ontario N2J 4A4	John Stauffer
4.	Brantford Hydro Inc. 44 King Street, Suite 207 Brantford, ON N3T 3C7 Tel: (226) 493-1043	James Nagle, Chief Operating Officer
5.	Brantford Power Inc. 84 Market Street Brantford, Ontario N3T 5N8 Tel: (519) 751-3522	Paul Kwasnik, Chief Executive Officer

6	CN Rail 1 Administration Road Concord, Ontario L4K 1B9 Tel: (905) 760-5007 (number kept ringing and no answering machine) Fax: (905) 760-5010	Manager, Community Planning & Real Estate

WELCOME

Braneida Stormwater Management Facility Retrofit and Downstream Channel Remediation

Public Information Centre

November 30, 2020

THE CORPORATION OF THE CITY OF BRANTFORD

ecosystem recovery inc. PROFESSIONAL ENGINEERS

The Purpose of this Information Centre

- ❑ Provide information on the Environmental Assessment (EA) study purpose and background
- ❑ Provide summaries of the existing conditions assessments
  - Stormwater Management Pond Design vs Current Functionality
  - Water Resources and Geomorphic Conditions
  - Natural Heritage
  - Archaeological and Cultural Heritage
- ❑ Present alternative solutions and proposed evaluation criteria
- ❑ Present the recommended alternative solution

We invite your input.

City of Brantford
Public Information Centre

Study Purpose

The EA study follows the **Municipal Class Environmental Assessment** under Schedule 'B' for the stormwater management facility (SWMF) servicing the Braneida Industrial Subdivision in the City of Brantford.

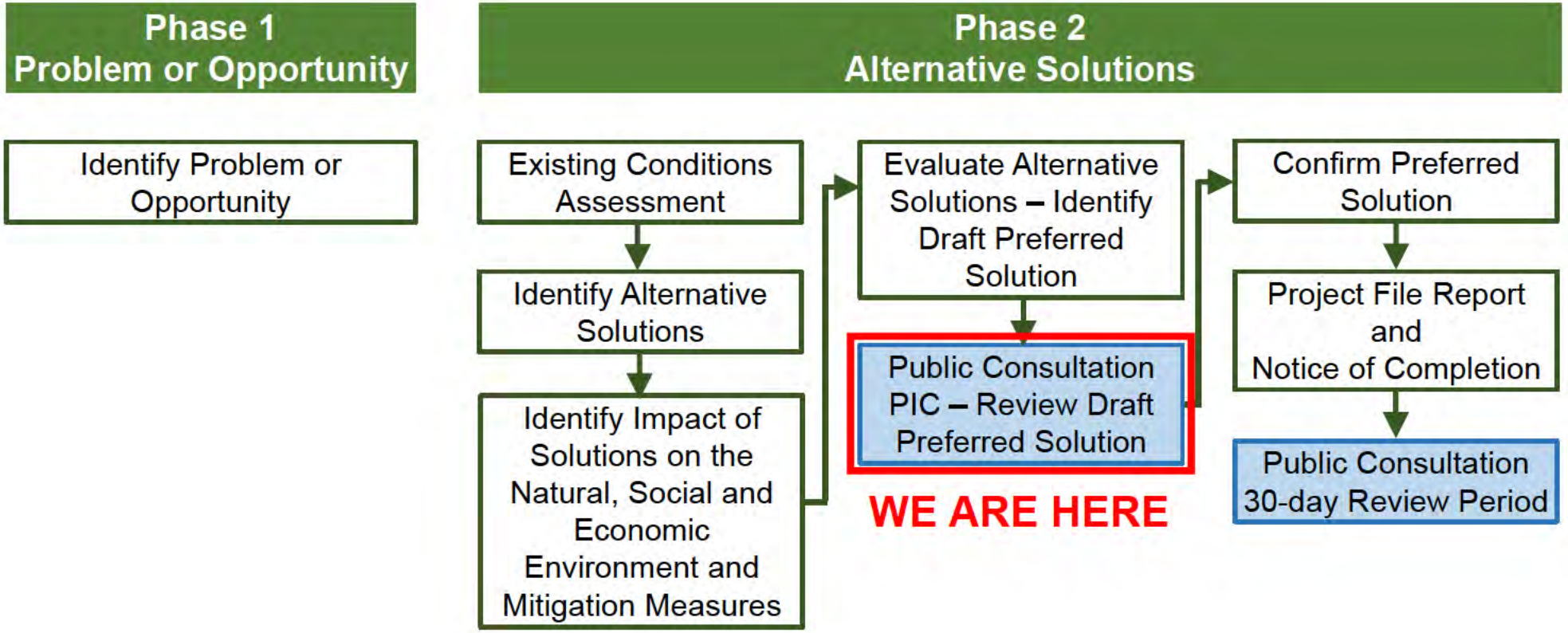
Problem Statement:

The existing Braneida Industrial SWMF was constructed in the 1990s and does not meet current MECP water quality and quantity control standards. Furthermore, there is no Environmental Compliance Approval (ECA) (formerly Certificate of Approval (C of A)) in place.

The ultimate objective on completion of the Municipal Class EA will be to obtain the necessary approvals and permits for the retrofit of the existing SWMF for water quality, erosion and quantity control in compliance with current provincial standards.

Municipal Class EA Process Overview

- The Municipal Class EA process provides opportunities for **public and stakeholder involvement** throughout the project
- Ensures that all **reasonable alternatives** are considered and that a selected alternative would have minimal impact on the surrounding environment
- The Braneida Stormwater Management Facility: Proposed Retrofits EA Study is being undertaken as a **Schedule 'B'** Class EA Project.



Characterization of Existing Conditions

Site Geometry

Description: General description of the subject lands

Quick Facts:

- Study area spans over 140 ha of mixed industrial development, the SWMF site is approximately 2.4 ha
- Tributary to Fairchild Creek downstream of SWMF outlet within the study scope is approximately 500 m long

Geotechnical

Description: Hydrologic calculation basis +
SWMF construction consideration

Quick Facts:

- GRCA GRIN Mapping identifies primarily clay underlying soils within the study area
- Pinchin geotechnical investigation (2019) in the SWM block identified the underlying soils will not require dewatering during construction
- Exp geotechnical reports (2018) identify underlying soils in the greater catchment area of the SWMF as interbedded clayey silt, sandy silt, silty sand, silt and silty clay in a moist to saturated state

Natural Heritage

Description: Potential impacts on natural environment

Quick Facts:

- Study area includes meadow, thicket, marsh and industrial lands.
- Tributary to Fairchild Creek contains fish species above and below SWM pond despite instream barriers to fish movement
- Vegetation includes native, non-native and invasive species
- Historic SAR identified within the surrounding habitat

Archaeological, Built and Cultural Heritage (Timmins and Martell reports, 2019)

Description: Archaeological significance of Study Area
Built heritage and cultural heritage landscapes

Quick Facts:

- Proximity to known archaeological sites, water sources, early historic settlements and transportation routes
- Potential easement 1 would require a Stage 2 archeological survey, other easements do not require further assessment work
- The Cultural Heritage Assessment (CHA) found that the subject property does not meet any Ministry of Tourism, Culture and Sports (MTCS) screening criteria for known or potential cultural heritage value
- No further heritage studies are recommended

Social

Description: Impacts on communities

Quick Facts:

- There is a series of trails downstream of the SWMF near the Garden Avenue Tributary
- These trails are not projected to be impacted by any of the proposed alternatives

Geomorphological

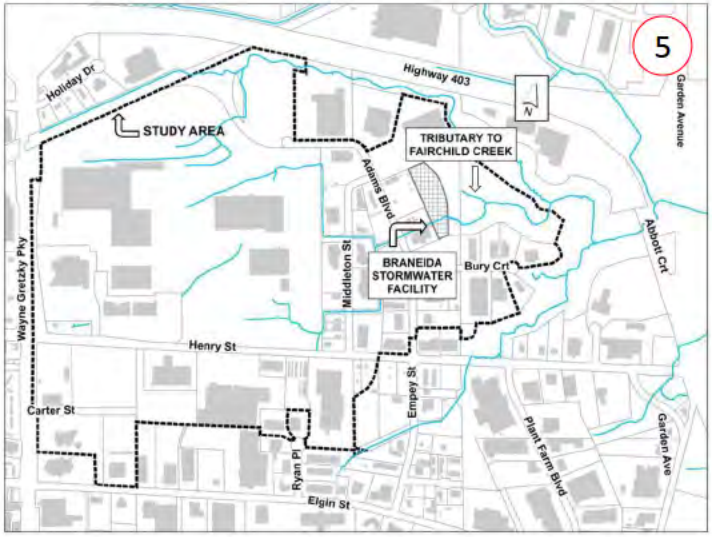
Description: SWMF outflow impacts on tributary

Quick Facts:

- The channel has been previously modified and exhibits evidence of response to changes in hydrology and channel realignment
- The channel has incised into silty clay till materials resulting in an entrenched condition (larger than bankfull flows does not spill onto a wide floodplain)
- The incision process is likely to continue as the watercourse adjusts to the modified hydrological conditions, until a state of equilibrium is be achieved

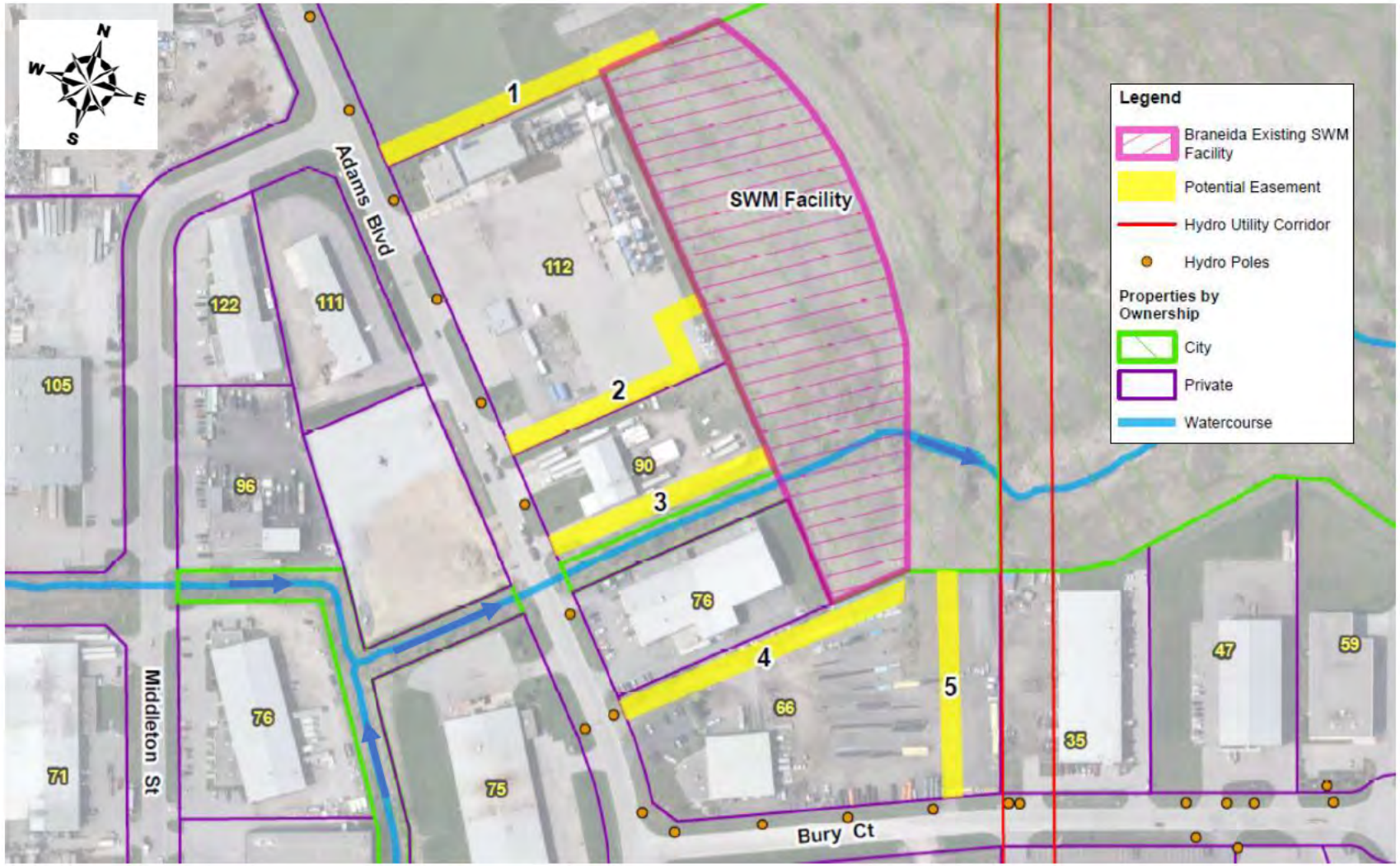
Existing Conditions

1. The outlet of the stormwater management facility has been clogged, resulting in the pictured weir acting as an overflow outlet for the facility. This has resulted in the loss of 13,700 m³ of stormwater storage space.
2. Twin 2000 mm diameter culverts downstream of stormwater management facility.
3. Tributary approximately 300 m downstream of stormwater management facility.
4. Indication of active bank erosion, lack of rooting depth, exposed clay at bank toe .
5. Study Area



City of Brantford
Public Information Centre

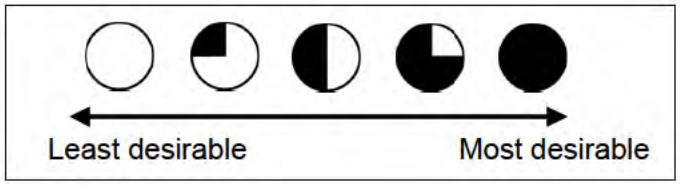
Potential Easement Locations



City of Brantford
Public Information Centre

Alternatives – Easement Location

Criteria	132 Adams Blvd (1)	112 Adams Blvd (2)	90 Adams Blvd (3)	66 Adams Blvd (4)	66 Adams Blvd from Bury Ct (5)
Land Use (35%)	●	○	◔	○	◔
Natural Environment (15%)	●	●	●	●	●
Design Requirements (25%)	◑	◑	◑	◔	◑
Land Availability (25%)	◑	◑	●	◑	◑
Overall Score	◔	◔	●	◑	○



Recommended alternative solution at this stage

Alternatives – SWM Facility Retrofit

Alternative 1

Do Nothing

- This alternative is a baseline for comparison. Under this option, there would be no implementation of retrofit stormwater quantity, quality or erosion controls to the existing Braneida SWM facility.

Alternative 2

Retrofit Existing Braneida SWMF within existing SWM Block

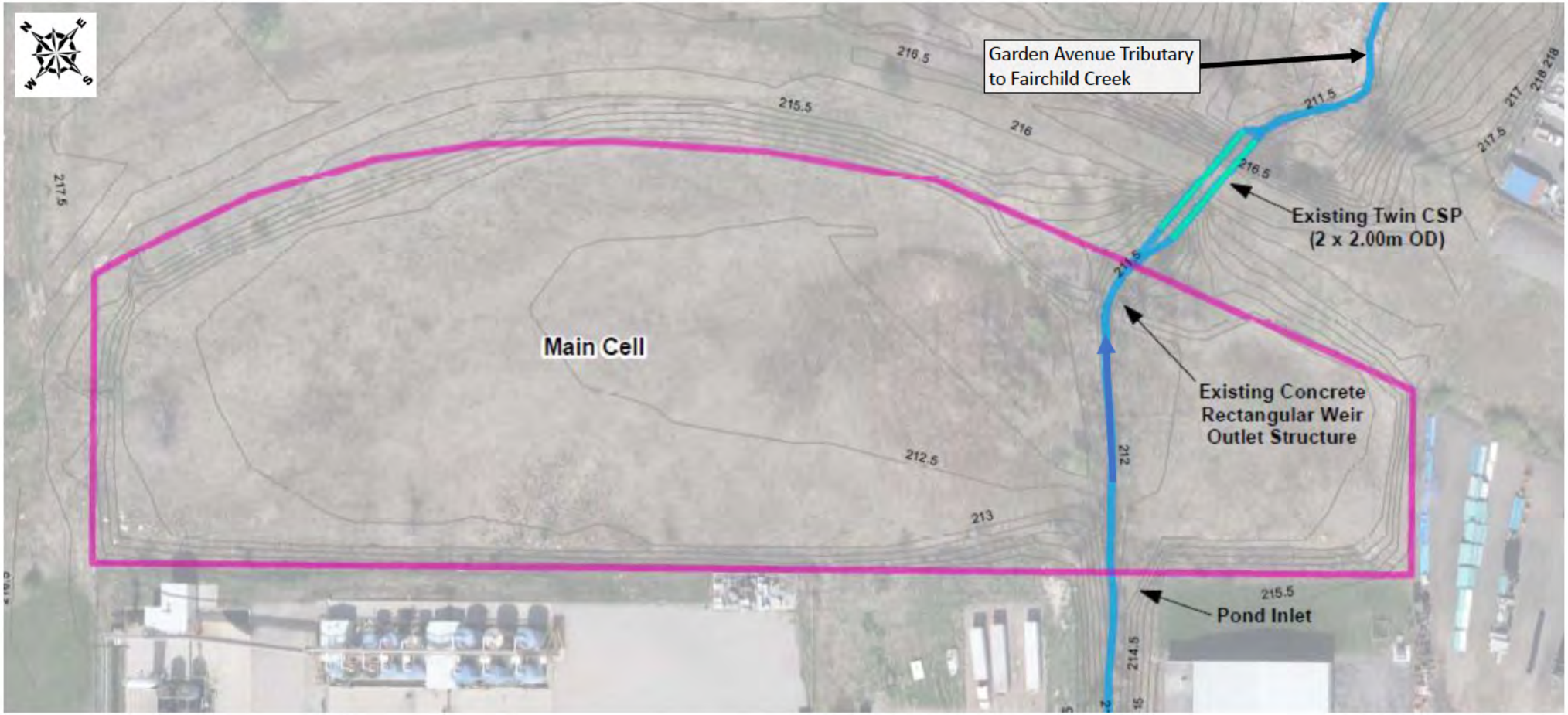
- Use existing SWMF block area, the only additional land required is a maintenance access easement
- Construct a permanent pool to provide water quality control
- Implement multi-stage outlet with erosion and quantity control
- Construct a forebay to improve maintenance accessibility to permanent pool
- Separation of inlet and outlet structure to increase flow path and detention time within SWMF

Alternative 3

Retrofit Existing Braneida SWMF within expanded SWM Block

- Same design criteria as Alternative 2, but with an expanded SWM Block to allow for additional storage and quality treatment volumes

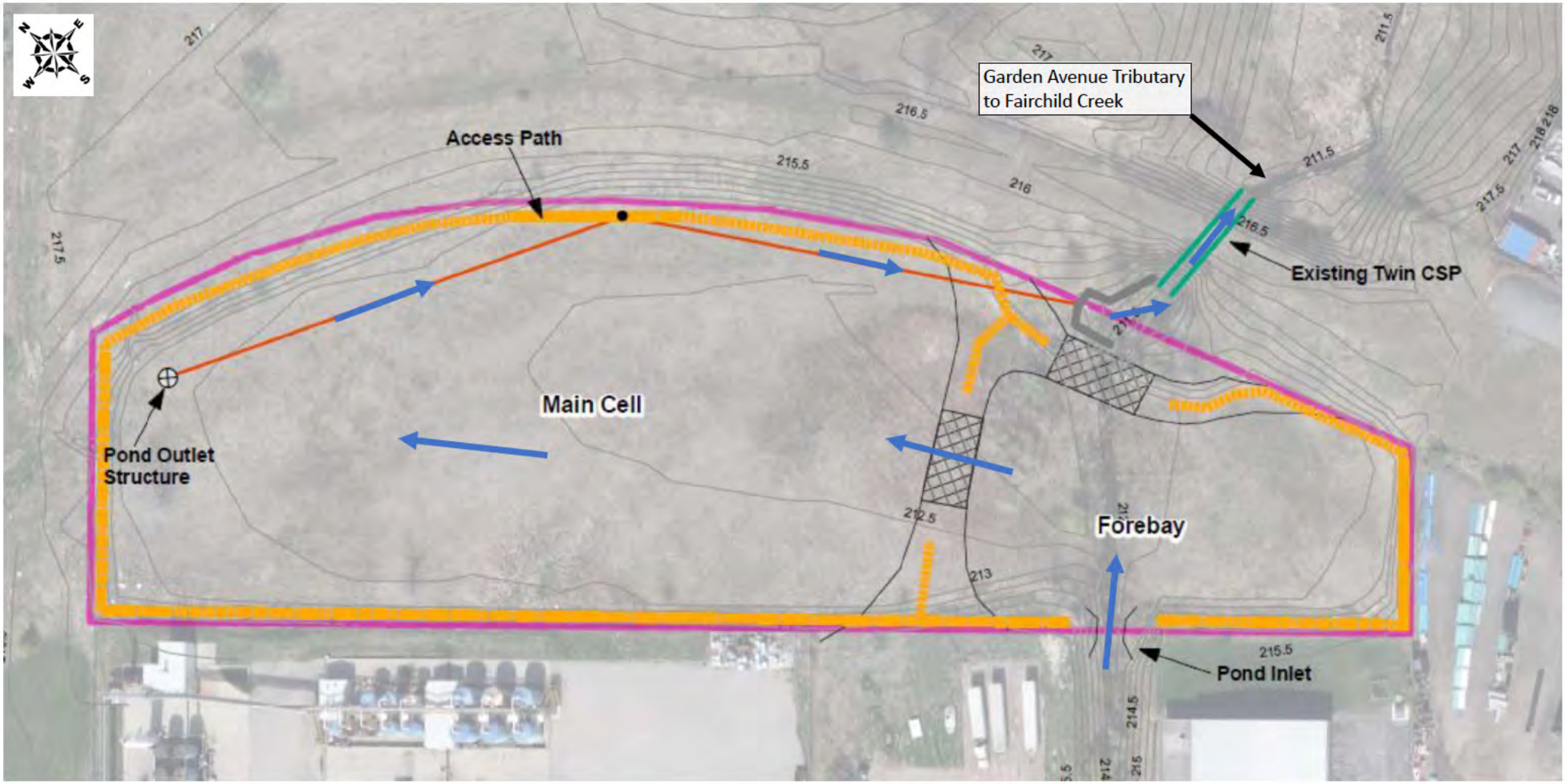
Alternative 1 – Do Nothing



City of Brantford

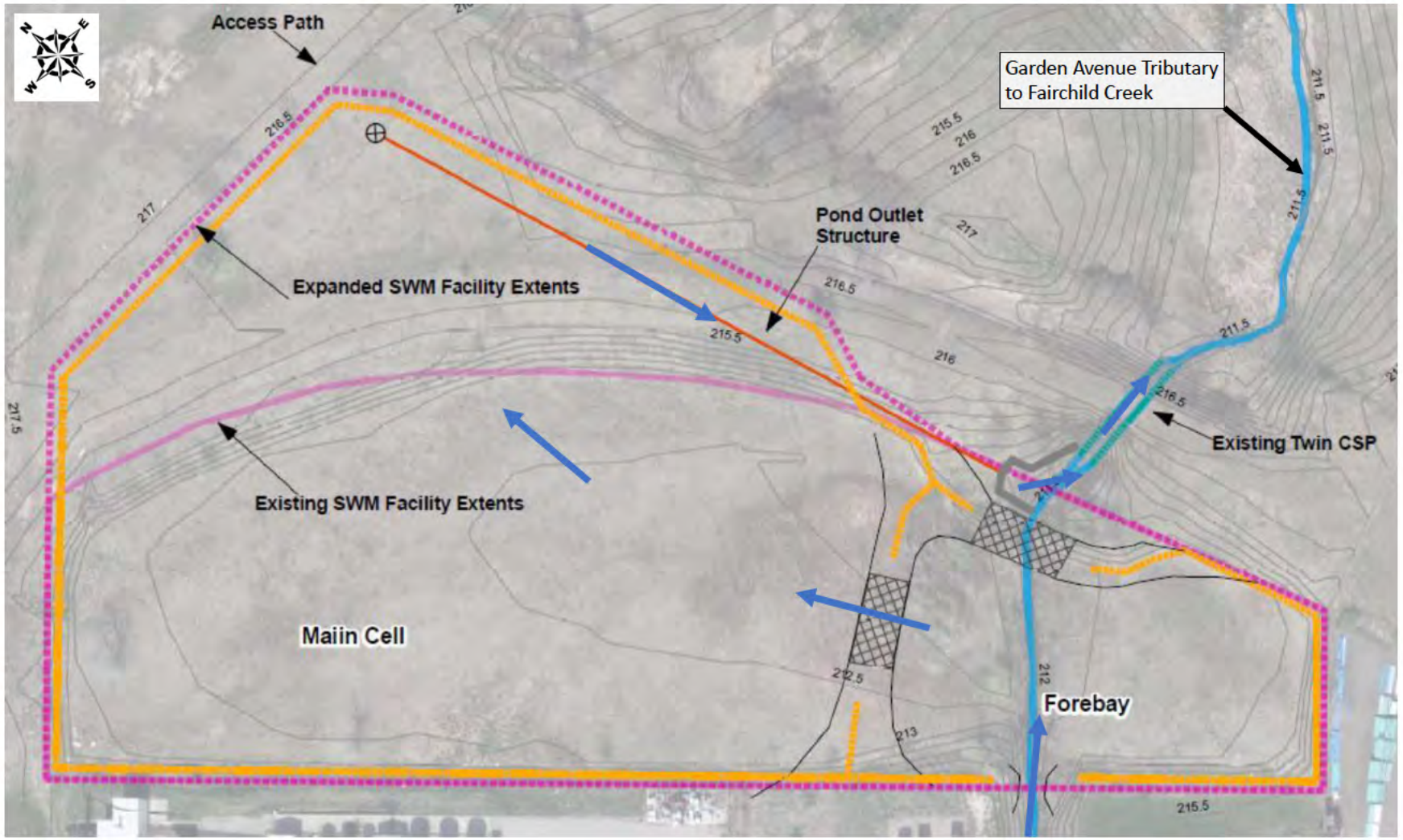
Public Information Centre

Alternative 2 – Retrofit Existing SWM Facility



City of Brantford
Public Information Centre

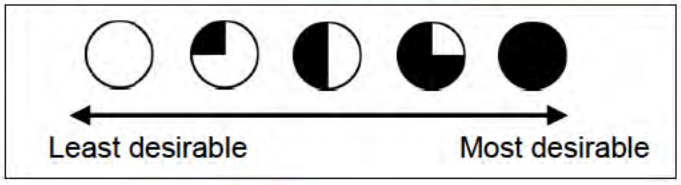
Alternative 3 – Retrofit with Expanded SWM Block



City of Brantford
Public Information Centre

Evaluation of Alternative Solutions

Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Retrofit Existing SWM Facility Area)	Alternative 3 (Retrofit an expanded SWM Facility Area)
Public Health and Safety (25%)	○	◔	●
Technical (10%)	○	◔	◔
Environmental (15%)	◔	◔	○
Heritage and Archaeological Resources (10%)	●	◔	○
Socio-economic (15%)	◔	◔	◔
Construction Cost (15%)	◔	◑	○
Constructability (10%)	●	◔	◑
Overall Score	◑	●	◔



Recommended alternative solution at this stage

City of Brantford
Public Information Centre

Alternatives – Channel Remediation

Alternative 1 — Do Nothing

- This option is a baseline for comparison. Under this option, there would be no action taken to address the identified channel bed incision and erosion concerns.

Alternative 2 — Channel Bed / Profile Enhancements

- This alternative would maintain the existing footprint of the channel and address sensitive areas within the study area.
- Protection of the clay channel bed would be provided at vertical drops (knickpoints) to prevent upstream migration. Placement of stone on the clay bed will also be provided in areas of sensitivity to prevent further incision.
- Implementation of this alternative will not completely halt ongoing channel bed incision or widening.

Alternative 3 — Channel Capacity / Floodplain Connectivity

- The cross-sectional configuration will be altered to include a floodplain adjacent to the defined bankfull channel that conveys frequent flows, in the incised sections. The increased area will convey larger storm events and will reduce erosion potential and attenuate the larger flow events compared to existing conditions. No in-channel changes would occur.
- Impacts to the natural environment are expected to be greater than those resulting from Alternative 2; impacts would remain limited to the channel and new floodplain.
- Like Alternative 2, impacts to the terrestrial natural environment will result at the locations of construction access, and in locations where vegetation removal will be required. This alternative would allow for enhancement opportunities to the terrestrial natural environment and also to the aquatic habitat within the channel.

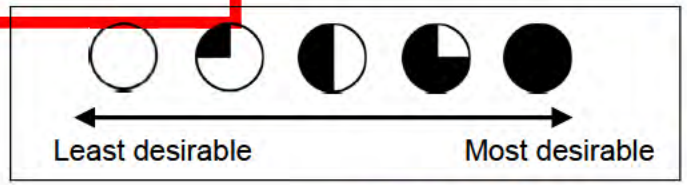
Alternative 4 — Channel Realignment

- In this alternative, the watercourse would be re-aligned to a new location in the study area, with a new planform pattern.
- The cross-sectional configuration would include a defined bankfull channel for frequent flows that is set within a larger section that conveys larger storm event flows. The larger channel is intended to reduce erosion potential and to attenuate flows during the larger flow events.
- Modification of the channel bed profile would be undertaken to conform to the natural occurring patterns within the channel and to be suitable for the planform pattern
- This alternative will address all identified erosion issues and erosion mechanisms. The focus would be on reducing flow energy and increasing floodplain connectivity.

Alternatives – Geomorphic Assessment

Criteria	Alternative 1 (Do Nothing)	Alternative 2 (Channel Bed / Profile Enhancements)	Alternative 3 (Channel Capacity / Floodplain Connectivity)	Alternative 4 (Channel Realignment)
Technical (25%)				
Environmental (25%)				
Socio-economic (20%)				
Cost (15%)				
Constructability (15%)				
Overall Score				

Recommend hybrid alternative solution at this stage including Alternatives 2 and 3



City of Brantford
Public Information Centre

Extents of Creek Rehabilitation

City of Brantford
Public Information Centre

Next Steps

- ❑ Finalize preferred alternative design considering public feedback
- ❑ Complete Project File Report
- ❑ Notice of Completion and 30-day public review period
- ❑ Detailed design, tendering and construction

Project Contacts

Please complete a Comment Sheet and return it to Chris Moon by December 14, 2020.

Should you have any questions or concerns at any time during the project, please contact either of the following people:

Chris Moon, P. Eng
Senior Project Manager
Ecosystem Recovery Inc.
350 Ridout Street South
London, Ontario N6C 3Z6
Phone: 519-859-8438
Email: chris.moon@ecosystemrecovery.ca

Nahed Ghbn
Senior Project Manager
Water Resources
City of Brantford
100 Wellington Square, P.O. Box 818
Phone: 519-759-4150
Email: NGhbn@brantford.ca

400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6

Phone: 519.621.2761 **Toll free:** 866.900.4722 **Fax:** 519.621.4844 **Online:** www.grandriver.ca

December 14, 2020

Nahed Ghbn, Senior Project Manager
City of Brantford
nghbn@brantford.ca

Chris Moon, Senior Project Manager
Ecosystem Recovery Inc.
chris.moon@ecosystemrecovery.ca

Re: Notice of Study Commencement
Braneida Stormwater Management Facility Retrofit and
Downstream Channel Remediation
Schedule 'B' Municipal Class Environmental Assessment (EA)
City of Brantford
GRCA File Number: W.89.144

Dear Mr. Ghbn and Mr. Moon,

The Grand River Conservation Authority (GRCA) is in receipt of your Notice of Study Commencement for the retrofit of the existing Braneida Stormwater Management Facility (SWMF) and remediation of the erosion hazard of the downstream channel. The existing Braneida SWMF was constructed in the 1990s and does not meet current standards. The proposed retrofits will provide for water quality and quantity control in compliance with current provincial standards. The study is intended to identify and evaluate retrofit alternatives and downstream watercourse rehabilitation opportunities. The GRCA wishes to participate in this study.

Features of interest to the GRCA exist within the study area. These features include tributaries to Fairchild Creek, associated floodplains, valleylands and erosion hazards as well as wetlands.

GRCA staff offers the following advisory comments at the outset of the EA process so they might be considered during the process and incorporated into the final design:

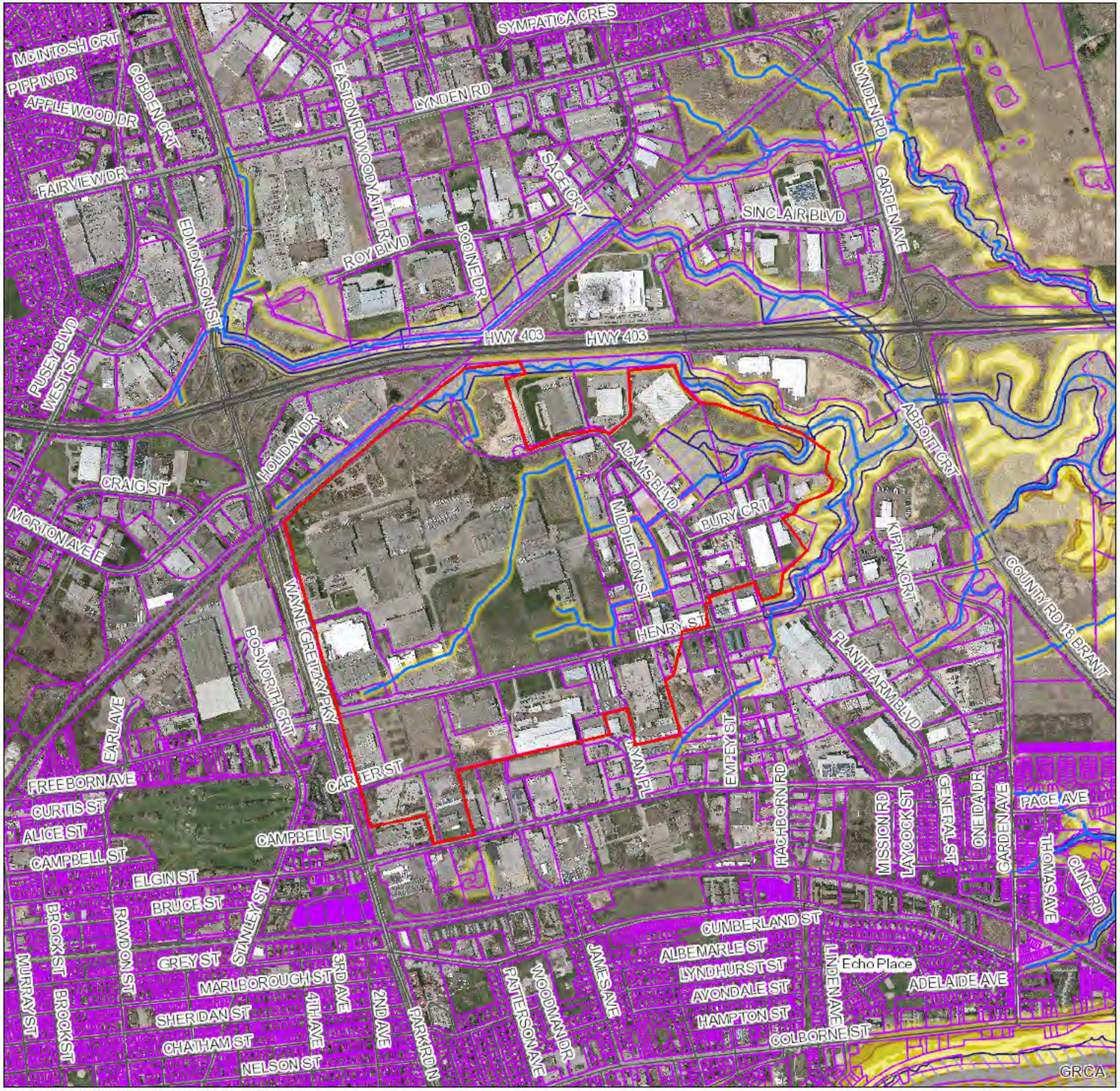
- As part of the EIS, please include details regarding the natural heritage features and the proposed SWM design;
- The extent of the downstream wetland appears to be larger than is currently mapped. The wetland boundaries should be confirmed as part of the EIS process;
- Protection and enhancements of the adjacent natural heritage features (i.e. wetland and watercourse) should be incorporated into the preferred design where possible;
- It is recommended that all of the 'Channel Remediation Alternatives' include aspects of streambank naturalization and planting of native species.

The Grand River Conservation Authority is interested in continuing our involvement with this project. We look forward to an opportunity to review and provide comment on the proposals for the solutions, design concepts and mitigation measures.

If you have any questions or concerns regarding this letter, please do not hesitate to contact the undersigned.

Sincerely,

Ashley Graham
Resource Planner - Grand River Conservation Authority
519-621-2763 ext. 2236 | agraham@grandriver.ca



Map Centre (UTM NAD83 z17): 562,670 53 4,778,932.79

This map is not to be used for navigation | 2015 Ortho (ON) | 2017 Ortho (Brant)

Grand River Conservation Authority

Date: Dec 11, 2020
Author: AG

Braneida SWMF, Brantford

EA

Legend

- Regulation Limit (GRCA)
- Regulated Watercourse (GRCA)
- Regulated Waterbody (GRCA)
- Wetland (GRCA)
- Floodplain (GRCA)
  - Engineered
  - Estimated
  - Approximate
  - Special Policy Area
- Slope Valley (GRCA)
  - Steep
  - Oversteep
  - Steep
- Slope Erosion (GRCA)
  - Oversteep
  - Toe
- Lake Erie Flood (GRCA)
- Lake Erie Shoreline Reach (GRCA)
- Lake Erie Dynamic Beach (GRCA)
- Lake Erie Erosion (GRCA)
- Parcel - Assessment (MPAC/MNRF)

This legend is static and may not fully reflect the layers shown on the map. The text of Ontario Regulation 150/06 supercedes the mapping as represented by these layers.

The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to: https://maps.grandriver.ca/Sources-and-Citations.pdf

0 120 240 480 720 Metres

N

NAD 1983 UTM Zone 17N

Scale: 20,000

Record of Communications

Six Nations of the Grand River

Robin Linn
rlinn@sixnations.ca

519-753-0665 ext. 5433

Mississaugas of the New Credit:

Fawn D. Sault
fawn.sault@newcreditfirstnation.com
Office - 905-768-4260
Cell – 289-527-6580

City of Brantford sent Notice of Commencement and Virtual PIC via email as they were on the Agency Contact List (see email)

Alana sent a separate email to both contacts on December 1, 2020 to confirm they received the Notice.

Robbin replied with a letter requesting further consultation, Chris reached out to set up a call.

Alana called Fawn's office and cell numbers, no answer. Left a message on office number requesting confirmation of receipt of the email with the Notice, and if they have further questions or concerns they can contact Chris (provided Chris' number).

Received email from Fawn later the same day (Dec. 1) acknowledging receipt of the Notice.

RE: Braneida Notice of Commencement and Virtual PIC

Chris Moon <chris.moon@ecosystemrecovery.ca>

Tue 12/1/2020 12:28 PM

To: Robin Linn <rlinn@sixnations.ca>; Alana Vandersluis <alana.vandersluis@ecosystemrecovery.ca>; Lonny Bomberry <lonnybomberry@sixnations.ca>; Jen Mt.Pleasant <jenmtpleasant@sixnations.ca>; Phil Monture (nativelandsltd@gmail.com) <nativelandsltd@gmail.com>
Cc: Nahed Ghbn <NGhbn@brantford.ca>

Hi Robin,

We appreciate the quick response.

What's your schedule like this week for a call to discuss?

Thank You,

Chris Moon, P.Eng. | Senior Project Manager **|** Cell: (519) 859-8438

From: Robin Linn <rlinn@sixnations.ca>
Sent: December 1, 2020 12:18 PM
To: Alana Vandersluis <alana.vandersluis@ecosystemrecovery.ca>; Lonny Bomberry <lonnybomberry@sixnations.ca>; Jen Mt.Pleasant <jenmtpleasant@sixnations.ca>; Phil Monture (nativelandsltd@gmail.com) <nativelandsltd@gmail.com>
Cc: Chris Moon <chris.moon@ecosystemrecovery.ca>; Nahed Ghbn <NGhbn@brantford.ca>
Subject: RE: Braneida Notice of Commencement and Virtual PIC

Please find attached our response letter to this notification.

Thank you.

From: Alana Vandersluis <alana.vandersluis@ecosystemrecovery.ca>
Sent: December 1, 2020 10:37 AM
To: Robin Linn <rlinn@sixnations.ca>
Cc: Chris Moon <chris.moon@ecosystemrecovery.ca>; Nahed Ghbn <NGhbn@brantford.ca>
Subject: Braneida Notice of Commencement and Virtual PIC

Hi Robin,

I just wanted to confirm that you have received the Notice of Commencement and Virtual Public Information Centre for the Braneida Stormwater Management Facility Retrofit and Downstream Channel Remediation Municipal Class Environmental Assessment, located in Brantford. I have attached the Notice for your reference.

Please let us know if you have any specific questions or concerns regarding the project. I have cc'ed the project managers from both the City of Brantford and ERI on this email.

Thanks!

Alana

Alana Vandersluis, EIT

Water Resources Engineering Intern

Ecosystem Recovery Inc.

80 Courtland Ave. East, Unit 2

Kitchener, Ontario, N2G 2T8

Tel: (519) 621-1500 | Fax: (226) 240-1080

www.ecosystemrecovery.ca

RE: Braneida Notice of Commencement and Virtual PIC

Fawn Sault <Fawn.Sault@mncfn.ca>

Tue 12/1/2020 2:03 PM

To: Alana Vandersluis <alana.vandersluis@ecosystemrecovery.ca>
Cc: Chris Moon <chris.moon@ecosystemrecovery.ca>; Nahed Ghbn <NGhbn@brantford.ca>; Mark LaForme <Mark.LaForme@mncfn.ca>

Good Afternoon Alana,

Thank you for the notification.

Fawn Sault
Consultation Coordinator
Mississaugas of the Credit First Nation
4065 Hwy. 6, Hagersville, N0A 1H0
Website: http://mncfn.ca/
Ph: 905-768-4260
Cell:289-527-6580

From: Alana Vandersluis <alana.vandersluis@ecosystemrecovery.ca>
Sent: Tuesday, December 1, 2020 10:37 AM
To: Fawn Sault <Fawn.Sault@mncfn.ca>
Cc: Chris Moon <chris.moon@ecosystemrecovery.ca>; Nahed Ghbn <NGhbn@brantford.ca>
Subject: Braneida Notice of Commencement and Virtual PIC

Hi Fawn,

I just wanted to confirm that you have received the Notice of Commencement and Virtual Public Information Centre for the Braneida Stormwater Management Facility Retrofit and Downstream Channel Remediation Municipal Class Environmental Assessment, located in Brantford. I have attached the Notice for your reference.

Please let us know if you have any specific questions or concerns regarding the project. I have cc'ed the project managers from both the City of Brantford and ERI on this email.

Thanks!

Alana

Alana Vandersluis, EIT

Water Resources Engineering Intern

Ecosystem Recovery Inc.

80 Courtland Ave. East, Unit 2

Kitchener, Ontario, N2G 2T8

Tel: (519) 621-1500 | Fax: (226) 240-1080

www.ecosystemrecovery.ca

Alana Vandersluis

[redacted]

Sent:
To:
Cc:
Subject:

Thank you. My interest is from the perspective of having current and future development projects in the City delayed due to site development being restricted pending SWM approval related to issues solely in the control of the City and other government jurisdictions having authority over the matter of SWM.

On 2020-12-02 11:12 a.m., Nahed Ghbn wrote:

> Hello [redacted],
> We have more several old ponds without documents available. I can't remember how many exactly. However, we are following up with the ministry to find these documents or to issue an ECA as part of their restoration process in future.
> Thanks,
> Nahed
>
> **Nahed Ghbn, PMP, P.Eng.**
> Senior Project Manager, Water Resources
> Engineering Services- Public Works Commission
> City of Brantford
>
> City Hall, 100 Wellington Square, Brantford, N3T 2M2
> Mailing Address: P.O. Box 818, Brantford, N3T 5R7
> Phone: (519) 759-4150 Fax: (519) 752-6775
> Email: nghbn@brantford.ca www.brantford.ca
>
> ---
>
> **From:** [redacted]
> **Sent:** December-02-20 10:34 AM
> **To:** Chris Moon
> **Cc:** Alana Vandersluis; Nahed Ghbn
> **Subject:** Re: Braneida SWMF virtual PIC
>
> Thank you for the reply Chris. I believe that you have provided sufficient detail and I don't think there is any need for additional clarification.
> I recognize that my question "how many other SWMF sites does the City have that do not have the appropriate approvals?" is outside the scope of your engagement with the City so I will leave it for City staff to respond to it.

Regards,
[redacted]

On 2020-12-01 9:31 a.m., Chris Moon wrote:

Hello [redacted],

Thank you for your comments regarding the Braneida SWMF EA study. The Project Team appreciates you taking the time to review the EA documentation and providing comments accordingly. This study is carried out following the requirements of the Municipal Class Environmental Assessment (Class EA) process. The content and format of the EA study components meet these requirements.

Please see below our responses to your questions, in green:

In the introductory slides it is stated that the current SWMF does not meet approval criteria for a facility of this type WRT current ministry guidelines/requirements. Is it necessary for this facility meet the current ministry guidelines/requirements and obtain the appropriate approvals? In owning and operating SWMFs the City of Brantford has a legal obligation under the Ontario Water Resources Act (OWRA). These obligations are typically outlined in an Environmental Compliance Approval (ECA) issued by the Ministry of Environment Conservation and Parks (MECP). In the absence of an ECA, as is the case for the Braneida SWMF, the MECP may still order the City to maintain, repair or operate the SWMF in a specific manner. The City may also face liability under common law should they fail to maintain a SWMF and property damage occurs.

It is best practice and the City's objective to have an ECA that clearly outlines these obligations for the Braneida SWMF. In obtaining an ECA the MECP requires that best efforts are made to meet current standards understanding the practical constraints that may be applied to a retrofit.

If yes, why bother to include the 'do nothing' alternative in the option comparison as the City is obligated to do something? The 'do nothing' alternative is included in all Class Environmental Assessments as a baseline comparison. It is possible that in the balance of evaluating alternatives that the do nothing alternative is selected as the recommended preferred alternative.

If yes, how many other SWMF sites does the City have that do not have the appropriate approvals? Reviewing the permit status of all of the City's SWMF sites is outside of the scope of the current Class Environmental Assessment. As such, unfortunately I'm unable to answer this question at this time.

If no, what are the reasons for considering this project at this time? The project will facilitate issuance of an ECA and ensure that the City's legal obligations are being met. It will also provide an opportunity to improve the function of the SWMF and provide a downstream stormwater quality and erosion control benefit.

I would be happy to discuss this further if you would like additional details, please feel free to reach out and we can set up a time for a phone call.

Thank you,

Chris Moon, P.Eng.
Senior Project Manager
Cell: (519) 859-8438

Ecosystem Recovery Inc.

350 Ridout Street South
London, Ontario, N6C 3Z5
www.ecosystemrecovery.ca

From: [redacted]
Date: November 30, 2020 at 7:01:53 PM EST
To: Nahed Ghbn <NGhbn@brantford.ca>
Subject: Braneida SWMF virtual PIC

Comments from [redacted]

In the introductory slides it is stated that the current SWMF does not meet approval criteria for a facility of this type WRT current ministry guidelines/requirements. Is it necessary for this facility meet the current ministry guidelines/requirements and obtain the appropriate approvals

If yes, why bother to include the 'do nothing' alternative in the option comparison as the City is obligated to do something?

If yes, how many other SWMF sites does the City have that do not have the appropriate approvals?

If no, what are the reasons for considering this project at this time?

Thank you

__
[redacted]

your system. We do not guarantee that this material is free from viruses or any other defects although due care has been taken to minimize the risk. Any views expressed in this message are those of the individual sender, except where the sender specifically states them to be the views of The Corporation of the City of Brantford.

BRANEIDA STORMWATER MANAGEMENT FACILITY RETROFIT AND CHANNEL REMEDIATION
Virtual Public Information Centre
Comment Sheet

Name: [redacted] Email: [redacted]

Address: [redacted]

1. Do you have any additional information regarding the existing conditions you would like to share with the project team?

a) Much of the study area downstream of the STMP is now called the New Forest in the City. The project began in 2012 has seen the community plant over 65,000 native trees and shrubs on the property. As well five bridges were installed. At some point, Brantford Parks and Recreation will open this natural area to the public.

b) Electrofishing was conducted by the MOE staff. I have a copy if you are interested.

c) In late winter, a local company (GFL) had a chemical spill upstream that resulted in a remediation effort just downstream of the culvert. Many trees were removed or destroyed during the remediation. the company has made an obligation to pay for 150 native trees and shrubs. The replanting was to take place in spring 2021. GRCA has provided a quote.

d) just so you know, the area of the creek designated for remediation was a potential area for infill planting in 2021.

e) Ontario Hydro has removed the power lines from the area and has no intention of using the existing towers in the future.

e) Was Brantford Parks and Recreation consulted?

2. Do you have any comments / preference / concerns regarding the potential solutions?

a) I personally like the option selected. I know that bank erosion in the channel area scheduled for remediation is extensive.

b) Regarding the remediation of the channel, will this remediation result in removal of many trees planted by the public and will the planting of new trees be only native trees and shrubs? If so, how many?

c) will you be planting only native trees and shrubs around the SWMP? If so, how many? I have previously advised Nahed, that the Brant Tree Coalition could possibly assist in this.

d) the study area includes areas upstream of the SWMP. Will there be any remediation work done of these feeder creeks?

e) Was this project going to plant the area of the chemical spill remediation with native trees and shrubs and should the remedial planting by the company that had the spill be cancelled?

3. Do you have any comments regarding the study?

a) I would be interested in getting copies of the SARS report and the areas of fish population upstream of the SWMP.

b) When do you feel construction will be completed, if it begins in the summer 2021?

c) I would welcome the opportunity to tour the site with either Chris or Nahed to gain a better understanding.

Thank you for taking the time to complete this comment sheet! Please return the completed comment sheet by **December 14th, 2020**

Nahed Ghbn P.Eng, City of Brantford

City Hall, 100 Wellington Square, Brantford, Ontario N3T 2M2

Tel: 519-759-4150 ext. 5262

By Email: nghbn@brantford.ca

chris.moo@ecosystemrecovery.ca

Project – "New Forest in the City" Restoration Project (revision – April 2016)

Vision 2012– create a 78 acre (31.6 hectare) native tree forest within the City of Brantford for future generations that sees the rejuvenation of three natural streams.

Background – several creeks run through the Braneida Phase 9 North East Industrial area of Brantford. (The area is bounded by Hwy#403 - north, Garden Ave. - east, Henry Street - south and Adams Blvd - west.) Theses creeks join into Sinclair Creek which eventually empties into Fairchild Creek which in turn joins the Grand River. The lands bordering the streams are exempt from development and the property of the City of Brantford.

According to the Land Registry office, the land consisted of two main lots. Part Lot 41 (conc. 3) and Part Lot 42, Conc. 3. A portion of Lot 42 received "patent" in the name of John Cole in February of 1850 while a the second portion of Lot 42 received "patent" in the name of John Cole in 1864. The other lot, Lot 41, received patent in July of 1864 in the name of John Cole. It is likely the lots were farmed for more than 125 years.
The City purchased Part Lot 42 in 1974 and Part Lot 41 on March 1999 for the creation of an industrial park.

Prior to development as an industrial park, a Storm Water Management Report of the area was conducted by Westlake Inc. (Oct. 1999) that looked at some of the Environmental aspects of the area. The assessment noted earlier fish habitat assessments conducted by C. Portt and Associates in 1992 and a follow up assessment of habitat conditions in 1999 by Ecoplans Ltd. These studies revealed the presence of aquatic life in the streams and various mammals and plant species.
A brief walk in the area in November of 2010 revealed the presence of coyotes, moles, rabbits, small fish in the water and a Red tailed hawk surveying for game.

Project – the Brant Tree Coalition (a collaborative group consisting of representatives from industry, the public and government) with the support of the community will embark on a 5 year restoration project and create a new native forest in the City.
Experts from the Grand River Conservation Authority, Ministry of Natural Resources and City of Brantford Urban Forestry group will provide guidance for the project.

Volunteers (primarily high school students, community groups and industry representatives) will be invited to plant trees in the spring and fall.
Only native trees will be utilized and where possible, having local genetic provenance.

Benefits

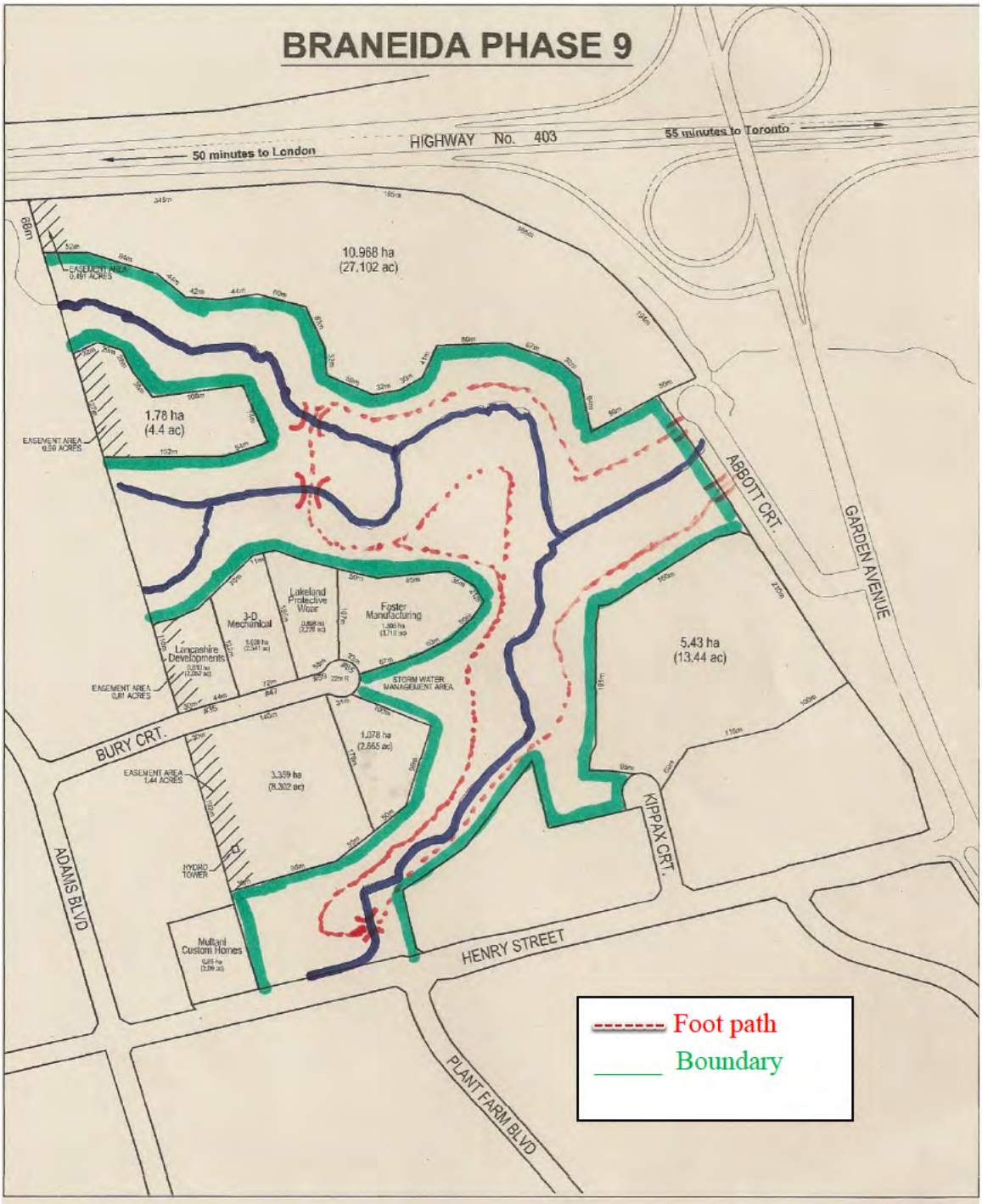
- students will experience a hands on environmental restoration project
- future biodiversity will be enhanced
- erosion will be reduced
- the tree canopy of Brantford will be increased
- water quality will be improved
- air quality will be improved

Funding

- **industry**
- **government**
- **foundations**

Promotion

- visit local industries
- community groups


BRANEIDA PHASE 9
50 minutes to London
HIGHWAY No. 403
55 minutes to Toronto
10.968 ha
(27,102 ac)
1.78 ha
(4.4 ac)
EASEMENT AREA
0.497 ACRES
EASEMENT AREA
0.56 ACRES
ABBOTT CRT.
GARDEN AVENUE
Lakeland Protective Wear
3-D Mechanical
Foster Manufacturing
Lancashire Developments
EASEMENT AREA
0.01 ACRES
STORM WATER MANAGEMENT AREA
5.43 ha
(13.44 ac)
BURY CRT.
1.078 ha
(2.665 ac)
EASEMENT AREA
1.44 ACRES
3.359 ha
(8.302 ac)
KIRPAX CRT.
ADAMS BLVD
HYDRO TOWER
Mullard Custom Homes
HENRY STREET
PLANT FARM BLVD
Foot path
Boundary

Alana Vandersluis

Sent:
To: [redacted]
Cc:
Subject:

Good afternoon [redacted],

We have summarized your questions below and provided responses. Please let us know if you have any further questions!

Question 1) Was Brantford Parks and Recreation consulted?
Yes, the City's project team had consulted with the City partners including Parks and Recreation

Question 2) Will the remediation of the channel result in removal of many trees planted by the public and will the planting of new trees be only native trees and shrubs? If so, how many?
The limits for the proposed SWMF retrofit and channel remediation have been designed to protect, where feasible, the existing natural heritage features within the study area. This includes the protection of The Garden Avenue Tributary and its associated riparian communities as well as the meadow communities located east of the SWMF. For this reason, potential impacts have been limited to those areas absolutely necessary to accommodate the SWMF retrofit reducing the overall impacts. Only native species will be used for the restoration of the site. The number of plantings that will be implemented will be determined during the detailed design phase, which will commence after the completion of the Municipal Class Environmental Assessment.

Question 3) Will you be planting only native trees and shrubs around the SWMP? If so, how many?
Any disturbed areas not permanently lost due to construction will be restored and replanted with native species as appropriate. The number of plantings that will be implemented will be determined during the detailed design phase, which will commence after the completion of the Municipal Class Environmental Assessment.

Question 4) The study area includes areas upstream of the SWMP. Will there be any remediation work done of these feeder creeks?
There is no remediation work planned as part of this project for the watercourses upstream of the SWMP.

Question 5) Was this project going to plant the area of the chemical spill remediation with native trees and shrubs and should the remedial planting by the company that had the spill be cancelled?
This project will involve replanting areas that are disturbed due to construction activities and will be limited to the SWMP boundary and the area of creek rehabilitation (shown in the PIC presentation). This is not anticipated to be in the direct area of the spill remedial planting, at this time it should not be cancelled.

Question 6) When do you feel construction will be completed, if it begins in the summer 2021?
Construction is expected to take ten weeks.

Question 7) would be interested in getting copies of the SARS report and the areas of fish population upstream of the SWMP.

Copies of the Environmental Assessment report will be available to the public upon completion of the study, which will include the Environmental Impact Study with general information on the species at risk (SAR) assessment and fisheries assessments. Prior to official completion of the EA, the full reports will be posted for a 30-day public review and comment period.

You indicated on the comment sheet that you have a copy of the results of the electrofishing that was conducted by the MOE. The project team would be interested in seeing these results if you can provide them.

Thanks,

Alana Vandersluis, EIT
Water Resources Engineering Intern

Ecosystem Recovery Inc.
80 Courtland Ave. East, Unit 2
Kitchener, Ontario, N2G 2T8
Tel: (519) 621-1500 | Fax: (226) 240-1080
www.ecosystemrecovery.ca

From: Nahed Ghbn <NGhbn@brantford.ca>
Sent: December 9, 2020 3:41 PM
To: [redacted] Chris Moon <chris.moon@ecosystemrecovery.ca>
Subject: RE: Comments on the Braneida Stormwater Management Facility Retrofit and Downstream Remediation EA

Thank you, [redacted] for your comments and information.
The Project Team appreciates you taking the time to review the PIC materials and providing comments accordingly. We will be following up as part of the EA process.
Regards,
Nahed

Nahed Ghbn, PMP, P.Eng.
Senior Project Manager, Water Resources
Engineering Services- Public Works Commission
City of Brantford

City Hall, 100 Wellington Square, Brantford, N3T 2M2
Mailing Address: P.O. Box 818, Brantford, N3T 5R7
Phone: (519) 759-4150 Fax: (519) 752-6775
Email: nghbn@brantford.ca www.brantford.ca

From: [redacted]
Sent: December-09-20 2:48 PM
To: chris.moo@ecosystemrecovery.ca; Nahed Ghbn
Cc: [redacted]
Subject: Comments on the Braneida Stormwater Management Facility Retrofit and Downstream Remediation EA

Chris and Nahed;

Comments attached and also the history of the New Forest Project.
Please let me know if you have any questions.
I would welcome a site visit.
[redacted]

Appendix C

Supplemental Geomorphic Documentation

Appendix C – Attachment 1

Historic Aerial Imagery

1964 Aerial Image (National Air Photo Library)

1982 Aerial Image (National Air Photo Library)

2006 Aerial Image (SWOOP)

Appendix C – Attachment 2

Photographic Inventory

Reach 1

Photo 1: Undercut bank with root exposure; exposed clay in bed and bank toe.

Photo 2: Low flow channel within clay bed; overhanging vegetation and exposed roots.

Photo 3: Gravel substrate deposited along channel bed.

Photo 4: Vegetation plantings (trees) compromised with ongoing channel bank erosion / slumping.

Photo 5: Sand and gravel deposits on the inner bend; exposed stiff clay on outer bend

Photo 6: Bank erosion and slumped bank material into the channel.

Reach 1

Photo 7: Erosion along channel bank toe.

Photo 8: Pedestrian bridge crossing.

Photo 9: Erosion protection failure under pedestrian bridge crossing; undercut bank.

Photo 10: Channel bank erosion and slumped material into channel.

Photo 11: Incision of channel from adjacent tablelands.

Photo 12: Sand bedforms deposited along channel bed.

Reach 2

Photo 1: Backwatered and vegetation dominated channel.

Photo 2: Multiple channel formations through larger wetland feature.

Reach 3

Photo 1: Downstream view of channelized / modified reach from Adams Boulevard.

Photo 2: Erosion blanket exposed on channel bed; grass, shrub, and tree vegetation surround channel.

Reach 3

Photo 3: Cable concrete lining on channel bed.

Photo 4: Backwatered conditions upstream of concrete weir.

Photo 5: Downstream view of concrete weir.

Photo 6: Downstream view of SWM facility embankment from concrete weir.

Photo 7: Backwatered conditions upstream of SWM facility embankment (double culvert).

Photo 8: Double culvert at SWM facility embankment.

Appendix D

Catchment Characteristics

Table E-1. Summary Catchment Characteristics for Existing Catchments (Major and Minor Flows)

				Minor				Major			
Catchment*	Area (ha)	Percent Impervious	Drainage Shed	Total Uncontrolled Drainage Area (ha)**	Downstream Catchment***	Total Percent Impervious (Uncontrolled)**	Total Percent Runoff (Uncontrolled)**	Total Uncontrolled Drainage Area (ha)**	Downstream Catchment***	Total Percent Impervious (Uncontrolled)**	Total Percent Runoff (Uncontrolled)**
101	39.63	80.0	Braneida SWMF	39.63	146	80.0	78.0	39.63	146	80.0	78.0
102	7.89	5.0	Braneida SWMF	7.89	146	5.0	33.0	7.89	146	5.0	33.0
103	8.71	10.0	Braneida SWMF	37.09	145	45.9	57.5	37.09	145	45.9	57.5
140	3.13	99.0	Braneida SWMF	17.88	103	53.8	62.3	3.13	103	99.0	89.4
141	0.55	99.0	Braneida SWMF	0.55	103	99.0	89.4	0.55	103	99.0	89.4
142	8.50	40.0	Braneida SWMF	8.50	140	40.0	54.0	8.50	143	40.0	54.0
143	6.26	50.0	Braneida SWMF	6.26	140	50.0	60.0	14.75	144	44.2	56.5
144	9.95	60.0	Braneida SWMF	9.95	103	60.0	66.0	24.70	103	50.6	60.4
145	12.72	90.0	Braneida SWMF	49.81	147	57.1	64.3	49.81	147	57.1	64.3
146	9.46	90.0	Braneida SWMF	56.98	147	71.3	72.8	56.98	147	71.3	72.8
147	2.26	80.0	Braneida SWMF	109.06	150	65.0	69.0	109.06	150	65.0	69.0
148	1.75	99.0	Braneida SWMF	1.75	150	99.0	89.4	1.75	150	99.0	89.4
149	0.92	99.0	Braneida SWMF	0.92	150	99.0	89.4	0.92	150	99.0	89.4
150	3.19	80.0	Braneida SWMF	114.91	152	66.2	69.7	114.91	152	66.2	69.7
151	9.36	60.0	Braneida SWMF	9.36	152	60.0	66.0	9.36	152	60.0	66.0
152	2.17	5.0	Braneida SWMF	126.44	154	64.7	68.8	126.44	154	64.7	68.8
104	16.71	25.0	External	16.71	-1	25.0	45.0	16.71	-1	25.0	45.0
105	0.99	5.0	External	0.99	-1	5.0	33.0	0.99	-1	5.0	33.0
153	9.08	80.0	External	9.08	-1	80.0	78.0	9.08	154	80.0	78.0
154	7.12	5.0	External	133.56	-1	61.5	66.9	142.64	-1	62.7	67.6
1001	0.82	50.0	On-site controls	0.00	1003	NA	NA	0.00	1003	NA	NA

1002	5.91	93.0	On-site controls	0.00	1003	NA	NA	0.00	1003	NA	NA
1003	5.63	93.0	On-site controls	0.00	102	NA	NA	0.00	102	NA	NA

*Catchments 1001, 1002, and 1003 have on-site controls for runoff for the 2-year through Regulatory event. Uncontrolled imperviousness and runoff coefficients are not calculated.

**'Total' indicates that the value is the cumulative and/or weighted value, considering all upstream catchments and the current catchment

***A downstream catchment of -1 indicates that this catchment outlets from the study area.

Table E-2. Summary Catchment Characteristics for Future Catchments (Major and Minor Flows)

				Minor				Major			
Catchment*	Area (ha)	Percent Impervious	Drainage Shed	Total Uncontrolled Drainage Area (ha)**	Downstream Catchment***	Total Percent Impervious (Uncontrolled)**	Total Percent Runoff (Uncontrolled)**	Total Uncontrolled Drainage Area (ha)**	Downstream Catchment***	Total Percent Impervious (Uncontrolled)**	Total Percent Runoff (Uncontrolled)**
140	3.13	99	Braneida SWMF	17.88	145	53.8	62.3	3.13	145	99.0	89.4
141	0.55	99	Braneida SWMF	0.55	145	99.0	89.4	0.55	145	99.0	89.4
142	8.50	40	Braneida SWMF	8.50	140	40.0	54.0	8.50	143	40.0	54.0
143	6.26	50	Braneida SWMF	6.26	140	50.0	60.0	14.75	144	44.2	56.5
144	9.95	60	Braneida SWMF	9.95	145	60.0	66.0	24.70	145	50.6	60.4
145	12.86	90	Braneida SWMF	41.24	147	67.2	70.3	41.24	147	67.2	70.3
147	2.26	80	Braneida SWMF	125.76	150	82.2	79.3	125.76	150	82.2	79.3
148	1.75	99	Braneida SWMF	1.75	150	99.0	89.4	1.75	150	99.0	89.4
149	0.92	99	Braneida SWMF	0.92	150	99.0	89.4	0.92	150	99.0	89.4
150	3.19	80	Braneida SWMF	131.61	152	82.5	79.5	131.61	152	82.5	79.5
151	9.36	60	Braneida SWMF	9.36	152	60.0	66.0	9.36	152	60.0	66.0
152	2.17	5	Braneida SWMF	143.14	154	79.9	77.9	143.14	154	79.9	77.9
346	9.72	90	Braneida SWMF	82.25	147	89.8	83.9	82.25	147	89.8	83.9
105	0.99	5	External	0.99	-1	5.0	33.0	0.99	-1	5.0	33.0
153	9.08	80	External	9.08	-1	80.0	78.0	9.08	154	80.0	78.0
154	7.12	5	External	150.26	-1	76.3	75.8	159.34	-1	76.5	75.9
301	19.63	93	Kylin Proposed SWMF	19.63	323	93.0	85.8	19.63	323	93.0	85.8
302	3.91	93	Kylin Proposed SWMF	3.91	324	93.0	85.8	3.91	324	93.0	85.8
303	3.72	93	Kylin Proposed SWMF	3.72	324	93.0	85.8	3.72	324	93.0	85.8

304	3.04	93	Kylin Proposed SWMF	3.04	324	93.0	85.8	3.04	324	93.0	85.8
305	5.53	93	Kylin Proposed SWMF	5.53	318	93.0	85.8	5.53	318	93.0	85.8
306	7.23	93	Kylin Proposed SWMF	7.23	318	93.0	85.8	7.23	318	93.0	85.8
307	1.62	93	Kylin Proposed SWMF	1.62	332	93.0	85.8	1.62	332	93.0	85.8
308	1.50	93	Kylin Proposed SWMF	1.50	330	93.0	85.8	1.50	330	93.0	85.8
309	2.44	93	Kylin Proposed SWMF	2.44	330	93.0	85.8	2.44	330	93.0	85.8
310	0.87	93	Kylin Proposed SWMF	0.87	331	93.0	85.8	0.87	331	93.0	85.8
311	3.14	93	Kylin Proposed SWMF	3.14	332	93.0	85.8	3.14	332	93.0	85.8
312	1.23	93	Kylin Proposed SWMF	1.23	325	93.0	85.8	1.23	325	93.0	85.8
313	1.21	93	Kylin Proposed SWMF	1.21	321	93.0	85.8	1.21	321	93.0	85.8
314	3.39	93	Kylin Proposed SWMF	3.39	320	93.0	85.8	3.39	320	93.0	85.8
315	2.45	93	Kylin Proposed SWMF	2.45	319	93.0	85.8	2.45	319	93.0	85.8
316	1.38	93	Kylin Proposed SWMF	1.38	321	93.0	85.8	1.38	321	93.0	85.8
317	3.25	93	Kylin Proposed SWMF	3.25	320	93.0	85.8	3.25	320	93.0	85.8
318	2.94	5	Kylin Proposed SWMF	72.53	346	89.8	83.9	72.53	346	89.8	83.9
319	0.50	99	Kylin Proposed SWMF	2.95	320	94.0	86.4	2.95	320	94.0	86.4

320	0.21	99	Kylin Proposed SWMF	9.79	321	93.4	86.1	9.79	321	93.4	86.1
321	0.38	99	Kylin Proposed SWMF	12.77	322	93.5	86.1	43.93	325	93.3	86.0
322	0.37	99	Kylin Proposed SWMF	13.14	323	93.7	86.2	31.16	321	93.2	85.9
323	0.03	99	Kylin Proposed SWMF	43.93	318	93.3	86.0	30.79	322	93.1	85.9
324	0.46	99	Kylin Proposed SWMF	11.13	323	93.2	85.9	11.13	323	93.2	85.9
325	0.54	99	Kylin Proposed SWMF	1.77	326	94.8	86.9	45.70	326	93.3	86.0
326	0.53	99	Kylin Proposed SWMF	2.29	318	95.8	87.5	46.23	318	93.4	86.0
329	0.30	99	Kylin Proposed SWMF	0.30	330	99.0	89.4	0.30	330	99.0	89.4
330	0.24	99	Kylin Proposed SWMF	4.48	331	93.7	86.2	4.48	331	93.7	86.2
331	0.23	99	Kylin Proposed SWMF	5.58	332	93.8	86.3	5.58	332	93.8	86.3
332	0.28	99	Kylin Proposed SWMF	10.61	318	93.6	86.2	10.61	318	93.6	86.2
1001	0.82	50	On-site controls	0.00	1003	NA	NA	0.00	1003	NA	NA
1002	5.91	93	On-site controls	0.00	1003	NA	NA	0.00	1003	NA	NA
1003	5.63	93	On-site controls	0.00	319	NA	NA	0.00	319	NA	NA

*Catchments 1001, 1002, and 1003 have on-site controls for runoff for the 2-year through Regulatory event. Uncontrolled imperviousness and runoff coefficients are not calculated.

**'Total' indicates that the value is the cumulative and/or weighted value, considering all upstream catchments and the current catchment

***A downstream catchment of -1 indicates that this catchment outlets from the study area.

Table E-3. Summary characteristics for Braneida Stormwater Facility in Consideration of Proposed Kylin Developments Stormwater Facility

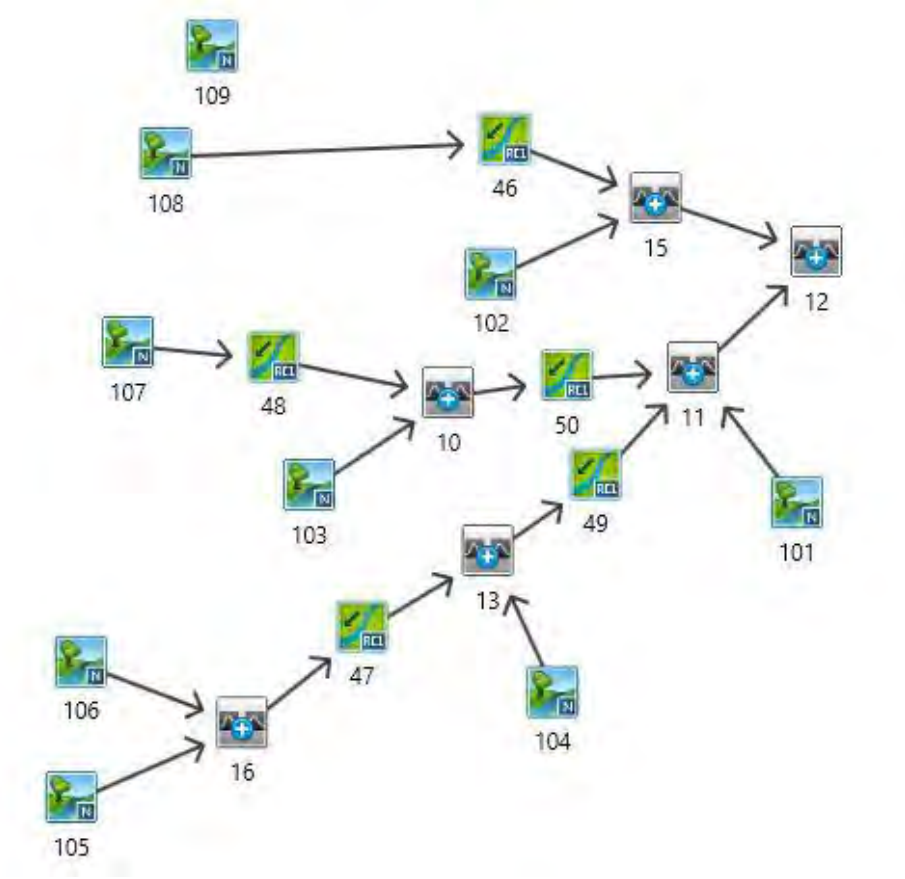
Braneida (exclusive of area treated by Kylin Proposed SWMF)			
Scenario	**Total Uncontrolled Drainage Area (ha)***	**Total Percent Impervious (Uncontrolled)***	**Total Percent Runoff (Uncontrolled)***
Existing	126.44	64.7	68.8
Future	70.61	69.7	71.8

**'Total' indicates that the value is the cumulative and/or weighted value, considering all upstream catchments and the current catchment

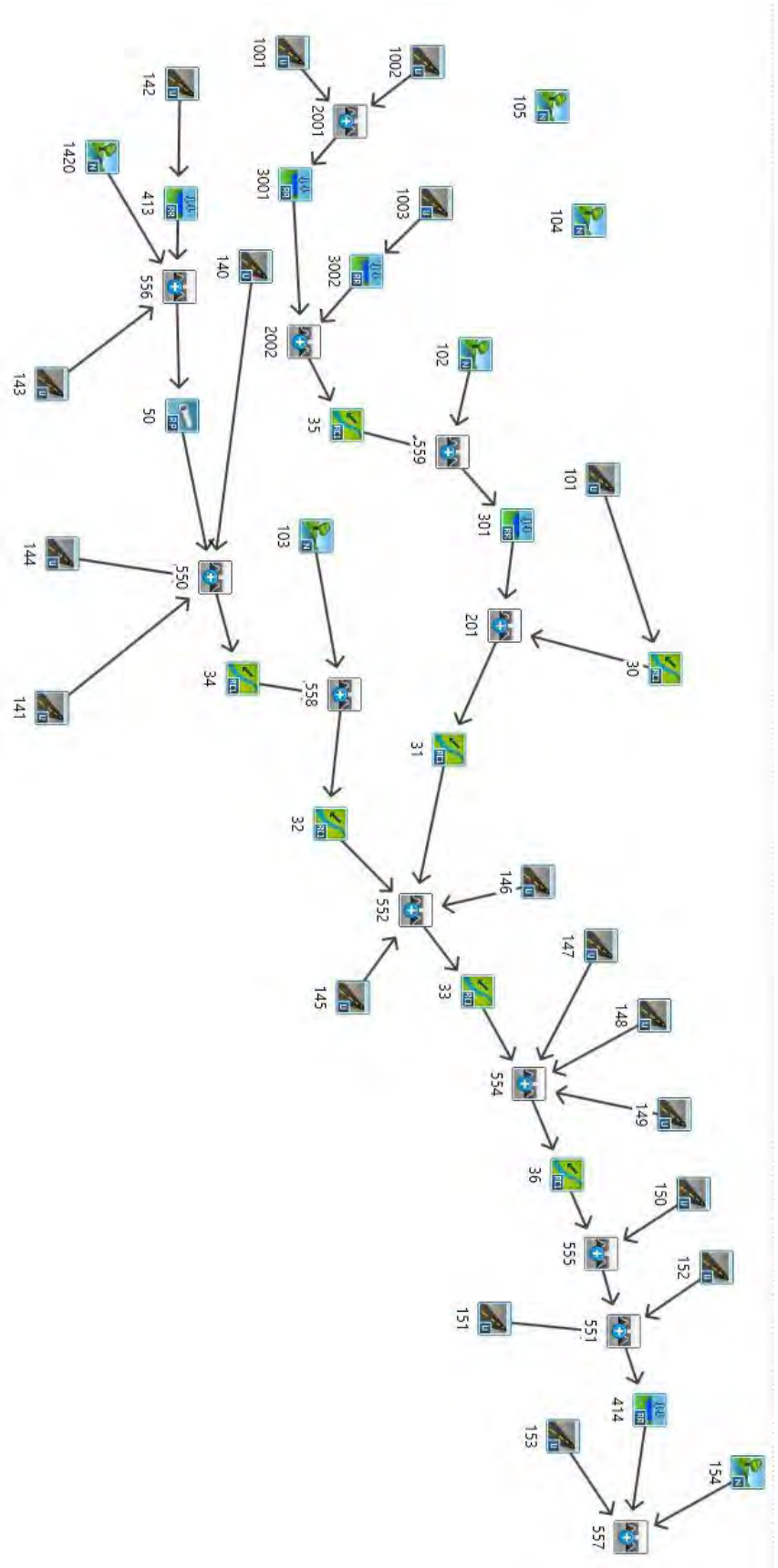
Appendix E

Visual OTTHYMO Schematics and Output

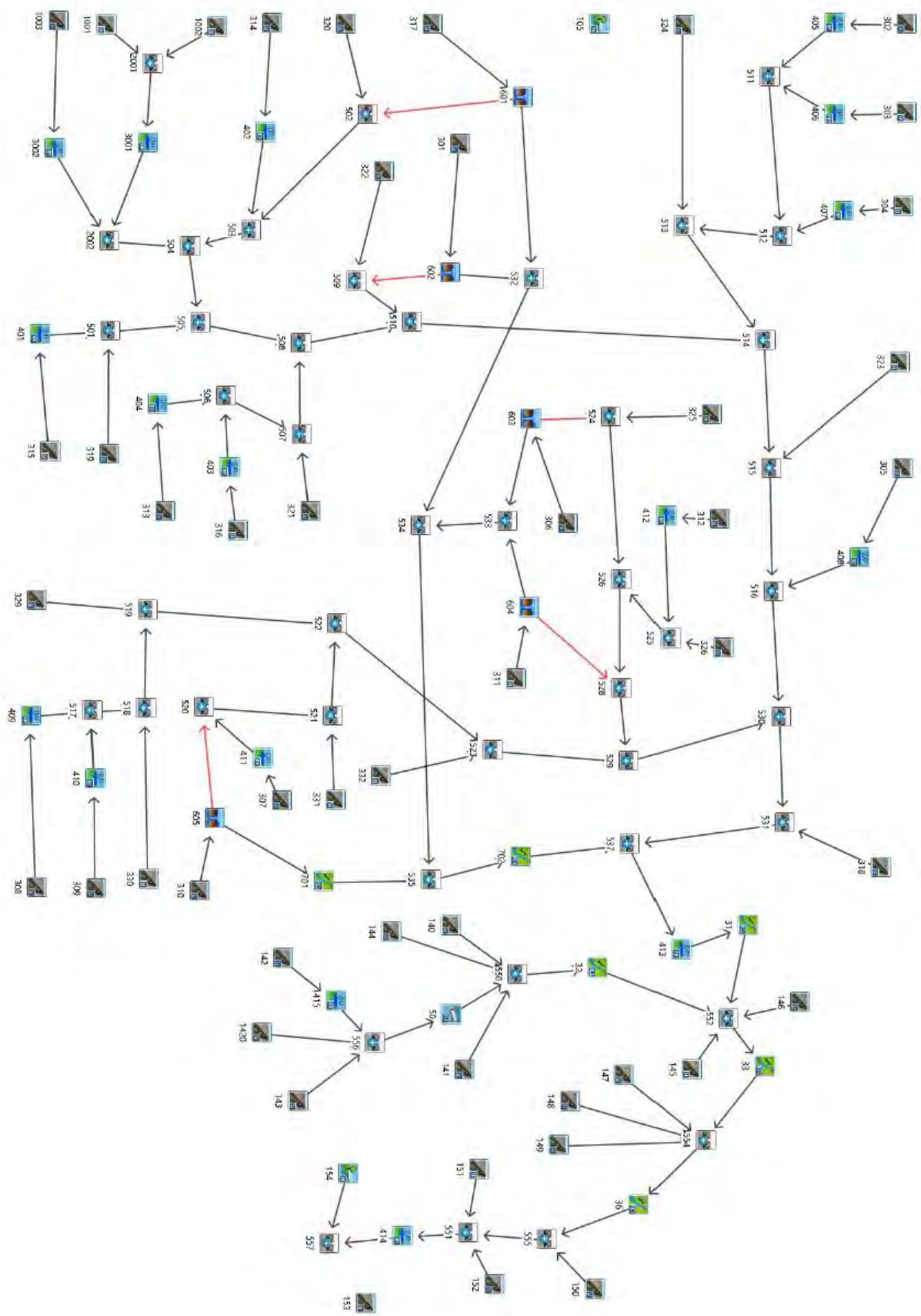
Predevelopment Greenfield/State of Nature Schematic:



Existing Conditions Schematic:



Ultimate Conditions Schematic:



```
*******************************
** SIMULATION:Run 01          **
*******************************

--------------------
| ADD HYD  (  0012)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):   102.70   0.401     2.58     3.66
      + ID2= 2 (  0015):    36.60   0.133     2.67     3.66
        ====================================================
        ID = 3 (  0012):   139.30   0.533     2.58     3.66

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 02          **
*******************************

--------------------
| ADD HYD  (  0012)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):   102.70   1.129     2.17     8.24
      + ID2= 2 (  0015):    36.60   0.387     2.33     8.23
        ====================================================
        ID = 3 (  0012):   139.30   1.508     2.17     8.23

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 03          **
*******************************

--------------------
| ADD HYD  (  0012)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):   102.70   3.311     2.08    20.12
      + ID2= 2 (  0015):    36.60   1.171     2.17    20.12
        ====================================================
        ID = 3 (  0012):   139.30   4.474     2.08    20.12

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 04          **
*******************************

--------------------
| ADD HYD  (  0012)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0011):   102.70   4.715     2.00    27.92
      + ID2= 2 (  0015):    36.60   1.684     2.17    27.92
        ====================================================
        ID = 3 (  0012):   139.30   6.383     2.08    27.92

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 05          **
*******************************

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

| ADD HYD (0012)|
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
---------- (ha) (cms) (hrs) (mm)
ID1= 1 (0011): 102.70 5.939 2.00 34.47
+ ID2= 2 (0015): 36.60 2.131 2.08 34.47
==========
ID = 3 (0012): 139.30 8.035 2.08 34.47

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

****
** SIMULATION:Run 06 **
****

| ADD HYD (0012)|
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
---------- (ha) (cms) (hrs) (mm)
ID1= 1 (0011): 102.70 7.253 2.00 41.37
+ ID2= 2 (0015): 36.60 2.611 2.08 41.36
==========
ID = 3 (0012): 139.30 9.817 2.00 41.36

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

****
** SIMULATION:Run 07 **
****

| ADD HYD (0012)|
| 1 + 2 = 3 | AREA QPEAK TPEAK R.V.
---------- (ha) (cms) (hrs) (mm)
ID1= 1 (0011): 102.70 10.418 10.50 144.63
+ ID2= 2 (0015): 36.60 3.803 10.50 144.63
==========
ID = 3 (0012): 139.30 14.222 10.50 144.63

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
*******************************
** SIMULATION:Run 01          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   6.5218      2.7025
                          0.7230     0.6050   |   8.3270      3.1752
                          3.1484     1.6425   |  17.0657      3.7300

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800      4.292      1.58      16.40
   OUTFLOW: ID= 1 (  0414)    138.800      1.515      2.83      16.40

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 35.30
                  TIME SHIFT OF PEAK FLOW         (min)= 75.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.9444

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 02          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   6.5218      2.7025
                          0.7230     0.6050   |   8.3270      3.1752
                          3.1484     1.6425   |  17.0657      3.7300

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800      7.720      1.42      25.58
   OUTFLOW: ID= 1 (  0414)    138.800      2.772      2.33      25.58

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 35.91
                  TIME SHIFT OF PEAK FLOW         (min)= 55.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.4824

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 03          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
```

DT= 5.0 min	OUTFLOW	STORAGE	OUTFLOW	STORAGE
	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	6.5218	2.7025
	0.7230	0.6050	8.3270	3.1752
	3.1484	1.6425	17.0657	3.7300

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0551)	138.800	12.490	1.42	36.42
OUTFLOW: ID= 1 (0414)	138.800	4.543	2.17	36.42

PEAK FLOW REDUCTION [Qout/Qin](%)= 36.38
TIME SHIFT OF PEAK FLOW (min)= 45.00
MAXIMUM STORAGE USED (ha.m.)= 2.0814

****
** SIMULATION:Run 04 **
****

RESERVOIR(0414)
IN= 2---> OUT= 1

DT= 5.0 min	OUTFLOW	STORAGE	OUTFLOW	STORAGE
	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	6.5218	2.7025
	0.7230	0.6050	8.3270	3.1752
	3.1484	1.6425	17.0657	3.7300

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0551)	138.800	15.848	1.42	44.22
OUTFLOW: ID= 1 (0414)	138.800	5.857	2.08	44.22

PEAK FLOW REDUCTION [Qout/Qin](%)= 36.96
TIME SHIFT OF PEAK FLOW (min)= 40.00
MAXIMUM STORAGE USED (ha.m.)= 2.4964

****
** SIMULATION:Run 05 **
****

RESERVOIR(0414)
IN= 2---> OUT= 1

DT= 5.0 min	OUTFLOW	STORAGE	OUTFLOW	STORAGE
	(cms)	(ha.m.)	(cms)	(ha.m.)
	0.0000	0.0000	6.5218	2.7025
	0.7230	0.6050	8.3270	3.1752
	3.1484	1.6425	17.0657	3.7300

```
                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     19.113      1.33      54.93
   OUTFLOW: ID= 1 (  0414)    138.800      7.739      2.08      54.93

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 40.49
                  TIME SHIFT OF PEAK FLOW         (min)= 45.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  3.0257

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 06          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   6.5218      2.7025
                          0.7230     0.6050   |   8.3270      3.1752
                          3.1484     1.6425   |  17.0657      3.7300

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     22.651      1.33      63.46
   OUTFLOW: ID= 1 (  0414)    138.800     10.784      1.92      63.46

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 47.61
                  TIME SHIFT OF PEAK FLOW         (min)= 35.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  3.3329

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 07          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   6.5218      2.7025
                          0.7230     0.6050   |   8.3270      3.1752
                          3.1484     1.6425   |  17.0657      3.7300

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     26.193      1.33      72.13
   OUTFLOW: ID= 1 (  0414)    138.800     14.095      1.83      72.12

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 53.81
```

```
                    TIME SHIFT OF PEAK FLOW         (min)= 30.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  3.5491

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 08          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   6.5218      2.7025
                          0.7230     0.6050   |   8.3270      3.1752
                          3.1484     1.6425   |  17.0657      3.7300

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     15.945     10.00     187.51
   OUTFLOW: ID= 1 (  0414)    138.800     15.113     10.17     187.51

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 94.78
                    TIME SHIFT OF PEAK FLOW         (min)= 10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  3.6066

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

```
********************************
** SIMULATION:Run 01          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   6.7600      4.0730
                          0.1400     1.3700   |   8.3600      4.5450
                          0.8900     1.9750   |  17.0700      5.1000
                          3.3600     3.0130   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800      4.292      1.58      16.40
   OUTFLOW: ID= 1 (  0414)    138.800      0.597      4.25      16.37

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 13.92
                    TIME SHIFT OF PEAK FLOW         (min)=160.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.7391

--------------------------------------------------------------------------------
********************************
** SIMULATION:Run 02          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   6.7600      4.0730
                          0.1400     1.3700   |   8.3600      4.5450
                          0.8900     1.9750   |  17.0700      5.1000
                          3.3600     3.0130   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800      7.720      1.42      25.58
   OUTFLOW: ID= 1 (  0414)    138.800      1.561      3.08      25.55

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 20.23
                    TIME SHIFT OF PEAK FLOW         (min)=100.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  2.2575

--------------------------------------------------------------------------------
********************************
** SIMULATION:Run 03          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   6.7600      4.0730
                          0.1400     1.3700   |   8.3600      4.5450
                          0.8900     1.9750   |  17.0700      5.1000
                          3.3600     3.0130   |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     12.490      1.42      36.42
   OUTFLOW: ID= 1 (  0414)    138.800      2.991      2.67      36.39

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 23.95
                    TIME SHIFT OF PEAK FLOW         (min)= 75.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  2.8594

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

```
********************************
** SIMULATION:Run 04          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   6.7600      4.0730
                         0.1400     1.3700   |   8.3600      4.5450
                         0.8900     1.9750   |  17.0700      5.1000
                         3.3600     3.0130   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     15.848      1.42      44.22
   OUTFLOW: ID= 1 (  0414)    138.800      4.215      2.42      44.19

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 26.60
                    TIME SHIFT OF PEAK FLOW         (min)= 60.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  3.2797

--------------------------------------------------------------------------------
********************************
** SIMULATION:Run 05          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   6.7600      4.0730
                         0.1400     1.3700   |   8.3600      4.5450
                         0.8900     1.9750   |  17.0700      5.1000
                         3.3600     3.0130   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     19.113      1.33      54.93
   OUTFLOW: ID= 1 (  0414)    138.800      5.925      2.25      54.90

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 31.00
                    TIME SHIFT OF PEAK FLOW         (min)= 55.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  3.8149

--------------------------------------------------------------------------------
********************************
** SIMULATION:Run 06          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   6.7600      4.0730
                         0.1400     1.3700   |   8.3600      4.5450
                         0.8900     1.9750   |  17.0700      5.1000
                         3.3600     3.0130   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     22.651      1.33      63.46
   OUTFLOW: ID= 1 (  0414)    138.800      7.324      2.17      63.43

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 32.33
                    TIME SHIFT OF PEAK FLOW         (min)= 50.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  4.2428

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

```
*******************************
** SIMULATION:Run 07          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   6.7600      4.0730
                         0.1400     1.3700   |   8.3600      4.5450
                         0.8900     1.9750   |  17.0700      5.1000
                         3.3600     3.0130   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     26.193      1.33      72.13
   OUTFLOW: ID= 1 (  0414)    138.800      9.625      2.08      72.09

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 36.75
                    TIME SHIFT OF PEAK FLOW         (min)= 45.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  4.6301

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 08          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000   |   6.7600      4.0730
                         0.1400     1.3700   |   8.3600      4.5450
                         0.8900     1.9750   |  17.0700      5.1000
                         3.3600     3.0130   |   0.0000      0.0000

                                   AREA     QPEAK     TPEAK       R.V.
                                   (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    138.800     15.945     10.00     187.51
   OUTFLOW: ID= 1 (  0414)    138.800     15.049     10.17     187.46

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 94.38
                    TIME SHIFT OF PEAK FLOW         (min)= 10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  4.9716

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

```
********************************
** SIMULATION:Run 01          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   2.6230      2.7906
                          0.0477     0.3141   |   3.0471      2.9861
                          0.1156     0.6381   |   3.4928      3.1841
                          0.1573     0.9720   |   5.1276      3.3846
                          0.2435     1.3160   |   7.7537      3.5876
                          0.6221     1.6697   |  11.0347      3.7930
                          1.1707     2.0334   |  14.8510      4.0009
                          1.8450     2.4070   |  19.1336      4.2114

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    155.570      3.791      1.50      19.65
   OUTFLOW: ID= 1 (  0414)    155.570      0.210      5.33      19.51

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.54
                    TIME SHIFT OF PEAK FLOW         (min)=230.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.1827

--------------------------------------------------------------------------------
********************************
** SIMULATION:Run 02          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   2.6230      2.7906
                          0.0477     0.3141   |   3.0471      2.9861
                          0.1156     0.6381   |   3.4928      3.1841
                          0.1573     0.9720   |   5.1276      3.3846
                          0.2435     1.3160   |   7.7537      3.5876
                          0.6221     1.6697   |  11.0347      3.7930
                          1.1707     2.0334   |  14.8510      4.0009
                          1.8450     2.4070   |  19.1336      4.2114

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    155.570      7.014      1.33      30.09
   OUTFLOW: ID= 1 (  0414)    155.570      0.789      4.33      29.94

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 11.25
                    TIME SHIFT OF PEAK FLOW         (min)=180.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.7802

--------------------------------------------------------------------------------
********************************
** SIMULATION:Run 03          **
********************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   2.6230      2.7906
                          0.0477     0.3141   |   3.0471      2.9861
                          0.1156     0.6381   |   3.4928      3.1841
                          0.1573     0.9720   |   5.1276      3.3846
                          0.2435     1.3160   |   7.7537      3.5876
                          0.6221     1.6697   |  11.0347      3.7930
                          1.1707     2.0334   |  14.8510      4.0009
```

```
                          1.8450     2.4070   |  19.1336      4.2114

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    155.570     10.345      1.33      42.09
   OUTFLOW: ID= 1 (  0414)    155.570      1.952      3.92      41.94

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.87
                    TIME SHIFT OF PEAK FLOW         (min)=155.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  2.4598

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 04          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                        0.0000     0.0000   |   2.6230      2.7906
                        0.0477     0.3141   |   3.0471      2.9861
                        0.1156     0.6381   |   3.4928      3.1841
                        0.1573     0.9720   |   5.1276      3.3846
                        0.2435     1.3160   |   7.7537      3.5876
                        0.6221     1.6697   |  11.0347      3.7930
                        1.1707     2.0334   |  14.8510      4.0009
                        1.8450     2.4070   |  19.1336      4.2114

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    155.570     13.153      1.33      50.57
   OUTFLOW: ID= 1 (  0414)    155.570      2.904      3.42      50.42

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 22.08
                    TIME SHIFT OF PEAK FLOW         (min)=125.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  2.9204

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 05          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                        0.0000     0.0000   |   2.6230      2.7906
                        0.0477     0.3141   |   3.0471      2.9861
                        0.1156     0.6381   |   3.4928      3.1841
                        0.1573     0.9720   |   5.1276      3.3846
                        0.2435     1.3160   |   7.7537      3.5876
                        0.6221     1.6697   |  11.0347      3.7930
                        1.1707     2.0334   |  14.8510      4.0009
                        1.8450     2.4070   |  19.1336      4.2114

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    155.570     15.989      1.33      60.98
   OUTFLOW: ID= 1 (  0414)    155.570      4.784      2.83      60.83

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 29.92
                    TIME SHIFT OF PEAK FLOW         (min)= 90.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  3.3427

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 06          **
*******************************
```

```
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   2.6230      2.7906
                          0.0477     0.3141   |   3.0471      2.9861
                          0.1156     0.6381   |   3.4928      3.1841
                          0.1573     0.9720   |   5.1276      3.3846
                          0.2435     1.3160   |   7.7537      3.5876
                          0.6221     1.6697   |  11.0347      3.7930
                          1.1707     2.0334   |  14.8510      4.0009
                          1.8450     2.4070   |  19.1336      4.2114

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    155.570     18.842      1.33      69.32
   OUTFLOW: ID= 1 (  0414)    155.570      6.697      2.50      69.17

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 35.54
                    TIME SHIFT OF PEAK FLOW         (min)= 70.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  3.5071

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 07          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   2.6230      2.7906
                          0.0477     0.3141   |   3.0471      2.9861
                          0.1156     0.6381   |   3.4928      3.1841
                          0.1573     0.9720   |   5.1276      3.3846
                          0.2435     1.3160   |   7.7537      3.5876
                          0.6221     1.6697   |  11.0347      3.7930
                          1.1707     2.0334   |  14.8510      4.0009
                          1.8450     2.4070   |  19.1336      4.2114

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0551)    155.570     21.622      1.33      80.25
   OUTFLOW: ID= 1 (  0414)    155.570      9.615      2.17      80.10

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)= 44.47
                    TIME SHIFT OF PEAK FLOW         (min)= 50.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  3.7049

--------------------------------------------------------------------------------
*******************************
** SIMULATION:Run 08          **
*******************************
--------------------
| RESERVOIR(  0414)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   2.6230      2.7906
                          0.0477     0.3141   |   3.0471      2.9861
                          0.1156     0.6381   |   3.4928      3.1841
                          0.1573     0.9720   |   5.1276      3.3846
                          0.2435     1.3160   |   7.7537      3.5876
                          0.6221     1.6697   |  11.0347      3.7930
                          1.1707     2.0334   |  14.8510      4.0009
                          1.8450     2.4070   |  19.1336      4.2114

                                    AREA     QPEAK     TPEAK       R.V.
```

```
                                    (ha)      (cms)      (hrs)        (mm)
   INFLOW : ID= 2 (  0551)    155.570      16.520      10.00      199.38
   OUTFLOW: ID= 1 (  0414)    155.570      16.070      10.08      199.20

                     PEAK   FLOW   REDUCTION [Qout/Qin](%)= 97.28
                     TIME SHIFT OF PEAK FLOW          (min)=  5.00
                     MAXIMUM  STORAGE   USED        (ha.m.)=  4.0636

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

Appendix F

Environmental Impact Study

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

City of Brantford

Braneida Stormwater Management Facility Environmental Impact Study

January 2021

80 Courtland Avenue East, Kitchener, Ontario, N2G 2T8| 519.621.1500 | www.ecosystemrecovery.ca

Revision Log

Revision #	Revised By	Date	Issue / Revision Description

Ecosystem Recovery Signatures

Contributing Authors:

Jadine Krist, B.Sc.
Environmental Scientist

Jessica Piette, H.B.E.S.
Terrestrial Ecologist

Kierian Keele, B.Sc.
Terrestrial Ecologist/Certified Arborist

Reviewed by:

Chris Moon, P.Eng.

Senior Water Resources Engineer

Table of Contents

Page

List of Figures

List of Tables

Attachments

1 Introduction

The City of Brantford has retained Ecosystem Recovery Inc. (ERI) to complete an Environmental Impact Study for proposed retrofits to the existing Braneida Industrial Stormwater Management Facility (SWMF).

The existing Braneida Industrial SWMF was constructed in the 1990s and does not meet current MOE water quality and quantity control standards. Furthermore, there is no Environmental Compliance Approval (ECA) (formerly Certificate of Approval [C of A]) in place for the SWMF.

It should be noted that a portion of the study area is classified as an existing SWMF and therefore is identified as "sewage works" under the Ontario Water Resources Act (OWRA) and as such, does not constitute habitat (TRCA, CH2M, 2018). However, it is recognized that these facilities may support habitat or be inhabited by wildlife such as fish, turtles and amphibians that require consideration prior to retrofit and thus have been included in our natural environment assessment.

1.1 Study Area and Adjacent Land Use

The subject lands are approximately 20 ha in size and are bounded to the west by Adam's Boulevard, to the north by Highway 403, to the northeast by Abbott Court and to the south by several industrial buildings.

As illustrated on Schedule 4-1 of the City of Brantford's Official Plan (OP), a portion of these lands are identified as Floodway Policy Areas. This designation, as per section 10.2.7 of the OP, requires all development within these lands be subject to Site Plan Control and the Grand River Conservation Authority's (GRCA) Development, Interference with Wetlands and Alterations to Shoreline and Watercourses Regulation. The study area is presented on **Figure 1.**

1.2 Agency Consultation

A request for information regarding the study area was submitted to the Ministry of Natural Resources and Forestry (MNRF) Guelph District office on February 6th, 2019. GRCA was also first contacted on February 6th, 2019 with an information request. A request was sent to the Ministry of the Environment, Conservation and Parks (MECP) on April 30th, 2020. The following information was requested:

- Presence of natural areas (Environmentally Significant Areas, Provincially Significant Wetlands, ANSI, Provincial Parks, Conservation Reserves and Wildlife Management Areas);
- Natural area reports;
- Species at Risk occurrences and potential to occur;
- Identification of Restricted Species;
- Rare species occurrences (locally and provincially rare);
- In-water timing restrictions;
- Important commercial or recreational fisheries;
- Water quantity/quality data;
- Groundwater discharge areas;
- Watercourse names, thermal and flow regimes;
- Fish habitat sensitivity;
- Habitat information including specific locations;
- Fisheries management objectives/plans;
- Fish community records;
- Benthic Invertebrate data;
- Aboriginal fisheries; and
- Significant Wildlife Habitat (SWH) or wildlife use within the area.

Braneida SWM Facility

Figure 1
Study Area

Legend

- Study Area
- Study Area 120 m Buffer
- Watercourse

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 40 80 160
Meters

NAD 1983 UTM 17N	1:3,500
Project: 1839: Braneida SWM Facility Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021:

Document Path: E:\1839 - Braneida SWM Pond5 - GIS\01 MXD\Ecology Figures\1839_Study_Area_20210111.mxd

On February 27th, 2019, a response to the information request was received from MNRF. A GRCA response was received on February 7th, 2020 and final Terms of Reference was delivered to GRCA on May 23rd, 2020. MECP provided a response to the information request on November 23rd, 2020. A copy of all agency correspondence is presented in **Attachment A**.

1.3 Legislative Context

The proposed SWM Facility upgrades will require the consideration of federal, provincial, regional and local policies, legislation and regulations. The following table outlines the legislation, policies and regulations relevant to natural heritage features and functions as they relate to the proposed SWM Facility upgrades.

Table 1-1. Applicable Legislation

Level of Governance	Legislation	Policies/Regulations	Guidelines	Applicability to the Subject Lands	Considerations
Federal	Species at Risk Act (SARA)		N/A	SARA is a piece of federal legislation with the purposes of monitoring and protecting SAR, providing recovery strategies for Extirpated, Endangered or Threatened species, as well as managing species of special concern (Government of Canada, 2016). On private or provincially owned-lands, only aquatic species listed as Endangered, Threatened or Extirpated and migratory birds listed on Schedule 1 are protected under SARA, unless ordered by the Governor in Council or for those species that have critical habitat identified.	Environmental management recommendations should include timing windows for clearance and construction. Any migratory bird species listed on Schedule 1 where critical habitat has been identified requires consideration under SARA; however, should this species also be listed under *ESA* and provides equal or greater protection, the *ESA* take precedence.
	Fisheries Act (1985)	Fish Protection Policy Statement	N/A	The federal *Fisheries Act* was amended on June 21, 2019 to restore protections to fish and fish habitat. Habitat protection provisions came into force on August 28, 2019 that prohibit the Harmful Alteration, Destruction, or Disruption (HADD) of fish habitat. They also prohibit the death of fish.	A review of the DFO website indicates no Species at Risk or Critical habitat is identified for the study area.
	Migratory Bird Convention Act (*MBCA*) (1994)	Regulations Respecting the Protection of Migratory Birds	N/A	The Migratory Bird Convention Act affords protection to Bird listed under Article 1 of the Migratory Birds Convention.	Environmental management recommendations should include timing windows for clearance and construction.

Level of Governance	Legislation	Policies/Regulations	Guidelines	Applicability to the Subject Lands	Considerations
					Vegetation clearing should take place outside of the bird nesting period (April 1st to August 31st) to avoid contravention of the *MBCA*.
Provincial	Planning Act (1990)	Provincial Policy Statement (2005)	Natural Heritage Reference Manual (2010) Significant Wildlife Habitat Technical Guide (2000) Ecoregion Criterion Schedule 7E (2015)	The PPS, NHIC, SWH Technical Guide and Ecoregion Criterion Schedules outline protection of Natural Heritage Features within Ontario including Significant Wetlands, Woodlands, and Wildlife Habitat.	Natural Feature Delineation.
	Conservation Authorities Act (1990)	Ontario Regulation 150/06	Grand River Conservation Authority Policies for the Development, Interference, with Wetlands and Alterations to Shorelines and Water Courses Regulation. Environmental Impact Study Guidelines and Submission Standards for Wetlands	The study area falls within the Grand River Conservation Authority (GRCA) regulation limits. As such, any proposed development application will require review and input from the GRCA. The study area contains small features, such as wetlands, regulated by the Ontario *Conservation Authorities Act*, with the implementation of it falling under the GRCA's local Ontario Regulation 150/06.	The completion of the EIS is required to demonstrate that there will be no significant negative impacts to the Natural Heritage Feature present within the GRCA regulated lands that fall within the study area.
	Fish and Wildlife Act (1997)	N/A	N/A	The Fish and Wildlife Act affords protection for some species of birds, amphibians, reptiles and mammals in Ontario. Some bird species which are not afforded protection under the *MBCA* are afforded	Environmental management recommendations should include timing windows for clearance and construction. Vegetation clearing should take place outside of the

Level of Governance	Legislation	Policies/Regulations	Guidelines	Applicability to the Subject Lands	Considerations
				protection under the Fish and Wildlife Act, such as raptors.	bird nesting period (April 1st to August 31st) to avoid contravention of the Fish and Wildlife Act.
	Endangered Species Act (*ESA*) (2007)	Ontario Regulation 242/08 Ontario Regulation 230/08	N/A	The *ESA* and its associated regulations list Species at Risk (SAR) within Ontario and afford protection for species listed as Threatened or Endangered, as well as their habitat.	Potential impacts to candidate SAR bat habitat (treed communities) are posed by the proposed works. Tree removal to be conducted outside of the bat maternity roosting period (April 30 – October 1) to avoid additional *ESA* requirements. However, should removal of trees be required within the bat maternity roosting period, bat surveys should take place to avoid contravention of the *ESA*.
Municipal	City of Brantford Official Plan	Natural Heritage Policies are presented in Section 8 The Natural Heritage Features are shown on Schedules 3-1, 3-2, 3-3. Community Health and Safety: Floodplain is shown on Schedule 4-1 and Section 10.	N/A	The study area contains lands designated as Floodway Policy Areas.	Floodway Policy Lands are subject to Site Plan Control and to GRCA Ontario Regulation 150/06.

1.4 Physiography and Quaternary Geology

Physiography describes the physical characteristics of geographic landforms, including relief and substrate type. The Braneida SWM facility study area is encompassed entirely within the Norfolk Sand Plain physiographic region. This physiographic region extends from the central north shore of Lake Erie to the Niagara Escarpment near Guelph. It is a former delta characterized by relatively flat topography and light, sandy soils. The majority of the study area consists of glaciolacustrine deep water deposits, with some modern alluvial deposits on the lower eastern edge of the site (**Figure 2**).

Braneida SWM Facility

Figure 2
Surficial Geology

Legend

- Study Area
- Study Area 120 m Buffer
- Watercourse

Geologic Deposit

- Modern alluvium, unsubdivided
- Glaciolacustrine deep water sediments

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 40 80 160
Meters

NAD 1983 UTM 17N	1:3,500
Project: 1839: Braneida SWM Facility Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021:

Document Path: E:\1839 - Braneida SWM Pond5 - GIS\01 MXD\Ecology Figures\1839_Surficial_Geology_20210111.mxd

2 Natural Heritage Existing Conditions

Detailed field investigations were completed during the spring, summer and fall of 2019 and 2020 for the subject lands and surrounding 120 m study area buffer. These investigations identified the existing natural heritage, aquatic and terrestrial habitat features present within the study area. Field surveys were conducted during the appropriate field seasons to confirm relevant habitat features and species presence. Incidental wildlife observations were collected during all site visits. **Figure 3** presents the survey locations and the dates and locations of specific surveys are presented in **Table 2-1.**

Table 2-1. Field Investigation Information.

Field Investigation	Protocol	Date
Aquatic Habitat Assessment	Modified OSAP 2013	August 14th 2020
Ecological Land Classification	Lee et. al (2008)	June 24th and June 30th 2020
Vascular Flora and Fauna Inventory	Systematic search by ELC polygon	June 24th and August 19th, 2019 and June 24th and 30th 2020
Breeding Bird Survey	OBBA 2001	May 22nd and June 30th
SAR Survey and SWH Verification	MNRF, 2015	May 2nd, 10th, 27th and June 7th, 2019
Water Quality Monitoring		August 6th, 2020
Fish Community Survey	MNRF Protocols	August 6th, 2020

2.1 Water Quality

2.1.1 Background

Water quality and flow monitoring measurements were performed within each reach of the study area on August 6th, 2020. Water quality was monitored using a Horiba U-52 multiparameter meter, which measures pH, conductivity, dissolved oxygen (DO), oxidation reduction potential (ORP), turbidity, temperature, salinity, and total dissolved solids (TDS). Data collected was in accordance with Provincial Water Quality Objectives (PWQO).

Water Temperature

Water temperature is an important indicator of thermal regime within a waterbody and influences the fish species composition, benthic composition, and aquatic vegetation community. In general:

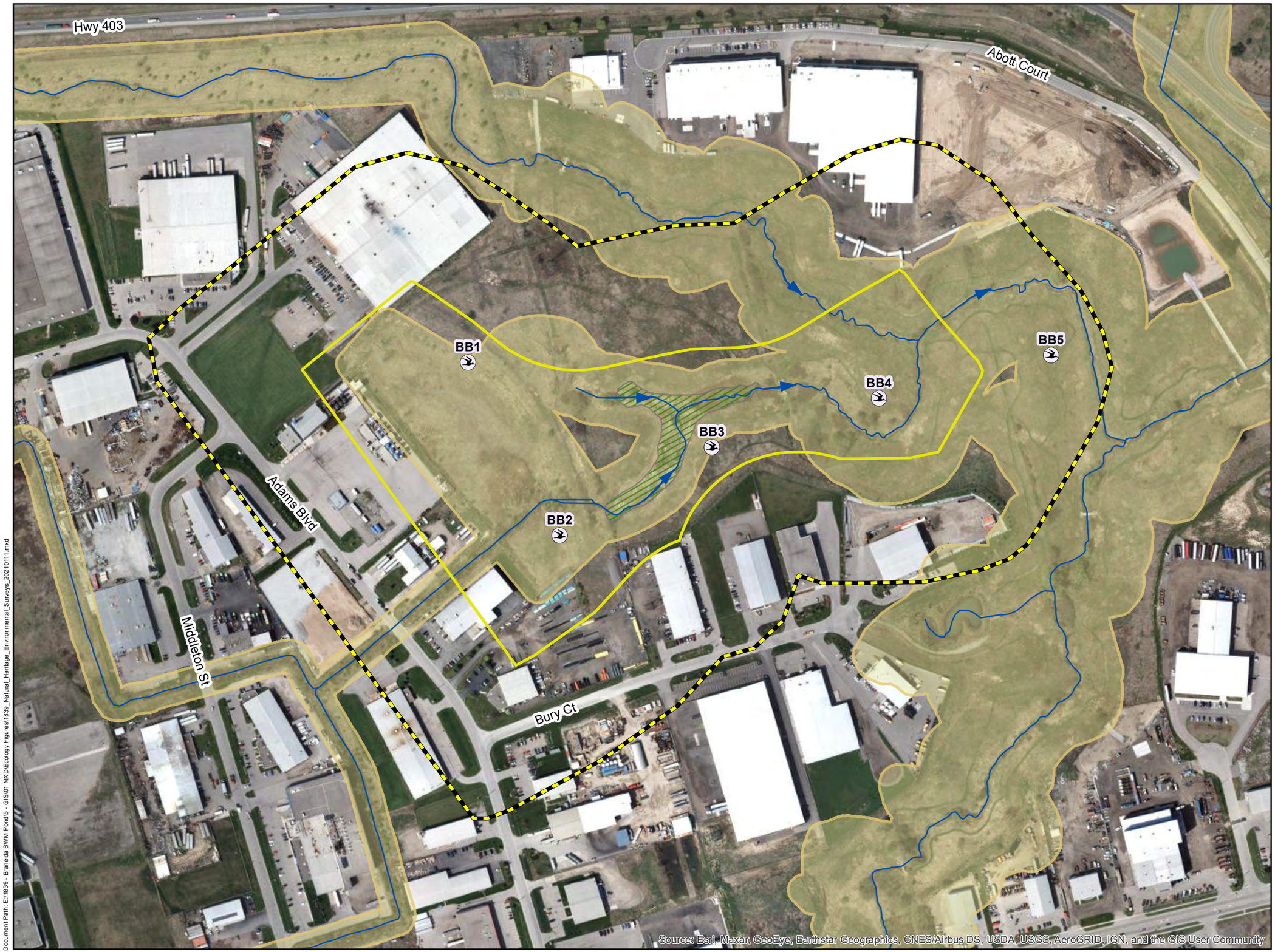
- Warmwater Stream (> 25 ^{o} C)
- Coolwater Stream (19^{o} C to 25^{o} C); and
- Coldwater Stream (19^{o} C).

pH

The PWQO acceptable range for pH is between 6.5 and 8.5 (MOEE, 1994).

Dissolved Oxygen

DO is directly influenced by temperature and the PWQO acceptable range is variable. A table of acceptable PWQO parameters for dissolved oxygen are shown in **Table 2-2.**



Braneida SWM Facility

Figure 3
Identified Natural Heritage Features and Environmental Surveys

Legend

- Study Area
- Study Area 120 m Buffer
- Wetland (MNRF)
- Watercourse
- GRCA Regulation Limit
- Breeding Bird Survey Locations

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 40 80 160
Meters

NAD 1983 UTM 17N	1:3,500
Project: 1839: Braneida SWM Facility Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021:

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\Ecology Figures\1839_Natural_Heritage_Environmental_Surveys_20210111.mxd

Table 2-2. Acceptable PWQO for Dissolved Oxygen.

Temperature (°C)	Cold Water Saturation (% Saturation)	Cold Water Biota (mg/L)	Warm Water Biota (% Saturation)	Warm Water Biota (mg/L)
0	54	8	47	7
5	54	7	47	6
10	54	6	47	5
15	54	6	47	5
20	57	5	47	4
25	63	5	48	4

Conductivity

Conductivity is a measure of TDS, where the higher TDS value, the more dissolved salts are present. There is no acceptable range for TDS and measurement is used for baseline investigations to track changes to the TDS value over time.

2.1.2 Methods

Water quality and flow monitoring measurements were performed within each reach of the study area on August 6th, 2020. Water quality was monitored using a Horiba U-52 multiparameter meter, which measures pH, conductivity, dissolved oxygen (DO), oxidation reduction potential (ORP), turbidity, temperature, salinity, and total dissolved solids (TDS). Data collected was in accordance with Provincial Water Quality Objectives (PWQO).

2.1.3 Results and Discussion

Results of the water quality monitoring are presented in **Table 2-3.**

Table 2-3. Water Quality Parameters.

Station	Temperature °C	pH	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)
WQ Station: #1	21.76	8.02	0.912	53	12.89
WQ Station: # 2	19.61	7.37	1.10	10	10.69
WQ Station: #3	20.79	7.7	1.24	30	6.75
WQ Station: #4	17.86	6.93	0.936	7.1	10.9
WQ Station: #5	-	-	-	-	-

Water quality parameters for watercourse are important for biological health of the streams as they support aquatic benthic and fish communities. Canadian Council of Ministers of the Environment (CCME) standard guidelines for DO is 5.5 mg/l. DO levels below this value can have negative impacts on aquatic health. No WQ station falls below this standard as part of the WQ monitoring results. The pH levels within all aquatic habitats were relatively a neutral pH, which is typical of a natural system. Overall, the water quality measurements within the reaches and ponds part of the aquatic habitat assessment are considered standard, compared against what is typically found in a warmwater watercourse within southern Ontario. This is validated by the results of the fish community assessment as many warmwater minnow and fish species were documented.

2.2 Aquatic Environment

2.2.1 Background

The Garden Avenue tributary flows towards Fairchild Creek, a mixed water system supporting both warmwater and coolwater fish species. GRCA has provided background fish records which are discussed in **Section 2.3.1**.

2.2.2 Methods

A detailed aquatic habitat assessment was conducted on Reaches 1 - 5 of the Garden Avenue tributary **Figure 4** to characterize aquatic features in the study area. The following information was documented during the aquatic habitat assessment:

- Substrate type and composition;
- Riparian and aquatic vegetation;
- Potential fish habitat or presence of fish;
- Water temperature;
- Flow conditions;
- Adjacent lands (vegetation community type, riparian habitat, canopy cover, land use, etc.);
- Channel morphology; and
- Instream habitat and cover.

Am Aquatic Habitat photolog was created to illustrate the characteristics of each reach and can be seen in **Attachment B**.

2.2.3 Results and Discussion

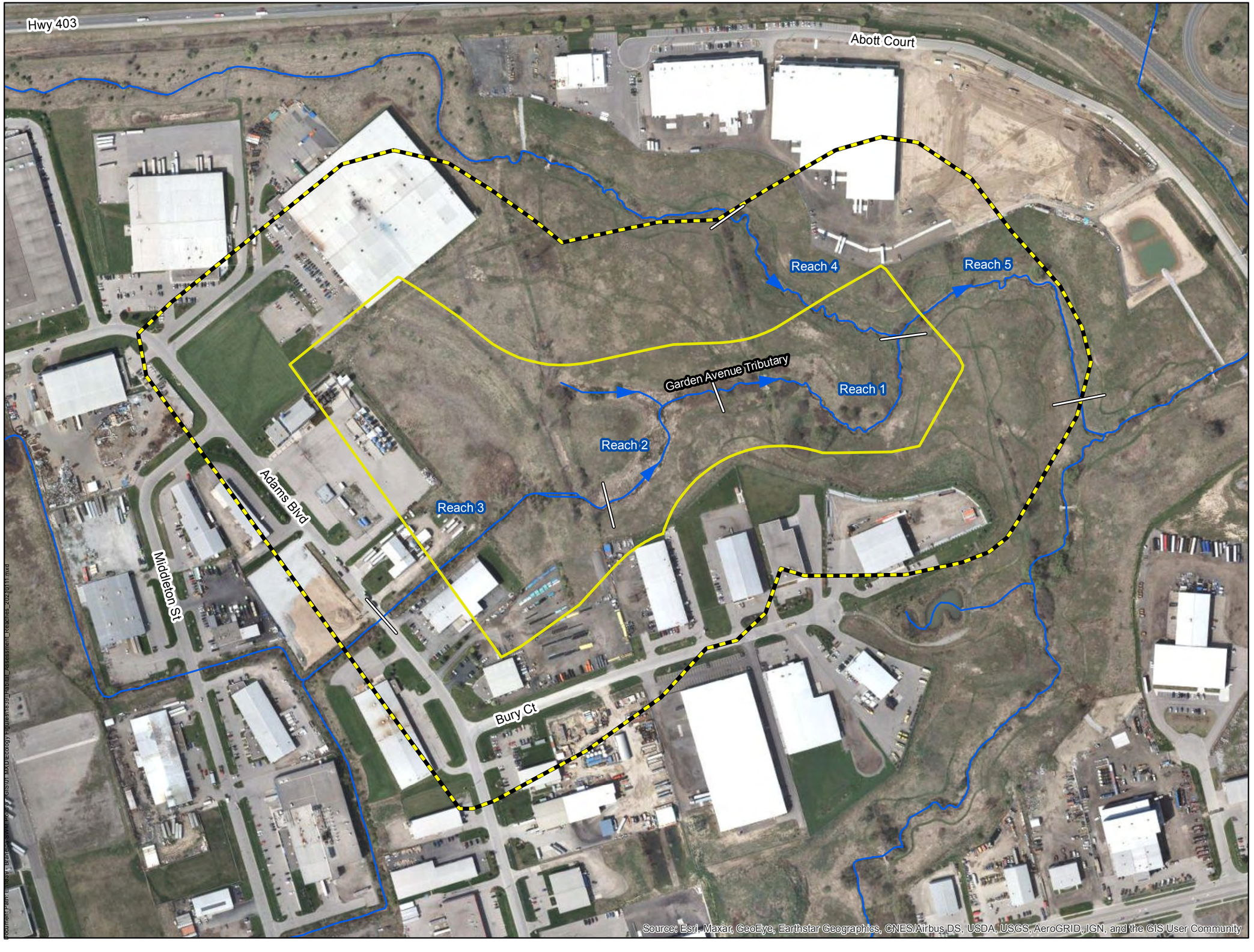
An Aquatic Habitat Assessment Reach figure was created to outline the reach areas within the study area and is presented in **Figure. 4**.

Reach 1

Reach 1 consists of 285 m of meandering stream between Reach 2 and the confluence of Reach 4 and 5. It is a narrow channel with very steep banks. These banks are moderately unstable with large areas of exposed soil and exposed roots due to the downcutting of the watercourse over time. In multiple areas, the banks are more than 1.6 m in height compared to the channel substrate. Undercutting of the banks ranged between 24 – 45 cm. Due to this erosion, the channel narrows and small soil islands are present. The wetted width of the channel ranges between 17 - 97 cm. Water depths ranged between 0 – 16 cm at the time of assessment, demonstrating low flow conditions that impede fish passage. The channel substrate was dominated by clay with a fine layer of silt overlay and areas of small pockets of gravel deposits. Both woody debris and detritus were observed in the channel. The hydraulic head and velocity were both measured at 0 m/s. Attached algae and emergent vegetation were occasionally present within the channel. The surrounding riparian vegetation on both sides of the bank were cultural meadow and cultural thicket. Canopy cover ranged between 50 - 75 % and shoreline vegetative cover ranged between 60 – 90 %. Seasonal fish migratory obstructions were present as areas of the channel were dry, which did not allow for fish passage. No direct source of pollution was observed, and a single pedestrian bridge spans the channel. A large patch of invasive common reed (*Phragmities australis*) has established and was dominant within a large section of the reach. In areas of common reed, the channel width ranged between 12 - 37 cm and water depth ranged between 4 – 25 cm.

Reach 2

Reach 2 of the Garden Avenue tributary extends 180 m northeast of Reach 3. It consists of a meandering, braided stream, which at its narrowest was 25 cm in width, before entering a cattail marsh wherein the flow was no longer defined, spreading evenly over the entire wetland. This cattail marsh has recently been disturbed by heavy equipment as portions of the vegetation have been removed and the wetlands depth deepened directly downstream of the large, corrugated steel culverts (CSP). In the areas of disturbance, seed has been broadcast



Braneida SWM Facility

Figure 4
Aquatic Habitat
Assessment Reaches

Legend

- Study Area
- Study Area 120 m Buffer
- Watercourse
- Aquatic Reach Break

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 40 80 160
Meters

NAD 1983 UTM 17N	1:3,500
Project: 1839: Braneida SWM Facility Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021:

on the exposed soil and no other erosion protection is present. Water depths within this reach ranged between 30 – 150 cm in depth and the flow velocity was too low to measure. The substrate of the watercourse is dominated by clay, while sand and silt were dominant in the wetland areas. Minnows, a leopard frog (*Lothobates pipiens*) and green frog (*Lithobates clamitans*) were observed. Attached algae and emergent vegetation were occasionally present within the channel. Vegetation in the creek includes arrowhead (*Sagittaria sp.*) and pondweed (*Potamogeton sp.*) and cattail species (*Typha sp.*) in the wetland portion. The surrounding riparian vegetation on both sides of the bank consisted of cultural meadow and cultural thicket. Canopy cover ranged between 50 - 75 % and shoreline vegetative cover ranged between 60 – 90 %. The banks of the creek were slightly unstable and areas of sediment loading from the disturbance were observed.

Reach 3

Reach 3 originates at Adams Boulevard and flows down a narrow channel lined with cable-concrete for 125 m. Further downstream, the reach flows through a larger deeper channel past the SWMF facility which has water held back by a large concrete weir. The water spills over the weir into another cable concrete lined channel and finally through 2 large and degraded CSP culverts. The drop at the concrete weir is 65 cm. The general riparian habitat surrounding this reach is thicket, cultural meadow and SWMF. Aside from the cable concrete, sand and silt are the second dominant substrate and areas of clay are also present. The substrate and channel are quite variable throughout the reach but have been previously altered/constructed and are not natural.

Within the cable concrete lined channel upstream of the SWMF, the wetted width ranges between 14 – 150 cm and water depths range between 0.5 – 13 cm. A fine layer of silt is present on the cable concrete and roots have established in the channel on the cable concrete. No minnows were observed, but a green frog was present. Only attached algae was present on the cable concrete. The velocity and steep grade of this portion of the channel would create issues for fish passage during low flow conditions.

Large deposits of soft, silty substrate are present upstream of the concrete weir. The weir itself contains held back sediment washed down from the upstream reaches. Depths within the main channel range between 38 – 55 cm and the wetted width between 2 – 3.5 m. Woody debris was present, and detritus is abundant in the section, with areas of sediment accumulating up to 25 cm. The water velocity was too low to measure at the time of the assessment, but water was flowing over the concrete weir. The banks were stable throughout the section with shrubs and ground cover established. Shoreline cover ranged between 30 – 60% and canopy cover between 75 – 100 %. Minnows and multiple green frogs were observed in this section of the reach and tracks of northern racoon (*Procyon lotor*) were also present on the shoreline. Filaments, attached algae and slimes/crusts were present within the reach. The SWMF facility may act as a source of pollution input for the creek, but this facility is typically dry unless there has been a recent rain event. The weir and culverts may act as a barrier to fish movement during most seasons.

Reach 4

Reach 4 is a tributary that flows from the northwest to its confluence with Reach 1 and Reach 5. Surrounded by cultural meadow and thicket habitat, its banks are very unstable with large areas of exposed soil and roots and areas where the banks have collapsed due to the downcutting of the channel. This is especially evident at the confluence. The bank heights range between 1.2 – 2 m in height, which undercutting ranging between 10 – 20 cm. The shoreline cover ranges between 60- 90% and the canopy cover between 50-75 %. The meandering channel has areas of shallow pools, runs and shallow riffles. The wetted width ranges between 12 – 109 cm and the water's depth ranges between 0 - 37 cm, with portions of the channel being dry. As portions of the creek were flowing and other portions were dry, there are likely groundwater inputs into the channel. The dry sections of the channel act as barriers to fish movement during the summer months. The dominant substrate is clay, followed by gravel. Woody debris and detritus are present; and are built up in some areas while absent from others. Only emergent aquatic vegetation, specifically cattails, were present within the channel. Minnows were observed in small pools during the assessment.

Reach 5

Reach 5 is located downstream of the confluence of Reach 1 and Reach 4. It contains one pedestrian bridge crossing. This meandering channel is surrounded by meadow and scrubland. It has areas of moderately unstable banks, erosion and downcutting. Exposed roots and exposed soil along its banks are present throughout the reach. Undercutting was measured between 15 – 23 cm and areas of bank slumping occurred. The banks were vegetated where no erosion has occurred with shoreline cover ranging between 90 - 100% and canopy cover being sparse, ranging between 25 – 50 %. The dominant substrate was clay followed by silt, with areas of gravel and cobble deposits in all riffles. Some of these riffles were man-made, and not natural, which is also the case for multiple pools observed. The wetted width of the channel ranged between 35 – 213 cm and the waters depth ranged between 4 – 48 cm. No flow could be recorded due to low flow conditions and the hydraulic head was measured at 0. Woody debris and detritus were present in the channel as well as emergent, submergent and attached algae. In multiple locations, piles of soil and woody debris impeded the channel's flow and sand bars are present occasionally. Minnows were observed in the channel, but no evidence of fishing pressure was observed.

2.3 Fisheries Assessment

2.3.1 Background

Correspondence with GRCA has indicated the following species are present within Fairchild Creek; common shiner (*Luxilus cornutus*), fathead minnow (*Pimephales promelas*), rock bass (*Ambloplites rupestris*), hornyhead chub (*Nocomis biguttatus*), northern pike (*Esox lucius*), blackside darter (*Percina maculata*), creek chub (*Semotilus atromaculatus*), blacknose shiner (*Notropis heterolepis*), bluntnose minnow (*Pimephales notatus*), white sucker (*Catostomus commersonii*), brook stickleback (*Culaea inconstans*), and johnny darter (*Etheostoma nigrum*). A review of NHIC and DFO for fish species within the study area limits did not identify any fish records.

2.3.2 Methods

A License to Collect Fish for Scientific Purposes was obtained from the MNRF Guelph District prior to the completion of the fish community survey.

A fish community assessment was conducted on August 6th, 2020 for the Garden Avenue Tributary with the study area. The fish community was completed by two ERI biologists using a HT2000 backpack electrofishing unit.

The entire lengths of all tributaries within the study area were assessed. The backpack electrofishing unit was set to a frequency of 80 Hz and a voltage ranging between 100 to 150 V.

2.3.3 Results and Discussion

The fish community reaches are shown on **Figure 4.** Fish and minnow species found as part of the Garden Avenue tributary include brook stickleback, creek chub, common shiner, blacknose shiner, bluntnose minnow and white sucker. In total, 156 fish and minnow species were caught as part of the assessment. The assessment took place during low flow conditions in which portions of the watercourse were dry. A list of species identified within the study area can be found in **Attachment C.**

2.4 Vegetation Communities & Plants

2.4.1 Background

The Ecological Land Classification system for southern Ontario was developed to facilitate management and monitoring of various environments across the province. This system delineates distinctions between natural regions based on established combinations of bedrock, climate, physiography, and vegetation characteristics. By classifying sub-sections of the study area into recognized communities, potential SAR habitat and other development sensitivities may be more easily anticipated.

As previously noted, some of the delineated vegetation communities' function as part of the existing SWM facility and therefore are not considered habitat (TRCA, CH2M, 2018). However, these communities may still support habitat or be inhabited by wildlife such as fish, turtles and amphibians that require consideration and were therefore included in the delineations below.

2.4.2 Methods

Ecological Land Classification (ELC) and Plants

Vegetation communities were characterized and mapped using the Ecological Land Classification (ELC) system for southern Ontario (Lee et. al., 1998). Data recorded for each vegetation community included species composition, dominance and uncommon species or features. In addition, incidental wildlife observations were recorded throughout all site visits. ELC communities are shown on **Figure 5.**

Floristic Quality Indicators

A series of Floristic Quality Indicators were calculated for each community including: the calculation of the mean Coefficient of Conservatism (CC), the Floristic Quality Index (FQI) and the Weediness Index.

Coefficient of Conservatism (CC) - These values range from 0 (low) to 10 (high) and are based on species tolerance of disturbance and fidelity to a specific habitat.

- **0 – 3:** Species found in a wide variety of communities, including disturbed sites;
- **4 – 6:** Species associated with a specific community but tolerate moderate disturbance;
- **7 – 8:** Species associated with a community in an advanced successional stage, tolerant of minor disturbances; and
- **9 – 10:** Species with a high degree of fidelity to a narrow range of ecological parameters.

Floristic Quality Index - The floristic quality (FQI) of an area is reflected in the mean value of CC. For example, an old field or grazed woodlot would likely have a low mean CC as these habitats are dominated by opportunistic species that occur in a wide range of site conditions and are tolerant of disturbance. A bog, prairie or intact forest would likely have a higher CC, reflecting the specific habitat requirements of many of the species and general absence of disturbance. Largely, a community with an FQI of 1 - 19 will be considered to be of low vegetative quality; communities with an FQI of 20 - 35 will be considered to have a high vegetative quality and communities with an FQI above 35 will be considered of "Natural Area" quality.

Weediness Index - The Weediness Index quantifies the potential invasiveness of non-native plants, and when used in combination with the percentage of non-native plants can be used as an indicator of disturbance. Values ranging from -1 (low) to -3 (high) have been assigned to most non-native species in Ontario based on the potential impact each species can have in natural areas: **-1:** Little or no impact on natural areas (most non-native plants fall into this category), **-2:** Occasional impacts on natural areas, generally infrequent or localized. **-3:** Major potential impacts on natural areas.

2.4.3 Results and Discussion

Vegetation community delineation and plant inventories occurred on June 24th, and August 19, 2019 and June 24 and June 30, 2020. A total of 8 vegetation communities were observed and delineated by ERI during field investigations. These communities can be divided into cultural meadow, cultural thicket, deciduous forest, swamp thicket, meadow marsh and shallow marsh communities. A total of 116 species were observed within the study area during ERI field investigations. Of these, 65 were native and 51 were non-native species, including six sensitive species and five regionally rare species. The overall FQI value for the study area was 29.77 with a mean CC value of 3.69. The relatively high FQI value is likely skewed by the few species with a high CC sensitivity ranking. The mean CC value suggests that most species observed are common of disturbed sites. Overall, 51% of the species observed had the lowest CC sensitivity ranking of 0-3, followed by 38% with a moderate CC sensitivity ranking of 4-6, 9% with a high CC sensitivity ranking of 7-8 and only 2% in the highest CC sensitivity ranking of 9-10. This suggests that most of the species observed are in the lowest sensitivity ranking and can be found in a wide variety of sites, including ones that have been disturbed. In addition, none of the individual

Braneida SWM Facility

Figure 5
Ecological Land Classification

Hwy 403
Abbott Court
Adams Blvd
Middleton St
Bury Ct
CUT1
CUM1-1
MAM2-5
MAS2-1
SWT2-2
MAM2
FOD7
SWT2
CUM1-1/CUT1

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Study Area
- Study Area 120 m Buffer
- Watercourse

ELC

- CUM1-1: Dry-Moist Old Field Meadow
- CUM1-1/CUT1: Cultural Meadow/Cultural Thicket Mosaic
- CUT1: Cultural Thicket
- FOD7: Fresh-Moist Deciduous Forest
- MAM2: Graminoid Mineral Meadow Marsh
- MAM2-5: Narrow-Leaved Sedge Graminoid Mineral Meadow Marsh
- MAS2-1: Mineral Shallow Marsh
- SWT2: Thicket Swamp
- SWT2-2: Willow Mineral Thicket Swamp

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

0 40 80 160
Meters

NAD 1983 UTM 17N	1:3,500
Project: 1839: Braneida SWM Facility Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021:

Document Path: E:\1839 - Braneida SWM Pond\5 - GIS\01 MXD\Ecology Figures\1839_ELC_20210111.mxd

communities detailed below have an average CC value above 4. This suggests that the sites are dominated by common plant species of low sensitivities. Therefore, none of the vegetation communities observed are anticipated to be negatively impacted by the proposed works with the implementation of appropriate mitigation measures, as they primarily consist of plants that are tolerant of a certain degree of disturbance.

A full list of plant species can be found in **Attachment D**. A terrestrial photolog with representative photos of each community can be found in **Attachment E.** All communities within the study area are considered common in Ontario.

The following presents a description of each of the delineated communities.

CUM1-1: Dry-Moist Old Field Meadow Type

This meadow community is the largest vegetation community delineated within the study area and is present both within and outside of the SWMF. It is present in both upland and lowlands. The topography of the site is rolling. In many areas, previous plantings of shrubs and occasional trees are present. Multiple nest boxes were also noted during field surveys. A walking pathway that is maintained is present throughout this community. This meadow is dominated by a mixture of graminoids and forbs, including reed canary grass (*Phalaris aruninacea),* smooth brome (*Bromus inermis*), common burdock (*Arctium minus*), teasel (*Dipsacus fullonum*), bird's foot trefoil (*Lotus corniculatus*), goldenrod species (*Solidago spp.*), wild carrot (*Daucus carota*), crown vetch (*Securigera caria*) and riverbank grape (*Vitis riparia*). Occasional shrub and tree species including red-osier dogwood (*Cornus sericea*), Tartarian honeysuckle (*Lonicera tatarica*), European buckthorn (*Rhamnus catharctica*) and staghorn sumac (*Rhus typhina*) are sporadic throughout this community. A total of 62 species were observed within this community during ERI field investigations. Of these, 32 were native and 30 were non-native species. The overall FQI value for the study area was 15.73 with a mean CC value of 2.78.

CUT1: Mineral Cultural Thicket

This community is found in multiple locations across the study area and is typically found near the watercourse in thick dense stands. These communities typically transition into cultural meadow. Tree and shrub species observed here include staghorn sumac, white mulberry *(Morus alba*), Russian olive (*Eleagnus angustifolia*), common buckthorn, grey dogwood (*Cornus racemosa*) and alternate leaved dogwood (*Cornus alternifolia*). Other vegetation species include riverbank grape, wild carrot, field-sow thistle (*Sonchus arvensis*), yellow rocket *(Barbarea vulgaris*), crown vetch, curly dock (*Rumex crispus*), red raspberry (*Rubus idaeus*), and multiflora rose (*Rosa multiflora*). A total of 59 species were observed within this community during ERI field investigations. Of these, 37 were native and 22 were non-native species. The overall FQI value for the study area was 21.04 with a mean CC value of 3.46.

CUM1-1/CUT1: Dry Moist Old Field Meadow Type and Mineral Cultural Thicket

This community is a combination of the cultural meadow and cultural thicket communities and has the same vegetation species composition. These areas transition from meadow to thicket frequently and are thus grouped together to define the greater area. Of note, portions of this community have been planted as part of historical restoration efforts. A total of 86 species were observed within this community during ERI field investigations. Of these, 44 were native and 42 were non-native species. The overall FQI value for the study area was 20.65 with a mean CC value of 3.11.

MAM2-5: Narrow-Leaved Sedge Graminoid Meadow Marsh

This vegetation community comprises the majority of the SWMF area. It is dominated by a mixture of sedges including fox sedge (*Carex vulpinoidea*), awl-fruited sedge (*Carex stipata*), bebb's sedge (*Carex bebbii*), purple loosestrife (*Lythrum salicaria*) and reed canary grass (*Phalaris arundinacea*) in approximately equal proportions. Common reed (*Phragmites australis*) was the dominant vegetation species over 2 metres in height, followed by narrow-leaved willow (*Salix exigua*). At the time of the assessment, the soil in the SWMF was moist, with areas

of shallow standing water. Of note, previous site visits have identified the SWMF to be dry during most seasons. A total of 28 species were observed within this community during ERI field investigations. Of these, 18 were native

and 10 were non-native species. The overall FQI value for the study area was 12.02 with a mean CC value of 2.83.

MAM2: Mineral Meadow Marsh

This dense community is dominated by common reed grass and is found in two areas within the study area along the watercourse. The first is directly adjacent to the cultural thicket found along the Garden Avenue Tributary within the SWMF. The second is found to the east of the cattail marsh and swamp thicket along the watercourse in proximity to the small pedestrian bridge. Due to the dominant nature of common reed, other vegetation species present are sporadic in appearance. These include purple loosestrife, wild carrot, coltsfoot and bittersweet nightshade. A total of 11 species were observed within this community during ERI field investigations. Of these, 5 were native and 6 were non-native species. The overall FQI value for the study area was 4.92 with a mean CC value of 2.20.

MAS2-1: Cattail Mineral Shallow Marsh

Three MAS2-1 communities are present in the study area and are located within and outside of the SWMF; a small, square-shaped polygon in the west corner of the SWMF near the property line of the industrial buildings, a larger community located within the SWMF south of the watercourse and an oblong area that encompasses the Garden Avenue tributary near the centre of the study area. This community is classified by over 25% emergent macrophyte cover and water levels below 2 m. In this community, broad-leaved cattail (*Typha latifolia*) is much more abundant than common reed, which is in turn much more abundant than aster species (*Symphyotrichum spp.*). Gray dogwood is the dominant shrub species, followed by red-osier dogwood (*Cornus sericea*). Riverbank grape, swamp milkweed (*Asclepias incarnata*), and bittersweet nightshade (*Solanum dulcamara*) are also found near the edge of this community. A total of 25 species were observed within this community during ERI field investigations. Of these, 16 were native and 9 were non-native species. The overall FQI value for the study area was 10.75 with a mean CC value of 2.69.

SWT2-2: Willow Mineral Thicket Swamp

This community is located adjacent to the MAM2 common reed grass mineral meadow marsh community in the SWMF. It is dominated by sandbar willow (*Salix exigua*), with scattered common reed grass. At the time of assessment, no water was present in this community, but the soils were moist. Species observed within the ground cover layer included reed canary grass, purple loosestrife, Goldenrod species (*Solidago spp.*), aster species, common milkweed, and wild carrot. A total of 11 species were observed within this community during ERI field investigations, of these 6 were native and 5 were non-native species. The overall FQI value for the study area was 5.31 with a mean CC value of 2.17.

FOD7: Fresh-Moist Lowland Deciduous Forest Ecosite

This woodland community covers the banks of the Garden Avenue tributary from Adams Boulevard northeast to the edge of the industrial lots. There is an additional small oblong FOD7 inclusion within the CUM1-1 community found on the southeast edge of the berm. The canopy in this community is dominated by crack willow (*Salix fragilis*), followed by Manitoba maple (*Acer negundo*), eastern cottonwood (*Populus deltoides*), and Russian olive. In the understory, downy hawthorn (*Crataegus mollis*) is the most abundant, followed by gray dogwood, Manitoba maple, and peach-leaved willow (*Salix amygdaloides*). Goldenrod species (*Solidago spp.*) dominated the ground cover vegetation, followed by riverbank grape (*Vitis riparia*), smooth brome, and reed canary grass. A total of 39 species were observed within this community during ERI field investigations, of which 13 were native and 26 were non-native species. The overall FQI value for the study area was 11.09 with a mean CC value of 3.08.

2.5 Breeding Birds

2.5.1 Background

The Ontario Breeding Bird Atlas (OBBA) was used to identify existing bird species records within a 10 km square of the study area (17NH67). In addition, eBird records from three separate sites were included: the closed road allowance at the end of Papple Rd., the Ancaster Rail Trail at Papple Rd., and the Cainsville Lagoons. Lastly, iNaturalist observations within a 2.1 km radius of the study area were included as part of the background review.

In total, 145 bird species were identified in the background review. This included the following five SAR and six SCC: chimney swift (*Chaetura pelagica*) (THR), barn swallow (*Hirundo rustica*) (THR), bank swallow (*Riparia riparia*) (THR), bobolink (*Dolicholynx oryxivorus*) (THR), eastern meadowlark (*Sturnella magna*) (THR), eastern wood-pewee (*Contopus virens*) (SC), wood thrush (*Hylocichla mustelina*) (SC), rusty blackbird (*Euphagus carolinus*) (SC), grasshopper sparrow (*Ammodramus savannarum*) (SC), common nighthawk (*Chordeiles minor*) (SC), and bald eagle (*Haliaeetus leucocephalus*) (SC).

2.5.2 Methods

Two breeding bird surveys were conducted in the study area on May 22nd & June 30th, 2020. Data was recorded using the Ontario Breeding Bird Atlas protocols (OBBA, 2001). Five stations were selected in the study area. At each station, a 10-minute point count was conducted for both visual and audible documentation of species presence including the highest level of breeding evidence exhibited for each species recorded. Incidental observations were also recorded during travel between stations, as well as during all during other field surveys on site for the duration of the project. The point count locations are shown on **Figure 3**.

2.5.3 Results and Discussion

A total of 45 bird species were observed during the breeding bird survey and other site visits. This included two SAR: barn swallow and bank swallow. Both species were observed as either foraging or flyovers and did not display any evidence of breeding within the study area. For a full list of species identified in the background review and on site by ERI ecologists, please see **Attachment F.** The point count species from the breeding bird survey can be found in **Attachment G.**

Other than the species listed above, bird observed by ERI during breeding bird surveys are common and widespread in southern Ontario. The *Migratory Birds Convention Act* protects actively nesting migratory bird species; however, other birds such raptors are protected under the *Fish and Wildlife Conservation Act* which also restricts the removal of nests without a permit or correspondence. Therefore, in order to remain in compliance with the *Migratory Birds Convention Act* and *Fish and Wildlife Conservation Act*, it is recommended that any necessary vegetation removal take place outside of the breeding bird season (April 1st to August 31st) for this region.

2.6 Amphibians and Reptiles

2.6.1 Background

A desktop review was conducted to identify amphibian and reptile species likely to nest, breed, or forage within the study area. Records were obtained for a 10 km x 10 km square from the Ontario Reptile and Amphibian Atlas (square 17NH67). Amphibian and reptile records reported to iNaturalist within a 2.1 km radius of the study area were also included in the background review. In total, 20 species of reptile and amphibian were identified in the background review, including 3 SCC: snapping turtle (*Chelydra serpentina*) (SC), northern map turtle (*Graptemys geographica*) (SC), and western chorus frog (*Pseudacris trisetaria*) (S3). For a full list of reptile and amphibian species, please see **Attachment H.**

2.6.2 Methods

Four Blanding's turtle surveys were undertaken on May 2nd, May 10th, May 27th and June 7th, 2019 at the stormwater management pond and surrounding wetland areas. The habitat was classified as meadow marsh and identified as poor quality Blanding's turtle habitat. No observations of any turtle species were recorded during any of the surveys.

Incidental reptile and amphibian observations were recorded during all site visits.

2.6.3 Results and Discussion

No Blanding's turtles were observed during field investigations.

Three amphibian species were observed by ERI ecologists during site visits: green frog (*Lithobates clamitans*), northern leopard frog (*Lithobates pipiens*) and spring peeper (*Pseudacris crucifer*). None of these species are classified as SAR or SCC. In addition, a predated turtle nest was found in the gravel driveway directly beside the SWM facility and on the Oakhills Feed private property. Due to the predation and destruction of the eggs, the species of turtle was unable to be identified.

2.7 Mammals

2.7.1 Background

Mapping provided by the Ontario Mammal Atlas (Dobbyn, 1994) was used to identify historical species records within the general vicinity of the study area. Mammal records from iNaturalist within 2.1 km of the study area were also included in the review. In total, 34 mammals were identified in the background review, including 4 SAR: tricolored bat (*Perimyotis subflavus*) (END), eastern small-footed myotis (*Myotis leibii*) (END), little brown myotis (*Myotis lucifugus*), and northern myotis (*Myotis septentrionalis*) (END). For a full list of mammal species, please refer to **Attachment I.**

2.7.2 Methods

No mammal specific surveys were conducted as part of this study, however, incidental sightings during all field visits were recorded.

2.7.3 Results and Discussion

In total, four mammal species were observed during site visits; white-tailed deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), coyote (*Canis latrans*) and northern raccoon (*Procyon lotor*). None of these species are considered SAR or SCC.

2.8 Insects

2.8.1 Background

A desktop review for insect species was conducted to identify known species within the vicinity of the study area. Records were obtained from a 10x10 km square from the Ontario Butterfly Atlas (square 17NH67). iNaturalist insect records within a 2.1 km radius of the study area were also included. In total, 53 insect species were identified in the background review, including two SCC; monarch (*Danaus plexippus*) (SC) and arrow clubtail (*Stylurus spiniceps*) (S2).

2.8.2 Methods

No insect specific surveys were conducted as part of this study, however, incidental sightings during all field visits were recorded. For a full list of insect species identified in the background review, please see **Attachment J.**

2.8.3 Results and Discussion

In total, ERI ecologists identified five different insect species within the study area, all of which are common and widespread within Ontario. These include twelve-spotted skimmer (*Libellula pulchella*), eastern forktail (*Ischnura veticalis*), orange bluet (*Enallagma signatum*), cabbage white (*Pieris rapae*), and virginia ctenucha moth (*Ctenucha virginica*). Of note, masses of over 50 virginia ctenucha moth individuals were observed flying together within the CUM1-1 community during a site visit on June 24, 2020.

None of the observed insect species are classified as SAR or SCC.

3 Determination of Significance

The features and species found within the study area have been assessed using federal, provincial and municipal ranking and evaluation systems as outlined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), Endangered Species Act (ESA), the MNRF, GRCA, and the City of Brantford. The following provides a summary of the identified significant features found within the study area.

3.1 Designated Natural Areas and Significant Features

No Designated Natural Areas are located within the study area; however, as illustrated on Schedule 4-1 of the City of Brantford's Official Plan, a portion of the study area is identified as Floodway Policy Areas. This designation, as per section 10.2.7 of the OP, requires all development within these lands be subject to Site Plan Control and the Grand River Conservation Authority's Development, Interference with Wetlands and Alterations to Shoreline and Watercourses regulation.

3.2 Aquatic Habitat & Fisheries

The Garden Avenue Tributary contains no aquatic SAR species based on background records and field survey results. All species found are common to southern Ontario. NHIC mapping did identify greater redhorse (*Moxostoma valenciennesi*), which is defined as an S3 species, within the vicinity of the study area.

3.3 Vegetation Communities and Plants

All vegetation communities observed within the study area are common and widespread throughout Ontario. Regionally rare species within the County of Brant found during site specific surveys within the study area or identified in historical records from past local studies are outlined in the table below.

Table 3-1. Regionally Rare Species

Common Name	Botanical Name	S-Rank	Local Status Brant	Identifying Source	Associated ELC Community
Meadow horsetail	*Equisetum pratense*	S5	R	ERI	CUT1, MAS2-1
Marsh Horsetail	*Equisetum palustre*	S5	R	ERI	MAM3-5
Tamarack	*Larix laricina*	S5	R	ERI	CUT1, CUM1-1
Poke Milkweed	*Asclepias exaltata*	S4	R	ERI	CUT1
Western Pearly Everlasting	*Anaphalis margaritacea*	S5	R	ERI	CUM1-1

3.4 Significant Wildlife Habitat Assessment

3.4.1 Background

Significant Wildlife Habitat is identified under Section 2.3 of the PPS as areas where plants, animals and other organisms live and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual or life cycle; and areas which are important to migratory or non-migratory species. Wildlife habitat is considered significant where it is ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or Natural Heritage System.

Defining wildlife habitat significance for Ecoregion 6E, in which the subject property is located, is described in the SWHTG Addendum (MNRF, 2015b). SWH is protected under the Ontario Provincial Policy Statement (OMMAH 2014).

Wildlife habitat is divided into four broad categories as described in the OMNR's Significant Wildlife Habitat Technical Guide (SWHTG, OMNR 2000), as follows:

- Seasonal concentration areas;
- Rare vegetation communities or specialized habitats for wildlife;
- Habitats of species of conservation concern, excluding the habitats of endangered and threatened species; and
- Animal movement corridors.

3.4.2 Methods

After conducting the natural heritage field investigations, the study area was evaluated for suitable geographic criteria and habitat characteristics of each candidate Significant Wildlife Habitat, as outlined in the MNRF SWHTG.

A summary of the SWH screening results are provided in the following sections and the detailed analysis is provided in **Attachment K**.

3.4.3 Results and Discussion

Candidate Significant Wildlife Habitat

The SWH screening found that the criteria for candidate SWH were met for the following 3 categories:

- **Turtle Overwintering:** The study area contains suitable overwintering habitat for snapping turtle within the MAS2-1 along the Garden Avenue Tributary.
- **Amphibian Breeding Habitat (Wetland):** The study area contained suitable marsh ecosites of sufficient size, including MAM and MAS communities, to support amphibian breeding. Amphibian call surveys were not conducted to confirm the presence of amphibian breeding populations, but incidental observations of green frog and leopard frog show they use the habitat present within the study area.
- **Special Concern and Rare Wildlife Species –** The study area includes candidate habitat for snapping turtle within the Garden Avenue Tributary. A predated nest was found during Blanding's turtle surveys but was unable to determine which turtle species the eggs were from.

Confirmed Significant Wildlife Habitat

The SWH screening found that the criteria for confirmed SWH were met for the following categories:

- **Special Concern and Rare Wildlife Species:** Monarch was identified in the study area within the CUM communities adjacent to the Garden Avenue Tributary.

- **Turtle Nesting Areas:** Turtle eggs were identified during field surveys. In addition, the study area contains three discrete MAS2-1 communities, which are classified as candidate habitat for nesting turtles. Turtle studies were conducted in May and June of 2019 but did not confirm any turtle observations beyond one predated turtle nest of an unknown species.

The confirmed SWH requires protection and no development can occur within these habitats, unless they can demonstrate the development has no negative impacts on the natural heritage functions and features of the SWH.

3.5 Species at Risk Assessment

3.5.1 Background

A habitat screening was conducted to determine the potential occurrence of SAR within the Study Area. For this screening, SAR are defined as species that are listed as either THR or END under the *ESA*. Individuals of these species, as well as their habitat, are protected in Ontario. Species listed as SC under the *ESA* receive protection under the NHRM and their habitat is considered SWH. Species listed under SARA are only protected on federal land or as part of projects that are otherwise being permitted by a federal agency. This includes aquatic SAR; however, no aquatic SAR have been identified within the Study Area.

3.5.2 Methods

ERI conducted a background review to create a list of potential SAR within the study area and surrounding landscape to supplement existing information known for the study area. This list was developed using multiple background resources including:

- Ontario Breeding Bird Atlas (Bird Studies Canada 2009),
- Reptiles and Amphibians of Ontario Atlas (Ontario Nature 2018),
- Species at Risk in Ontario List – Online Tool (MNRF 2020)
- Natural Heritage Information Centre (Natural Heritage Areas application) (MNRF 2020);
- Atlas of the Mammals of Ontario (Dobbyn 1994);
- DFO online aquatic SAR Mapping tool (DFO 2020);
- eBird (Cornell Lab of Ornithology, 2020);
- Ontario Butterfly Atlas (MacNaughton et al. 2017), and
- iNaturalist citizen science initiation (iNaturalist, 2020).

In addition to the above listed resources, ERI requested SAR background information from the MNRF, and MECP. Once the list was compiled, a screening exercise was completed to determine the presence of suitable habitat for each SAR identified as potentially occurring within the study area, based on known preferred habitat characteristics for each species.

3.5.3 Results and Discussion

Four federally ranked species with candidate or confirmed habitats, listed on Schedule 1 of the *Species at Risk Act,* were identified within the study area:

- Barn Swallow – THR;
- Bank Swallow – END;
- Snapping Turtle – SC; and
- Monarch - SC.

However, as there are no Federal Lands found within the study area, the Species at Risk Act does not apply, related to the above-listed organisms. These SAR are therefore addressed under provincial legislation below.

Watercourses identified as fish habitat are subject to the *Fisheries Act*. Any proposed work that may result in the death of fish or the harmful alteration, disruption, or destruction (HADD) of fish habitat requires a Request for

Review submitted to the DFO on October 22nd, 2020 and response received December 15th, 2020 with permit approval (20-HCAA-02198) for the proposed stormwater facility retrofit. The permit is provided in **Attachment L**.

Several of the breeding birds observed within the study area are afforded protection under the *MBCA*.

Provincially, the following species were observed to either have candidate or confirmed habitat within the study area. Species identified with a SC ranking have been addressed under the Significant Wildlife habitat section above. The full SAR Screening is found in **Attachment M**.

Confirmed SAR

Barn Swallow (THR) – Barn swallow is listed as Threatened provincially and federally. It is typically found within close proximity to humans, building cup-shaped mud nests almost exclusively on human made structures such as in culverts, under bridges and in barns. They prefer unpainted, rough-cut wood, as opposed to smooth surfaces. Barn swallow populations are decreasing by as much as 65% (MNRF, 2018). Construction activities may be subject to the MBCA (CWS, 2013), though it is not anticipated that human made structures will be affected by the proposed works.

Bank Swallow (THR) – Bank swallow is listed as Threatened both provincially and federally. Bank swallows form burrows in the side of vertical faces such as cliffs, riverbanks, road cuts, or soil stockpiles. Breeding sites are typically formed close to aerial foraging areas such as grasslands, meadows, pastures, or cropland. The study area contains suitable meadow habitat, and one individual was observed flying overhead during an ERI breeding bird survey.

4 Proposed Design

Stormwater Management Facility

The proposed design illustrated on **Attachment N** indicates the preferred alternative solution is the retrofit of the existing SWMF within the current footprint. The retrofit will include the implementation of the following:

- A permanent pool to provide water quality;
- A forebay to improve maintenance frequency of the main cell;
- Access roads and easement;
- Multi-stage outlet with erosion control and quantity control that is active during frequent storm events; and
- Separation of the inlet and outlet structures to increase the flow path and residence time in the SWMF.

Downstream Channel Remediation

The proposed watercourse remediation provides an opportunity to optimize erosion control enhancements within the stormwater management facility retrofit. Based on the assessment of existing geomorphic conditions, the following considerations have been identified for the channel remediation works:

- **Floodplain connectivity and channel capacity:** it is beneficial to reconnect the Reach 1 channel to the floodplain, reducing the existing channel capacity to reduce entrenchment and to mitigate ongoing incision within the channel.
- **Flow management:** manage proposed flows from the SWM facility retrofit to reduce erosion potential as identified through the erosion threshold analysis.
- **Channel form and function:** decrease high energy conditions (i.e., effective shear stress on channel boundary) existing within the channel to reduce further erosion and incision. Improve natural channel form and function to the adjusting system.

The concept plan for these works is included in **Attachment O**.

The preferred alternative solution includes a combination of channel bed/profile enhancements and increased channel capacity and floodplain connectivity. It also includes the removal of two twin culverts under the former

railway spur , which will increase connectivity and allow for improved fish passage. The combined benefits, as well as the minimal negativities, based on the evaluation criteria, condones a hybrid approach to the channel remediation.

Work will address channel processes and erosion concerns while minimizing the footprint of proposed works. Channel modifications will focus primarily on enhancing channel form to manage flow energy through channel widening and providing stability through channel bed enhancements.

5 Impacts of Proposed Design

The following section identifies, describes, and discusses the existing and potential impacts to the natural environment that may occur due to proposed works.

- *Existing Impacts* are the existing stressors or other factors contributing to the site's current state.
- *Short Term impacts* are generally those associated with the construction stage of the project and are typically temporary and preventable through the application of proper construction practices & mitigation and site inspection.
- *Long Term impacts* are those related to actual development plan and post-construction activities; however, these can also be mitigated or minimized through careful planning, construction design and the implementation of environmental best management practices.

Based on ERI's site investigations, the following impacts are relevant to the proposed SWMF retrofit and Garden Avenue Creek rehabilitation and should be considered for future management of natural heritage features and functions within the study area.

5.1 Impacts to Designated Features

There are no Designated Features within the study area; however, Official Plan Flood Plain Policy areas are present. Impacts to these areas are covered under the aquatic sections below.

5.2 Impacts to Aquatic Habitat & Fisheries

5.2.1 Existing Impacts

- ***Contamination from Industrial Buildings and Parking Lots to Aquatic Habitat*** – Runoff and roads salts from the paved roadway may introduce higher concentrations of chemical contaminants into the Garden Avenue Tributary.
- ***Degraded Aquatic Habitat within the Garden Avenue Tributary*** – Poor water quality may result from surface runoff from adjacent land uses and both point and non-point pollution sources. This may negatively affect aquatic vegetation and macrophytes, leading to decreased quality of aquatic habitat.
- ***Barrier to Fish Movement*** – A concrete weir along the Garden Avenue Tributary has created a permanent barrier to fish and existing twin culverts under the former railway spur may impact fish passage.
- ***Erosion*** – Varying degrees of erosion are present along much of the banks of the Garden Avenue Tributary.

5.2.2 Short-Term Impacts

- ***Water Quality*** - Short-term water quality impacts include runoff from construction area that may allow sediment to enter the tributary and increase turbidity of the water.
- ***Dewatering*** – Temporary dewatering may be required to complete construction of the SWMF pond and channel remediation work. Pumping could decrease creek flows temporarily, or adversely affect connectivity, movement, migration as well as reduce available fish habitat.
- ***Sediment and Erosion*** – Clearing and grading activities will expose soils potentially resulting in sediment run-off discharging into the adjacent Garden Avenue Tributary.

5.2.3 Long-Term Impacts

- ***Changes to Drainage Patterns*** **-** Based on current project designs, there are no proposed changes to catchment parameters. Drainage patterns will remain unchanged.
- ***Storm Water Management Related Impacts*** **-** Potential impacts related to storm water management result from the discharge of storm water directed to the Garden Avenue Tributary. The proposed retrofits to the SWMF will result in operational improvements. Potential impacts may include reduced sediment deposition within the tributary, reduced potential for erosion along the banks, and improved quality of surface water flowing to the tributary and wetland.
- ***Alteration to Fish Habitat*** **–** Improvements to the connection of the SWM facility to the Garden Avenue Tributary and channel remediation work have the potential to cause serious harm to fish and fish habitat.

5.3 Impacts to Vegetation Communities and Plants

5.3.1 Existing Impacts

- ***Stormwater Management Facility*** – A portion of the observed vegetation communities function as part of the existing SWMF, therefore were most likely planted during construction of the facility.
- ***Fragmentation of Natural Vegetation and Habitat*** – The study area has been heavily influenced by clearing for industrial purposes, and municipal roads and highways. The industrial buildings surround the natural heritage features on all sides.
- ***Dust Deposition*** **-** Vegetation and groundcover within vegetation communities likely experience reduced productivity of vegetation along their edges due to the adjacent industrial businesses.
- ***Edge Effects on Vegetation Communities*** – The edges of the small vegetation communities within the study area are exposed to increased effects of light, wind and road salts.
- ***Wetland Community Disturbance*** – A Hydro One Easement is located within the cattail marsh community along the Garden Avenue Tributary where some maintenance activities may occur from time to time creating some disturbances to wetland communities. Recent (2020) excavation and heavy equipment disturbance to the wetland directly downstream of the twin culverts occurred and was documented during field surveys. This involved removal of vegetation and changes to the watercourse flow.
- ***Human Activities*** – Walking trails are scattered throughout the study area, which create minor impacts to edge vegetation, including potential for litter and maintenance mowing.
- ***Invasive Species*** – Many invasive species are present within the observed vegetation communities.

5.3.2 Short-Term Impacts

- **Rooting Zones** – Heavy machinery can impact the root zone of trees through grading and construction activities.
  Soils - Soil compaction and soil contamination may occur because of heavy machinery operation, spills and/or leaks.
- **Sediment** - Increased levels of sediment and erosion potential due to land clearing may impact adjacent natural areas and increase dust deposition.
- **Invasive Species** - Introduction of non-native species may occur from contaminated equipment, increased site activity and disturbance to site.

5.3.3 Long-Term Impacts

- **Loss of Vegetation** –The proposed SWM facility and grading will remove all existing vegetation within the existing stormwater facility temporarily during construction and restoration planting will restore the disturbed areas. Total vegetation area will be reduced as the SWMF is currently dry, and is proposed to be a wet facility, increasing the total aquatic area in place of the existing vegetated lands. However, as previously mentioned this existing vegetation is currently part of the Braneida SWMF and not naturally

occurring. Therefore, this removal will not cause a significant impact as similar communities are present elsewhere within the study area.

- **Loss/Disturbance of Wetland Habitat** – Minor encroachment into wetland communities may occur due to grading activities, removal and installation of culverts, accessing the site, and other aspects of construction design; however, work will be undertaken to limit the impacts to wetland communities.

5.4 Impacts to Significant Wildlife Habitat and Species at Risk

5.4.1 Existing Impacts

- **Noise Pollution** – Moderate to high noise levels from adjacent roads and industrial buildings were noted throughout the study area. This noise may cause a reduction in the species abundance or richness of birds and other wildlife residing within the study area. Some species have likely become accustomed to the noises generated by human activities.
- **Human Activities** – Occasional use of the walking trail by the community including dogwalkers can impact wildlife species, specifically during the breeding season. This can increase mortality of species and influence success rate of breeding.
- **Maintenance Activities** – Mowing of the walking trail was noted in the study area. Mowing can cause noise pollution, disturbance to wildlife and potential mortality of reptiles, amphibians and small rodents.

5.4.2 Short-Term Impacts

- **Noise/Vibration Pollution** – Short-term increases in noise, vibration, human activity and disturbances from construction traffic may interfere with species carrying out life processes, including breeding.
- **Wildlife Movement** - Temporary disruptions to wildlife movement may occur due to construction zone exclusion fencing, as well as temporarily taking portions of the watercourse offline during restoration activities. There is a risk of entrapment or mortality due to exclusion fencing and use of heavy equipment.

5.4.3 Long-Term Impacts

- **Disturbance to Wildlife Habitat** – The removal of vegetation communities would represent a slight decrease in available habitat for wildlife species within the study area; however, habitat is still readily available throughout the landscape. This loss of terrestrial habitat should not negatively impact any SWH or SAR. The creation of aquatic habitat will likely positively impact aquatic species, specifically amphibians and reptiles, including snapping turtles.
- **Loss/Disturbance of Species at Risk, Special Concern and Rare Wildlife Species Habitat** – The removal of foraging habitat for barn swallow and bank swallow and monarch foraging habitat represents a negligible decrease in available habitat given its widespread availability throughout the study area.
-

6 Environmental Mitigation Strategy

The following three components form the basis of the strategy developed to minimize potential impacts to the natural environment.

- *Avoidance* – Placement of the final design layout outside of valuable natural heritage features to the extent possible.
- *Mitigation* – Implementing measures designed to minimize or eliminate impacts to natural features or functions.
- *Compensation* – Restoring, enhancing, or replacing features or functions which may be affected by the construction of the project.

6.1 Avoidance

The limits for the proposed SWMF retrofit have been designed to protect, where feasible, the existing natural heritage features within the study area. This includes the protection of The Garden Avenue Tributary and its associated riparian communities as well as the meadow communities located east of the SWMF. For this reason, potential impacts have been limited to those areas essential for accommodation of the SWMF retrofit, thereby reducing the overall impacts.

6.2 Construction Impacts Mitigation

Construction related impacts can typically be reduced or avoided through the implementation of a set of established standard mitigation measures. They are regularly implemented for infrastructure projects and include measures meant to minimize, or in some cases, altogether eliminate potential impacts to the natural environment. The following measures are recommended to be implemented for the proposed works.

Construction Equipment – Construction equipment impacts can be minimized through regular machinery inspections and maintenance. Identifying dedicated locations away from natural heritage features for re-fueling and storing equipment can also reduce or avoid unnecessary impacts. These locations should not occur within 30 m of wetland communities or the Garden Avenue Tributary.

Installation of Protection Fencing – The installation of tree protection fencing and sediment and erosion protection fencing (silt fencing) can minimize construction impacts, such as damage to trees or sediment transport into adjacent natural heritage features. Protective fencing should be installed adjacent to vegetation communities being protected. This includes the area surrounding the Garden Avenue Tributary and around all trees not identified for removal. Proper installation and maintenance of installed fencing is necessary to reduce the risk of potential impacts.

Invasive Species Management and Control – Construction shall follow the Clean Equipment Protocol during construction activities to prevent the further spread of invasive species. Removal of all invasive species within the construction limits shall occur, including root systems. Disposal of invasive species shall be administered in an appropriate manner following accepted and approved disposal guidelines from governing agencies.

Timing Restrictions – Construction related activities should be restricted outside of sensitive periods for resident wildlife reducing potential disturbances during various life cycle stages. These activities should be limited to the daylight hours (i.e. 7am to 7pm) to reduce the amount of noise disturbance. In addition, vegetation clearing should occur outside of the breeding bird period (i.e. April 1 to August 31) for birds afforded protection under the *MBCA* avoiding incidental take and reducing impacts to breeding birds. Any in-water works shall comply with the DFO Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (March 15th to July 15th).

Wildlife Observation and Handlings Protocols – During construction, workers are to take preventative measures with respect to wildlife species. A majority of the wildlife in Ontario is afforded protection either under the *Fish and Wildlife Conservation Act*, the *Endangered Species Act* or by the federal *Migratory Bird Convention Act*, therefore care should be taken in order to avoid contravening any of the aforementioned *Acts*. A plan should be developed to outline appropriate mitigation measures specific to the site. Generally speaking, the following should be considered when wildlife is encountered:

1. Do not feed wildlife.
2. Do not harass or harm wildlife.
3. Identify the species observed and contact a qualified Ecologist should there be doubt in identification of the species.
4. Should SAR be suspected, do not handle unless the species is in immediate danger. Contact a qualified Ecologist immediately. Species should only be handled by permit holders and/or qualified Ecologists/Construction Monitor.

5. Should the species identified NOT be SAR, guide the species away from the construction area into the nearest natural feature; if not known where to move the species, contact a qualified Ecologist for recommendations.
6. For proper wildlife handling methods, follow the safe handling protocols, as outlined in the MNRF's Ontario Species at Risk Handling Manual: For Endangered Species Act Authorization Holders.
7. Should an injured animal be observed; contact a Qualified Ecologist for next steps.

An application for a Wildlife Scientific Collectors Authorization shall be obtained from the MNRF for the duration of the construction project by a qualified individual.

6.3 Compensation, Restoration and Enhancement

The recommendation for restoration, and/or compensation of degraded habitats creates an opportunity to provide a net benefit to existing features and functions, thereby contributing to the improvement of overall health of the natural heritage system. The following presents the recommended compensation and restoration measures to be considered for the Braneida study area.

Restoration of Disturbed Areas – Planting of native trees, shrubs and herbaceous species can reduce or eliminate negative edge effects caused by construction activities. All areas disturbed by construction activities should be revegetated once construction is complete. A planting plan will be prepared at the detailed design stage.

Invasive Species Management - Consideration should be given to the removal of the identified invasive species that exist within the current SWMF. Phragmites and purple loosestrife have been observed within the dry cell and should be removed and disposed of at an approved landfill site following acceptable and approved methods by governing agencies. An invasive species management plan should be developed at detailed design to identify proper removal and disposal techniques as well as identify disposal locations.

Garden Avenue Tributary Enhancement – Targeted locations along the tributary will be restored using native bank armouring materials including rock and soil. Restoration planting will use native seeds, plants, trees and shrubs. All planting material will be locally sourced and native to the local area. Plant selection will consider species that are used by pollinators and wildlife and are suitable for the site conditions, with the intent to increase site biodiversity. Additionally, in-water features including boulders and woody debris will be incorporated to provide in-stream fish habitat. See **Section 4** above for a description of the proposed channel works.

7 Net Environmental Effects

Net effects are described as those impacts that remain or are residual after mitigation measures, including avoidance, compensation and restoration, have been applied. The net effects of potential impacts were assessed based on the expected efficacy of the recommended mitigation measures intended to avoid or reduce potential environmental effects.

The following criteria were used to determine the net effects from the design, construction, and existing land use related to the Braneida SWMF retrofit.

No net effect - identifies no measurable impact to any natural features and their functions.

Low net effect - identifies the loss of common habitat types possessing limited potential value, or the loss of a portion of an identified habitat; however, not resulting in long-term impacts such as a reduction or loss in function to the habitat being protected or to the ability of local species to carry out life processes.

Medium net effect- identifies the loss of uncommon habitat that may result in long-term impacts to remaining habitat or linkages, reduction in local size of population that may have an impact on other species life cycles, longer or more frequent interruptions to animal behaviour activities and change or replacement of a system with some loss of ecological function.

High net effect – identifies the loss of rare or unusual habitat types that will result in long-term and cumulative impacts on remaining habitat and linkages, significant reduction in the local size of a population that will impact species life cycles, long term continuous interruptions of animal behaviour activities that results in the loss of productivity and or death of young while animal is away and change or replacement of a cultural system with complete loss of ecological function.

The net effects of the Proposed Works and associated mitigation measures are shown in **Table 7-1**.

Table 7-1. Assessment of Net Effects.

Source/Potential Impact	Potential Effects	Recommendations	Net Effects
1.0 Potential Short-term Impacts - Construction:			
1.1 Sediment and Erosion	▪ Sediment deposition within adjacent vegetation and Garden Avenue Tributary. ▪ Sediment deposition within Garden Avenue Tributary.	▪ Installation of erosion and sediment control measures (ESC) around the entire construction limits. Monitoring to ensure erosion controls are installed as intended. ▪ The construction area should not overlap with the Maximum Hazard Line.	**NO NET EFFECT** Proper installation and monitoring of ESC measures can reduce the risk of sediment deposition to the adjacent natural features and Garden Avenue Tributary.
1.2 Dust Deposition	▪ Dust accumulation on vegetation communities affecting plants' ability to photosynthesize.	▪ Use of dust suppressants as required. ▪ Water adjacent vegetation when dust occurs.	**NO NET EFFECT** Use of dust suppressants can reduce the risk of dust accumulation in vegetation communities.
1.3 Damage to Adjacent Natural Features	▪ Limited tree removal will be required. ▪ Damage to tree rooting zone adjacent to areas of grading and excavation. ▪ Soil compaction by machinery in areas adjacent to natural features affecting trees' ability to absorb nutrients and water. ▪ Structural damage to adjacent vegetation by operation of heavy machinery (broken tree limbs etc.).	▪ Delineate the limits of work. ▪ Installation and monitoring of tree protection fencing to protect trees and their root zones. ▪ Limiting tree removal to the extent possible. ▪ Proper root pruning of adjacent trees during grading and excavation following good forestry practice.	**LOW NET NEGATIVE EFFECT** Roots of trees being preserved may require pruning to avoid impacts. Proper installation and monitoring of protective fencing, as well as restriction of access can reduce the risk of potential injury and impacts to trees.
1.4 Construction Equipment Impact	▪ Damage to adjacent vegetation communities and watercourses caused by leaks and spills.	▪ Regular maintenance and inspection of machinery.	**LOW - NO NET NEGATIVE EFFECT**

Source/Potential Impact	Potential Effects	Recommendations	Net Effects
		▪ Perform refueling and maintenance in designated areas > 30 m away from Garden Avenue Tributary. ▪ Adherence to the Clean Equipment Protocol for Industry.	Proper cleaning and maintenance of machinery will reduce leaks and spills and prevent spread of invasive species. Designated refueling areas will prevent spills into drainage features.
1.5 Disturbance to Wildlife	▪ Disturbance of breeding birds and other wildlife due to noise and vibration.	▪ Restrict construction activities to daytime hours (sunrise to sunset). ▪ Restrict vegetation clearing to periods before and after the bird nesting period of April 1st to August 31st and outside of the bat maternity roosting period of April 1 to October 1. ▪ Install construction fencing to delineate the limits of construction. ▪ Meeting between contractor and project ecologist at the commencement of the project to outline the expectation and requirements of working in a natural environment.	**LOW NET EFFECT** With the implementation of restrictions to the timing of construction disturbance to birds and other wildlife can be minimized. Construction is not anticipated to prevent wildlife movement between natural features.
2.0 Potential Long-term Impacts:			
2.1 Loss of Vegetation	▪ Potential disturbance/removal of vegetation of 21,916 m^2 approximately within the existing SWMF.	▪ Disturbed areas not permanently lost due to construction should be replanted with native trees, shrubs and seed mix. ▪ Sediment and erosion control fencing will be installed to prevent any construction machinery from entering natural areas. ▪ New SWMF facility shoreline will be planted with native species. ▪ Loss of vegetation within SWM facility will not cause a negative impact to features being protected.	**LOW NET EFFECT** The removal of vegetation will be compensated for by planting native seed, shrubs and trees to increase biodiversity. There will be a net loss of total vegetation, but existing vegetation present within the SWMF has many non-native and invasive species, which will be removed as part of these works.
2.2 Disturbance to Garden Avenue Tributary	▪ Degradation of the Garden Avenue Tributary ▪ Twin Culvert replacement will remove existing vertical drop which will improve fish passage, ▪ Temporary impacts to the creek at the location of restoration during construction works and will be short term. ▪ Potential release of sediment temporarily into the watercourse.	▪ Install sediment and erosion control measures prior to onset of construction including silt fence. ▪ Proper contractor practices will include working avoiding working near water during high flow events, proper maintenance of equipment, installation of erosion controls, flow diversion and temporary coffer dams, etc. ▪ Minimize in-water works. Restore watercourse to pre-existing conditions or enhanced condition. ▪ Follow mitigation outlined for culvert replacement, including the use of cofferdam or equivalent, flow diversion and bypass pumping to divert flows. ▪ Garden Avenue Tributary Improvements will be taking place at	**NO NET EFFECT** Through the implementation of all proposed mitigation measures. proposed works are not anticipated to cause a negative impact to the watercourse. The removal/replacement of the culvert will create better connectivity upstream and downstream of the culvert and promote fish passage barriers within the watercourse.

Source/Potential Impact	Potential Effects	Recommendations	Net Effects
		multiple targeted locations downstream of the SWMF.	
2.3 Potential Disturbance to Species at Risk Individuals or Habitat	▪ Potential disturbance barn and bank swallow foraging habitat. (21,916 m2)	▪ Native seed mix and planting of native trees and shrubs shall be used to revegetate disturbed areas within the habitat during the appropriate seasons and conditions. ▪ Restriction of the removal of vegetation outside of the maternity roosting season of April 1st to October 1s ▪ New SWMF will have open water feature that could be used by Barn and Bank Swallow for foraging	**NO NET EFFECT** Disturbance to the vegetated community of the SWMF will not affect the form or function of the use of the study area by these species as the adjacent lands contain large open areas also used by the species.
2.4 Potential Loss of Significant Wildlife Habitat	▪ Potential disturbance to monarch habitat. ▪ Candidate SWH exists for, turtle wintering, turtle nesting, amphibian breeding, and amphibian movement corridor.	▪ Native seed mix and planting of native trees and shrubs will be used to revegetate disturbed areas within the habitat to the extent possible. ▪ Seed mixes used shall incorporate the use of milkweed to compensate for the minor loss of monarch habitat. ▪ Restriction to vegetation removal within natural features outside of the bird nesting season (April 1st to August 31st) and outside of the bat roosting period. ▪ The form and function of the SWH habitats will be maintained. ▪ Installation of sediment fencing along the edges of natural features to prevent intrusion. ▪ Any works within potential overwintering habitat of amphibian or reptile habitat will have to have a wildlife rescue performed prior to the hibernation period (early October to the end of May (timing is seasonally dependent)) and permitting and authorization obtained from MNRF.	**NO NET EFFECT** The vegetation removal is not anticipated to affect the form and function of the Significant Wildlife Habitat through the implementation of mitigation measures.
2.5 Interference with Wetlands and Watercourses	▪ Potential disturbance to wetland communities through grading and twin culvert replacement and at locations proposed for restoration along the Tributary. ▪ Potential disturbance within the following wetland vegetation communities (MAM2, MAM3-5, MAS2-1, SWT2, SWT2-2) ▪ Potential impacts to surface water	▪ Proposed work is limited to the edges of natural features. ▪ Implementation of setbacks to provide protection to natural features (i.e. no machinery within wetland/aquatic features). ▪ Obtain Development, Interference with Wetlands and Alteration to Shorelines and Watercourses Permit from GRCA and follow permitting requirements. ▪ Installation of sediment and erosion protection measures and continued monitoring of their effectiveness throughout the duration of the construction works.	**NO NET EFFECT** The vegetation disturbance is not anticipated to affect the form and function of the wetland along Garden Avenue Tributary as work is temporary and appropriate mitigation will be applied.

8 Natural Heritage Recommendations

The following presents the recommended natural heritage recommendations for the proposed SWMF retrofit. These recommendations have been developed based on the protection of the identified significant natural heritage features within the study area to the maximum extent possible.

8.1 Environmental Management Areas

The Garden Avenue Tributary and associated riparian communities are the primary natural heritage feature to be protected within the study area during construction of the project. These areas, outside of the proposed work area, should be designated as “no works” areas during construction and protected through the installation of appropriate fencing and should be clearly outlined on contract drawings and specifications.

8.2 Rehabilitation Areas

Habitat restoration and enhancement shall occur in areas disturbed by construction and along the Garden Avenue Tributary through the planting of native trees and shrubs within disturbed areas, thereby creating a stable edge to further protect the integrity of existing features. Plantings should consist of native trees, shrubs and herbaceous species. Species selected for the planting plan should include a mixture of those native species already present within the study area. In order to provide rapid establishment of native ground cover, a seed mix comprised of grasses, asters, goldenrods, milkweeds and other species suitable to soil conditions at restoration locations is recommended.

8.3 Construction Mitigation Measures

Natural areas are particularly susceptible to disturbance during the construction phase of a given project as site conditions are most significantly altered during this period. Recommended construction mitigation measures include:

- **Natural Feature Identification and Protection:** Identifying and protecting natural heritage features is an important component in the design process and for the execution of a successful construction project. Limiting potential impacts to the defined work area and minimizing disturbances should be considered where possible. It is recommended that heavy-duty Erosion and Sediment Control (ESC) and Tree Protection Fencing (TPZ) be installed to clearly delineate the limits of work and to protect the surrounding natural features. Inspection of the TPZ and ESC should be done at regular intervals and after a rainfall. Any deficiencies should be repaired immediately.

- **Grading Techniques**: Site grading and runoff controls should be developed during the final design to mitigate potential stormwater runoff impacts to the surrounding natural areas. This plan should provide for post-construction contours that minimize runoff to the natural areas.

- **Tree Removals**: Where tree removal is proposed, then all removals must comply with the County of Brant Tree Bylaw (197-07) and the City of Brantford Tree Bylaw (Chapter 322). Tree removal should be completed by or overseen by a Certified Arborist using proper arboricultural techniques.

- **Riparian Vegetation Removals**: Clearing of riparian trees and/or shrubs should be minimized such that physical and biological functional attributes of the terrestrial vegetation can be maintained as they relate to aquatic ecological function.

- **Timing Restrictions for Wildlife** – Restricting construction related activities outside of sensitive periods for local or significant wildlife species can limit disturbance during life cycle stages. Construction related activities should be limited to the daylight hours (i.e. 7am to 7pm) to reduce the amount of noise disturbance to wildlife. Any vegetation clearing should occur outside of the breeding bird period (i.e. April 1 to August 31) as well as the bat roosting period (April 1 to October 15) to reduce impacts to breeding birds avoiding incidental take under *MBCA* and bats under *ESA*.

- **Wildlife or Sensitive Species Encounters** – If sensitive or SAR species are suspected contact a qualified Ecologist immediately to inquire on next steps. If the species is identified as SAR, do not handle the individual unless it's in immediate danger and a setback should be established to protect the species until guidance has been received. Details regarding the size and implementation of the setback should be determined in consultation with the MECP. If the species is NOT identified as SAR, direct the species away from the construction footprint to the nearest natural area; if unsure of where to relocate the species, contact a trained Ecologist for guidance. Should the species be identified within the construction footprint, a relocation plan may be drafted in consultation with the appropriate agencies. In order to conduct any type of wildlife handling or relocation, a Wildlife Scientific Collectors Permit from the MNRF will be required.

- **Installation of Reptile and Amphibian Exclusionary Fencing** - A qualified ecologist or trained construction monitor should assess the construction footprint prior to the onset of construction for the presence of any reptiles or amphibians. Any species encountered may require relocation outside of the construction footprint. This should be completed in consultation with appropriate agencies and with the required permitting (e.g. Wildlife Scientific Collectors Permit etc.) Once construction footprint is cleared exclusionary fencing should be installed along the perimeter of the area using protocols outlined in the MNRF Species at Risk Best Practices Technical Notes for Reptile and Amphibians Exclusion Fencing version 1.1 (July 2013).

- **Construction Vehicles:** Vehicle access should be limited to areas outside of the drip-line of the trees being protected and limited to less sensitive areas to prevent soil compaction and/or the initiation of soil erosion events. Construction vehicle re-fueling stations should be centralized away from vegetation communities and watercourses. Vehicle washing should be prohibited in areas adjacent to vegetation communities and watercourses. The following recommendations are provided to address these potential sources of impact.
    - Construction vehicle access should be limited to existing roadways and construction paths, away from the identified vegetation communities when feasible.
    - For areas immediately adjacent to the Garden Avenue Tributary, periodic supervision of the construction is recommended.
    - Machinery will arrive on site in a clean, washed condition and is to be maintained free of fluid leaks;
    - Wash, refuel and service machinery and store fuel and other materials for the machinery away from water to prevent any deleterious substance from entering the water.

- **Construction Timing (Fish):** To minimize disturbance during critical periods, construction for in-water works must be restricted to a period between March 15th and July 15th of any given year. This timing window will allow for all possible species to complete their spawning without construction disturbance. Where feasible, in-water work should be conducted under low flow conditions to further reduce the risk to fish and fish habitat and to increase the likelihood that the in-water work area can be effectively isolated.

- **Restoration of Disturbed Areas** – Vegetation clearing occurring for the proposed works can be mitigated through the planting of native vegetation in any areas disturbed by construction activities. Areas disturbed should be revegetated once construction is complete through the planting of native trees, shrubs and native grasses and sedges. Milkweed should be incorporated into the plantings plans, where feasible.

- **Contaminant and Spill Response Plan**: A plan should be developed and implemented immediately in the event of a sediment release or spill of a deleterious substance and an emergency spill kit must be kept on site. No storage of construction equipment, materials, chemicals, stockpiled resources of soil or storage of any other objects associated with site alteration is to occur within the delineated natural area, or within 30m of the Garden Avenue Tributary. Also, maintenance of machinery during construction should occur a minimum of 30m away from the watercourse.

- **Construction Monitoring** is undertaken during the implementation of proposed works to ensure that methods for mitigating concerns and for environmental enhancement are performed as planned and approved and that any problems that may arise during construction are effectively addressed. Construction activities are to be undertaken in accordance with all applicable guidelines, policies, regulations, and statutes.

8.4 Environmental Monitoring

The monitoring of environmental conditions post-construction is integral in determining the success of protection and mitigation measures implemented as part of this plan. The following provides an outline of a proposed Environmental Monitoring Program:

- **Restoration or Compensation Area Monitoring** – Monitoring of planting survivorship and health conditions within these zones should be completed. Evidence of browsing, rodent damage, and mortality should be recorded. The presence of any invasive non-native vegetation should also be recorded.
- **Edge Monitoring** – Vegetation monitoring along the edges of the riparian communities along Garden Avenue Tributary shall take place to document construction works and identify incidental damage caused by construction that would require additional restoration.

An Environmental Monitoring Program should be developed to monitor the success of the implementation of protection and mitigation measures of this EMP. The program should include restoration or enhancement area monitoring, vegetation monitoring, and corrective measures where applicable. The plan should be prepared prior to the initiation of construction.

9 Policy Compliance

The following presents how the proposed works complies with applicable Federal, Provincial, and Municipal Legislation/Policies:

- ***Migratory Birds Convention Act, 1994*** – Vegetation will be cleared outside of the breeding bird season of April 1 to August 31 of any construction year.
- ***Ontario Restricted Activity Timing Windows for the Protection of Fish and fish Habitat (DFO)***
- ***Fisheries Act*** – DFO Request for Review has been submitted and a response permit (20-HCAA-02198) was received from DFO. All works will adhere to the permitting requirements.
- ***Endangered Species Act, 2007*** – No SAR were found during field investigations.
- ***GRCA Ontario Regulation 150/06 –*** A permit will be required from the GRCA. No negative impacts to onsite wetlands are anticipated as a result of proposed retrofit. Where wetland communities are in proximity to proposed works appropriate mitigation measures will be implemented reducing the risk of negative impacts.
-

10 Conclusions

This EIS report provides the required supporting documentation for the proposed Braneida SWMF Retrofit and Downstream Garden Avenue Tributary Rehabilitation. This report provides:

- A description of the existing natural heritage conditions within the study area as delineated through a combination of field investigations and review of available background information,
- The identification of vegetation communities, plants, wildlife, and natural heritage features known to occur within the study area,
- An assessment of the level of significance of the identified features and species based on federal, provincial, and municipal criteria,
- An assessment of potential impacts on natural heritage system; and,
- A summary of environmental recommendations to protect the features and species within the study area, including recommended mitigation measures to reduce or avoid impacts on natural features, and plans for the restoration of degraded habitats within the study area.

Based on the above evaluations of the aquatic and terrestrial environments, the Braneida SWMF Retrofit and downstream creek rehabilitation will not result in net negative impacts on the features and functions of the adjacent lands with the implementation of the mitigation, restoration, and enhancement recommendations presented in this report.

Future design plans should adhere to the environmental recommendations of this report.

11 References

Bird Studies Canada (BSC), Environment Canada's Canadian Wildlife Service, Ontario Nature, Ontario Field Ornithologists and Ontario Ministry of Natural Resources. 2006. Ontario Breeding Bird Atlas Database. http://www.birdsontario.org/atlas/index.jsp

Canadian Wildlife Service (CWS). 2013. Migratory Birds Convention Act (MBCA) and Regulations. June 15, 2019. http://www.ec.gc.ca/nature/default.asp?lang=En&n=7CEBB77D-1

Dobbyn, J.S. 1994. Atlas of the Mammals of Ontario. Don Mills, Federation of Ontario Naturalists.

Fisheries and Oceans Canada (DFO). 2013. Ontario Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat. December 27, 2013. http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/on-eng.html

Government of Canada. 2017. Species at Risk Public Registry: Species Search. Last updated January 7, 2021. https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

Government of Canada. 2017. Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Updated October 2020.

Government of Canada. 2017. Migratory Birds Convention Act. 1994. Last modified January 2, 2021. https://laws-lois.justice.gc.ca/eng/acts/m-7.01/

Government of Canada. 2018. General Nesting Periods for Migratory Birds. https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/general-nesting-periods.html. Last modified October 30, 2018.

Halyk, Larry (OMNR). 2013. “New Forest Creek” Reconnaissance and Rehabilitation Recommendations.

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

Macnaughton et al. 2017. Ontario Butterfly Atlas Online. Toronto Entomologists’ Association. Last updated August 2020. http://www.ontarioinsects.org/atlas_online.html

Ministry of Natural Resources and Forestry (MNRF). 2020. Ministry of Natural Resources Make a Map: https://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US

Ministry of Natural Resources and Forestry (MNRF). 2018. Species at Risk in Ontario (SARO) List. https://www.ontario.ca/environment-and-energy/species-risk-ontario-list.

Ministry of Natural Resources and Forestry (MNRF). 2017. Survey Protocol for Species at Risk Bats within Treed Habitats. April 2017.

Ministry of Natural Resources and Forestry (MNRF). 2015. Significant Wildlife Habitat Ecoregion 6E Criterion Schedule: Addendum to Significant Wildlife Habitat Technical Guide. MNRF, January 2015.

Ontario Breeding Bird Atlas (OBBA). 2006. Guide for Participants. Atlas Management Board, Federation of Ontario Naturalists, Don Mills.

Ontario Breeding Bird Atlas (OBBA). 2019. Atlas Data Summary. http://www.birdsontario.org/atlas/datasummaries.jsp?lang=en. Accessed May, 2019.

Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide. October 2000.

Ontario Ministry of Municipal Affairs and Housing (OMMAH). 2014. Provincial Policy Statement. Queen's Printer for Ontario, 2014.

Ontario Ministry of Natural Resources (OMNR). 2013b. In-Water Works Timing Window Guidelines. March 11, 2013.

Ontario Nature. 2019. Reptiles and Amphibians of Ontario Range Maps. Last Updated in 2019. http://www.ontarionature.org/dynamic-maps/dynamic-maps/.

Stanfield, L. (editor). 2013. Ontario Stream Assessment Protocol. Version 9.0. Fisheries Policy Section. Ontario Ministry of Natural Resources. Peterborough, Ontario. 505 Page

Attachment A

Agency Correspondence

Ecosystem Recovery Inc.
80 Courtland Avenue East, Unit 2
Kitchener, Ontario, N2G 2B8
Phone: 519.621.1500
www.ecosystemrecovery.ca

To:	Nathan Garland (GRCA)	**Date:**	January 14, 2021
From:	Kierian Keele (ERI)	**ERI Project No.:**	1839
CC:	Nahed Ghbn (City), Chris Moon (ERI), Rob Messier (GRCA)		
Project:	Braneida SWM Pond Retrofit and Downstream Watercourse Rehabilitation – Class EA		
Re:	EIS Terms of Reference		

The following has been prepared for the purpose of outlining a potential Terms of Reference for the Scoped Environmental Impact Study (EIS) pertaining to a proposed Braneida Stormwater Management Faciltiy (SWMF) retrofit and downstream watercourse rehabilitation.

A Schedule "B" Environment Assessment is being undertaken by the City of Brantford for a proposed retrofit to the Braneida Industrial Stormwater Management Facility (SWMF). The SWMF is located adjacent to 76 Adams Boulevard in Brantford, Ontario. The SWMF was designed and constructed in the 1990s. This project is part of the maintenance and redesign of the SWM facility to meet current design standards and performance criteria.

The potential Terms of Reference have been prepared based on our review of the City of Brantford Official Plan requirements, and Grand River Conservation Authority (GRCA) Planning and Regulations Guidelines, specifically the Environmental Impact Study Guidelines.

A EIS would provide site wide environmental background information and could include a biophysical inventory and analysis, an identification of constraints and opportunities, an assessment of impacts, and analysis of mitigation measures and identification of monitoring needs.

Task 1: Background Information Desktop Review

Using resources such as the Ministry of Natural Resources (MNRF) database, Ministry of Environment, Conservation and Parks (MECP), GRCA, City records and eCommunal sources (e.g. eBird, i Naturalist, etc.), ERI will document the existing conditions of the subject lands and the 120 m study area buffer for the entire site, which includes the SWMF, wetlands, watercourse and uplands. Existing conditions of adjacent properties will also be documented as they relate to the subject lands. Features would include:

- Species at Risk (SAR) Data;
- Fisheries and Oceans Canada (DFO) Aquatic SAR Mapping;
- Wildlife database records;
- Municipal natural heritage, forestry and wildlife records or applicable management plans;
- Available natural feature mapping (e.g., wetlands, significant woodlands, significant natural features, etc.); and
- GRCA regulated areas.

ERI has reviewed current available data records for the Study Area, and have contacted the City of Brantford, MNRF and MECP for any further natural heritage, SAR and natural features records within the Study Area and surrounding lands. Connectivity of natural features identified on, or adjacent to the site will be mapped, and identified. The desktop review has been completed.

Ecosystem Recovery Inc.
80 Courtland Avenue East, Unit 2
Kitchener, Ontario, N2G 2B8
Phone: 519.621.1500
www.ecosystemrecovery.ca

Task 2: Agency Liaison

ERI have completed further agency liaison with the MECP, MNRF and GRCA as required to identify any natural heritage features for protection, or for further site specific investigations. Information gathered through this liaison has been used to inform field surveys, and will inform the design of the retrofit for the facility and downstream watercourse rehabilitation.

Task 3: Species at Risk Screening

ERI have updated SAR information obtained from the background reports to confirm and identify suitable SAR habitat within the study area. MNRF correspondence outlined the requirement for Blandings Turtle (*Emydoidea blandingii*) surveys following the Survey Protocol for Blanding's Turtle, MNRF 2015, which are now complete.

Task 4: Field Surveys

ERI initially conducted a preliminary site reconnaissance to review the aquatic and natural features within the Study Area (May 2nd, 2019). Additional field investigations could be undertaken to verify desktop review findings and previously collected information, and further characterize the natural features present within the Study Area. The focus of the field investigations subject to GRCA confirmation could include:

a) **Ecological Land Classification (ELC):**
   - Verification of existing preliminary ELC classification through characterization of vegetation communities following MNRF Ecological Land Classification System for Southern Ontario (Lee et. Al., 1998) First Approximation Methods
   - One event (May-June, 2020)

b) **Vegetation Inventory:**
   - Vegetation inventory will be completed for defined study area of the proposed impact limits of proposed construction areas to document existing vegetation present and identify any rare species
   - One event (May-June, 2020)

c) **Fisheries and Aquatic Habitat Survey:**
   - One detailed aquatic habitat assessment of the entire length of the Garden Avenue Tributary limits within Study Area to characterize the aquatic features present. (March 2020) following the Ontario Stream Assessment Protocol (2013)
   - Fisheries community assessment including the acquisition of a License to Collect Fish for Scientific Purposes from the MNRF for Fisheries for the Garden Avenue Tributary within the study area limits.

d) **Breeding Bird Survey:**
   - Two events in the early spring/summer. (May-June 2020)
   - In accordance with industry standard monitoring methods (e.g Marsh Monitoring Protocol, Parks Canada Forest Bird Monitoring, Ontario Breeding Bird Atlas)

Ecosystem Recovery Inc.
80 Courtland Avenue East, Unit 2
Kitchener, Ontario, N2G 2B8
Phone: 519.621.1500
www.ecosystemrecovery.ca

e) Incidental Wildlife Observations:

- Incidental wildlife observations will be conducted during all field assessments of the Study Area

All field investigations are anticipated to be carried out concurrently (where possible) in Spring and early Summer 2020, and as appropriate for the survey type. Timing of field investigations will be determined by weather, seasonal climate and site conditions.

Task 5: Existing Conditions Reporting and Analysis

Based on the results from the desktop review and field investigations a Scoped Environmental Impact Study (EIS) will be prepared as a supporting document for the proposed SWMF retrofit and downstream watercourse rehabilitation include an assessment of impacts on identified natural features and recommended mitigation strategies will be presented. A detailed description of the proposed site retrofit and downstream watercourse rehabilitation will be included, and provide the basis for assessment of impacts. This will be prepared in accordance with the City of Brantford Official Plan Guidelines.

Should it be determined through spring and early summer investigations that a fall survey is required, the schedule for the draft and final EIS reports will be revised accordingly.

From: Tony Zammit
To: Kierian Keele
Cc: Ashley Graham; Nathan Garland
Subject: RE: Braneida Fish Records
Date: Monday, July 27, 2020 4:54:40 PM
Attachments: image001.png
image003.png

Hi Kierian:

Unfortunately, fish records for the tributaries within your study area are not readily available and I'm not able to check our paper files at the moment as I am still working from home. The watercourses located within the Brantford Northeast Industrial Area flow toward Fairchild Creek, which is a mixed water system that supports species with warm and cool water affinities. Within your study area, fish were surveys were carried out in 1999 (Ecoplans) and 2013 (MNRF). A fish survey was conducted in 2006 (Cam Portt & Associates) along the main branch and immediately upstream of Garden Ave.

The fish community along Fairchild Creek (downstream of the 403) consists of the following species:

-

Staff in the MNRF Guelph District Office might be able to assist you further.

Best regards,

Tony

Anthony E. Zammit, MES|Watershed Ecologist
Grand River Conservation Authority
400 Clyde Road, Box 729, Cambridge, Ontario N1R 5W6
Tel: 519-621-2763 x2246 | Mobile: 519-240-0714
tzammit@grandriver.ca | www.grandriver.ca

From: Kierian Keele <kierian.keele@ecosystemrecovery.ca>
Sent: Monday, July 27, 2020 1:45 PM
To: Nathan Garland <ngarland@grandriver.ca>
Cc: Tony Zammit <tzammit@grandriver.ca>; Ashley Graham <agraham@grandriver.ca>

Subject: RE: Braneida Fish Records

Thanks Nathan

From: Nathan Garland <ngarland@grandriver.ca>
Sent: Monday, July 27, 2020 12:10 PM
To: Kierian Keele <kierian.keele@ecosystemrecovery.ca>
Cc: Tony Zammit <tzammit@grandriver.ca>; Ashley Graham <agraham@grandriver.ca>
Subject: RE: Braneida Fish Records

Hi Kierian,

I've cc'd Tony Zammit in case he is aware. There may be some downstream information as I thought it was part of a Municipal Drain further down. Ashley Graham is the planner from GRCA returning to Brantford and I have cc'd her on this email as well.

Regards,

Nathan Garland
519.621.2763 x 2237

From: Kierian Keele <kierian.keele@ecosystemrecovery.ca>
Sent: Tuesday, July 21, 2020 8:17 AM
To: Nathan Garland <ngarland@grandriver.ca>
Subject: Braneida Fish Records

Hi Nathan,

Does the GRCA have any fish records for the Braneida site (Garden Ave Tributary)? During our meeting Rob said there may be some further upstream of the site. If available, are you able to send them to me?

Thank you,

Kierian

From: Buck, Graham (MNRF)
To: Kierian Keele
Subject: RE: Information Request: Braneida Brantford
Date: Wednesday, February 27, 2019 11:00:37 AM
Attachments: SAR_Brantford.pdf
InfoRequestGuide_2018-12-18-FINAL.pdf

Thank you for your request for information on natural heritage features. Due to the presence of **Blanding's Turtle** in the area portions of the D'Aubigny Creek Swamp and intervening lands, including agriculture lands might be protected habitat of the species. Surveys for the species are recommended to confirm if habitat of the species is present on the property.

It remains the proponent's responsibility to complete a preliminary screening for each project, to obtain available information from multiple sources, to conduct any necessary field studies, and to consider any potential environmental impacts that may result from an activity. We wish to emphasize the need for the proponents of development activities to complete screenings prior to contacting the Ministry or other agencies for more detailed technical information and advice.

The Ministry continues to work on updating data housed by Lands Information Ontario and the Natural Heritage Information Centre, and ensuring this information is accessible through online resources. Species at risk data is regularly being updated. In order to ensure access to reliable and up to date information, the attached list provides a summary of species at risk that have been observed, or may potentially be present, at a geographic township / municipal level.

This information will assist in scoping the necessary field assessments for an area if development or site alteration is proposed. This information is not meant to circumvent the responsibility of the proponent to undertake species and / or habitat surveys. Surveys or additional site level assessment are often required to confirm presence or absence of natural heritage features and values. Environmental consulting firms have the professional and technical expertise to assess sites for natural heritage features and can gauge the potential for such features to exist.

Absence or lack of information for a given geographic area does not necessarily mean the absence of natural heritage features. Many areas in Ontario have never been surveyed and new plant and animal species records are still being discovered for many localities. In addition, new species may be listed and new natural heritage features may be defined over time. For these reasons, the Ministry cannot provide a definitive statement on the presence, absence or condition of natural heritage features in all parts of Ontario.

In order to provide the most efficient service possible, the attached *Natural Heritage Information Request Guide* has been developed to assist you with accessing natural heritage data and values from convenient online sources.

Thank you for your inquiry.

Sincerely,

Graham Buck
Management Biologist
Ministry of Natural Resources and Forestry
Guelph District
1 Stone Road West Guelph ON
N1G 4Y2
519 826 4505
graham.buck@ontario.ca

From: Kierian Keele <kierian.keele@ecosystemrecovery.ca>
Sent: February-06-19 11:05 AM
To: ESA Guelph (MNRF) <ESAGUELPH@ontario.ca>
Cc: Chris Moon <chris.moon@ecosystemrecovery.ca>
Subject: Information Request: Braneida Brantford

Hello,

Please find attached Information Request and Study Area Figure for the Braneida SWM Facility. If you have any questions, please do not hesitate to contact me.

Thank you,

Kierian

Kierian Keele, B.Sc.
Environmental Scientist, Certified Arborist
Tel: (519) 621-1500
Cell: (519) 998-0475

Ecosystem Recovery Inc.
80 Courtland Ave. East, Unit 2
Kitchener, Ontario, N2G 2T8
Tel: (519) 621-1500 | Fax: (226) 240-1080
www.ecosystemrecovery.ca

Attachment B

Aquatic Photolog

Reach 5: View of MAM3-5 open water with vegetated banks.

Reach 5: View of watercourse with dense herbaceous cover shading water.

Reach 5: Moderately deep pool present along tributary.

Reach 5: Narrow, shallow channel with exposed substrate downstream of small riffle.

Reach 5: Large vertical erosion to bank of watercourse.

Reach 5: Small meander in watercourse, minnows observed.

Reach 5: View of historic restoration feature in watercourse.

Reach 5: View of the deep pool with many minnows and fish present.

Reach 5: Channel narrows and sand bar formed on right bank.

Reach 4: Narrow channel with non-aquatic vegetation established.

Reach 4: Shallow, and slow velocities flowing in channel.

Reach 4: View of channel with dense vegetation established on its banks.

Reach 4: Shallow water flowing over hardpan clay substrate.

Reach 4: Dense vegetation established on banks of creek in meadow habitat.

Reach 1: View of shaded water due to dense overhanging vegetation.

Reach 1: Shallow water flowing over hardpan clay substrate.

Reach 1: Narrow channel during low flow conditions.

Reach 1: Water flowing clear in channel.

Reach1: Clear water with attached algae present.

Reach 2: Channel directly upstream of disturbed cattail marsh.

Reach 2: Recently disturbed cattail marsh.

Reach 2: Recently disturbed cattail marsh with pooling water.

Reach 2: Recently disturbed cattail marsh with all vegetation stripped and open, clear pool left.

Reach 2: View through large culvert present at boundary between Reach 2 and 3.

Reach 3: View upstream towards concrete weir.

Reach 3: View of large twin culverts at Reach 2 and 3 boundary.

Reach 3: View of concrete weir and barrier to fish passage.

Reach 3: View downstream as water flows over concrete weir.

Reach 3: View of channel upstream of concrete weir and deep sediment has built up and is easily disturbed.

Reach 3: View of channel lined with cable concrete.

Reach 3: Vegetation and root masses have established over the cable concrete.

Reach 3: Narrow channel through cable concrete channel restricted by encroaching tree roots.

Attachment C

Fish Species

Fish Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	iNaturalist	MNRF Records	ERI Observations
Cypriniformes										
Nocomis biguttatus	Hornyhead Chub	S4							x	
Notropis heterolepis	Blacknose Shiner	S5							x	x
Pimephales notatus	Bluntnose Minnow	S5							x	x
Pimephales promelas	Fathead Minnow	S5							x	
Semotilus atromaculatus	Creek Chub	S5							x	x
Luxilus cornutus	Common Shiner	S5							x	x
Catostomus commersonii	White Sucker	S5							x	x
Moxostoma carinatum	River Redhorse	S2	SC	SC	SC		x			
Esociformes										
Esox lucius	Northern Pike	S5							x	
Gasterosteiformes										
Culaea inconstans	Brook Stickleback	S5							x	x
Perciformes										
Ambloplites rupestris	Rock Bass	S5						x	x	
Etheostoma nigrum	Johnny Darter	S5							x	
Etheostoma olmstedi	Tessellated Darter	S4							x	
Percina maculata	Blackside Darter	S4							x	
					Total:		1	1	13	6

Attachment D

Vegetation Species

COMMON NAME	BOTANICAL NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	INVASIVE SPECIES ONTARIO	PROVINCIAL RANK	ESA STATUS	COSEWIC STATUS (2016-08-19)	SARA STATUS (2016-08-19)	GLOBAL RANK	REGIONAL STATUS 7E - CAROLINIAN ZONE - 2017	LOCAL STATUS BRANT	STUDY AREA	FOD7	CUT1	MAM3-5	CUM1-1	MAM2	MAS2-1	SWT2-2	CUM1/CUT1
	Reference										Oldham 2017	Oldham 2017									
FERNS & ALLIES	**PTERIDOPHYTES**																				
Horsetail Family	**Equisetaceae**																				
Marsh Horsetail	*Equisetum palustre*	10	-3			S5				G5	R	R	x			x					
Meadow Horsetail	*Equisetum pratense*	8	-3			S5				G5	R	R	x		x	x			x		x
CONIFERS	**GYMNOSPERMS**																				
Cedar Family	**Cupressaceae**																				
Eastern Red Cedar	*Juniperus virginiana*	4	3			S5				G5	C	C	x		x		x				x
Eastern White Cedar	*Thuja occidentalis*	4	-3			S5				G5	C	C	x		x		x				x
Pine Family	**Pinaceae**																				
Tamarack	*Larix laricina*	7	-3			S5				G5	U	R	x		x		x				x
White Spruce	*Picea glauca*	6	3			S5				G5	U	X	x		x						x
Blue Spruce	*Picea pungens*		3			SNA				G5	IR		x		x						x
Eastern White Pine	*Pinus strobus*	4	3			S5				G5	C	C	x		x						x
DICOTS	**DICOTYLEDONS**																				
Maple Family	**Aceraceae**																				
Manitoba Maple	*Acer negundo*	0	0		1	S5				G5	C	C	x	x	x	x	x		x		x
Red Maple	*Acer rubrum*	4	0			S5				G5	C	C	x		x						x
Silver Maple	*Acer saccharinum*	5	-3			S5				G5	C		x		x						x
Sugar Maple	*Acer saccharum*	4	3			S5				G5	C		x		x						x
Freeman's Maple	*Acer X freemanii*	6	-5			SNA				GNA	hyb	hyb	x		x						x
Sumac or Cashew Family	**Anacardiaceae**																				
Staghorn Sumac	*Rhus typhina*	1	3			S5				G5	C	C	x		x	x	x		x		x
Carrot or Parsley Family	**Apiaceae**																				
Wild Carrot	*Daucus carota*		5	-2		SNA				GNR	IC	IX	x	x	x	x	x	x	x	x	x
Cow-parsnip	*Heracleum maximum*	3	-3			S5				G5	U	X	x						x		
Water Parsnip	*Sium suave*	4	-5		3	S5				G5	C	U	x			x					
Erect Hedge-parsley	*Torilis japonica*		3	-3		SNA				GNR	IX	IX	x		x						x
Dogbane Family	**Apocynaceae**																				
Spreading Dogbane	*Apocynum androsaemifolium*	3	5			S5				G5	C	C	x				x				x
Indian Hemp	*Apocynum cannabinum*	3	0			S5				G--T5?	C	C	x				x				x
Milkweed Family	**Asclepiadaceae**																				
Poke Milkweed	*Asclepias exaltata*	8	5			S4				G5	R	R	x		x						
Swamp Milkweed	*Asclepias incarnata*	6	-5			S5				G5	C	C	x					x	x		
Common Milkweed	*Asclepias syriaca*	0	5			S5				G5	C	C	x	x	x		x				x
Composite or Aster Family	**Asteraceae**																				
Western Pearly Everlasting	*Anaphalis margaritacea*	3	3			S5				G5	R	R	x				x				x
Common Burdock	*Arctium minus*		3	-2		SNA				GNR	IC	IX	x	x			x			x	x
Aster species	*Symphyotrichum sp.*												x				x	x		x	x
New England Aster	*Symphyotrichum novae-angliae*	2	-3			S5				G5	C	C	x	x			x		x	x	x
Purple-stemmed Aster	*Symphyotrichum puniceum*										C	C	x						x		
Nodding Thistle	*Carduus nutans*		3	-1	3	SNA				GNR	IX	IX	x	x							
Spotted Knapweed	*Centaurea stoebe*				3						IC	IX	x								x
Ox-eye Daisy	*Leucanthemum vulgare*		5	-1		SNA				GNR	IC	IX	x				x				x
Chicory	*Cichorium intybus*		5	-1		SNA				GNR	IC	IX	x	x			x				x
Canada Thistle	*Cirsium arvense*		3	-1	1	SNA				GNR	IC	IX	x	x			x				x
Bull Thistle	*Cirsium vulgare*		3	-1		SNA				GNR	IC	IX	x				x				x

COMMON NAME	BOTANICAL NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	INVASIVE SPECIES ONTARIO	PROVINCIAL RANK	ESA STATUS	COSEWIC STATUS (2016-08-19)	SARA STATUS (2016-08-19)	GLOBAL RANK	REGIONAL STATUS 7E - CAROLINIAN ZONE - 2017	LOCAL STATUS BRANT	STUDY AREA	FOD7	CUT1	MAM3-5	CUM1-1	MAM2	MAS2-1	SWT2-2	CUM1/CUT1
Fleabane species	*Erigeron sp.*												x								x
Eastern Daisy Fleabane	*Erigeron annuus*	0	3			S5				G5	C	C	x		x		x				x
Philadelphia Fleabane	*Erigeron philadelphicus*	1	-3			S5				G5	C	C	x		x		x				x
Sunflower species	*Helianthus sp.*												x					x			
Black-eyed Susan	*Rudbeckia hirta*	0	3			S5				G5	C	C	x				x				x
Goldenrod Species	*Solidago sp.*												x	x	x	x	x		x	x	x
Field Sow-thistle	*Sonchus arvensis*										IC	IX	x	x	x	x	x		x	x	x
Common Tansy	*Tanacetum vulgare*		5	-1		SNA				GNR	IX	IX	x	x			x				x
Common Dandelion	*Taraxacum officinale*		3	-2		SNA				G5	IC	IX	x		x	x					x
Coltsfoot	*Tussilago farfara*		3	-2		SNA				GNR	IC	IX	x					x	x	x	
Touch-me-not Family	**Balsaminaceae**																				
Jewelweed	*Impatiens capensis*	4	-3			S5				G5	C	C	x		x		x		x	x	x
Birch Family	**Betulaceae**																				
Paper Birch	*Betula papyrifera*	2	2			S5				G5	C	C	x		x						x
Mustard Family	**Brassicaceae**																				
Garlic Mustard	*Alliaria petiolata*		0	-3	1	SNA				GNR	IC	IX	x	x			x				x
Garden Yellowrocket	*Barbarea vulgaris*		0	-1	3	SNA				GNR	IC	IX	x		x						x
Field Penny-cress	*Thlaspi arvense*		5	-1		SNA				GNR	IC	IX	x	x			x				x
Honeysuckle Family	**Caprifoliaceae**																				
Tartarian Honeysuckle	*Lonicera tatarica*		3	-3	1	SNA				GNR	IC	IX	x				x				x
Elderberry sp.	*Sambucus sp.*												x		x				x		
Nannyberry	*Viburnum lentago*	4	-1			S5				G5	C	C	x		x		x				x
Pink Family	**Caryophyllaceae**																				
Rock Soapwort	*Saponaria ocymoides*		5	-1		SNA				GNR			x		x						x
Bladder Campion	*Silene latifolia*		5	-2		SNA				GNR	IX		x	x							
Morning-glory Family	**Convolvulaceae**																				
Field Bindweed	*Convolvulus arvensis*		5	-1	3	SNA				GNR	IC	IX	x	x			x				x
Dogwood Family	**Cornaceae**																				
Alternate-leaved Dogwood	*Cornus alternifolia*	6	5			S5				G5	C	C	x						x		
Gray Dogwood	*Cornus racemosa*	2	-2			S5				G5	C	C	x		x		x		x	x	x
Red-osier Dogwood	*Cornus sericea*	2	-3			S5				G5	C	C	x	x	x	x	x	x	x	x	x
Gourd Family	**Cucurbitaceae**																				
Wild Cucumber	*Echinocystis lobata*	3	-2			S5				G5	C	C	x		x						x
Teasel Family	**Dipsacaceae**																				
Fuller's Teasel	*Dipsacus fullonum*		5	-1	3	SNA				GNR	IC	IX	x	x	x		x				x
Oleaster Family	**Elaeagnaceae**																				
Russian Olive	*Elaeagnus angustifolia*		4	-1	3	SNA				GNR	IU	IX	x	x							x
Autumn Olive	*Elaeagnus umbellata*		3	-3	1	SNA				GNR	IU	IX	x		x						x
Pea Family	**Fabaceae**																				
Eastern Redbud	*Cercis canadensis*	8	3			SX				G5	H	IR	x		x						
Crown-vetch	*Securigera varia*		5	-2	1	SNA				GNR	IX	IX	x	x	x		x				x
Bird's-foot Trefoil	*Lotus corniculatus*		1	-2	2	SNA				GNR	IC	IX	x	x	x	x	x		x		x
Black Medick	*Medicago lupulina*		1	-1	4	SNA				GNR	IC	IX	x		x		x				x
White Sweet-clover	*Melilotus albus*		3	-3	2	SNA				G5	IC	IX	x	x							x
Alsike Clover	*Trifolium hybridum*		1	-1		SNA				GNR	IC		x		x		x				x
Red Clover	*Trifolium pratense*		2	-2	4	SNA				GNR	IC	IX	x		x	x					x
White Clover	*Trifolium repens*		2	-1	4	SNA				GNR	IC	IX	x		x						x
Cow Vetch	*Vicia cracca*		5	-1	2	SNA				GNR	IX	IX	x		x		x				x
Beech Family	**Fagaceae**																				
Bur Oak	*Quercus macrocarpa*	5	1			S5				G5	C	C	x		x		x				x

COMMON NAME	BOTANICAL NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	INVASIVE SPECIES ONTARIO	PROVINCIAL RANK	ESA STATUS	COSEWIC STATUS (2016-08-19)	SARA STATUS (2016-08-19)	GLOBAL RANK	REGIONAL STATUS 7E - CAROLINIAN ZONE - 2017	LOCAL STATUS BRANT	STUDY AREA	FOD7	CUT1	MAM3-5	CUM1-1	MAM2	MAS2-1	SWT2-2	CUM1/CUT1
Red Oak	*Quercus rubra*	6	3			S5				G5	C	C	x		x		x				x
St. John's-wort Family	**Guttiferae**																				
Common St. John's-wort	*Hypericum perforatum*		5	-3	4	SNA				GNR	IC	IX	x								x
Walnut Family	**Juglandaceae**																				
Bitternut Hickory	*Carya cordiformis*	6	0			S5				G5	C	C	x				x				x
Black Walnut	*Juglans nigra*	5	3			S4?				G5	C	C	x	x							
Mint Family	**Lamiaceae**																				
Common Heal-all	*Prunella vulgaris ssp. vulgaris*		0	-1		SNA				G5TU	IR		x				x				x
Loosestrife Family	**Lythraceae**																				
Purple Loosestrife	*Lythrum salicaria*		-5	-3	1	SNA				G5	IC	IX	x		x	x	x	x	x	x	x
Mulberry Family	**Moraceae**																				
White Mulberry	*Morus alba*		0	-3	1	SNA				GNR	IC	IX	x	x			x				x
Evening-primrose Family	**Onagraceae**																				
Common Evening-primrose	*Oenothera biennis*	0	3			S5				G5	C	X	x				x				x
Plantain Family	**Plantaginaceae**																				
Common Plantain	*Plantago major*		-1	-1		SNA				G5	IC	IX	x	x	x		x				x
Smartweed Family	**Polygonaceae**																				
Knotweed sp.	*Polygonum sp.*												x					x			
Lady's-thumb	*Persicaria maculosa*		-3	-1		SNA				G3G5	IC	IX	x						x		
Curly-leaf Dock	*Rumex crispus*		-1	-2		SNA				GNR	IC	IX	x	x	x		x				x
Buttercup Family	**Ranunculaceae**																				
Tall Buttercup	*Ranunculus acris*		-2	-2		SNA				G5	IC	IX	x		x		x				x
Buckthorn Family	**Rhamnaceae**																				
Common Buckthorn	*Rhamnus cathartica*		3	-3	1	SNA				GNR	IC	IX	x	x		x	x		x		x
Rose Family	**Rosaceae**																				
Small-flowered Agrimony	*Agrimonia parviflora*	4	-1			S4				G5	R		x		x						x
Hawthorn species	*Crataegus sp.*	4	5										x	x	x						x
Downy Hawthorn	*Crataegus mollis*	4	-2			S4S5				G5	C		x	x							
Wild Strawberry	*Fragaria virginiana*	2	1			S5				G5	C	C	x		x		x				x
Avens species	*Geum sp.*												x		x						
Yellow Avens	*Geum aleppicum*	2	-1			S5				G5	C	C	x		x						x
White Avens	*Geum canadense*	3	0			S5				G5	C	C	x			x			x		
Ninebark	*Physocarpus opulifolius*	5	-2			S5				G5	U	C	x		x		x				x
Rough-fruited Cinquefoil	*Potentilla recta*		5	-2		SNA				GNR	IC	IX	x	x	x	x			x		x
Dog Rose	*Rosa canina*		5	-1		SNA				GNR	IX		x				x				x
Multiflora Rose	*Rosa multiflora*		3	-3	1	SNA				GNR	IC	IX	x		x		x				x
American Red Raspberry	*Rubus idaeus*	0	-2			SNA				G5			x		x	x	x		x		x
Black Raspberry	*Rubus occidentalis*	2	5			S5				G5	C	X	x				x				x
Northern Mountain-ash	*Sorbus decora*	8	3			S5				G5	R		x				x				
White Meadow-sweet	*Spiraea alba*	3	-4			S5				G5	C	C	x			x			x		
Willow Family	**Salicaceae**																				
Eastern Cottonwood	*Populus deltoides*										C	C	x	x	x		x	x			x
Trembling Aspen	*Populus tremuloides*	2	0			S5				G5	C	C	x		x	x	x				x
Willow species	*Salix sp.*												x	x		x	x	x	x		x
White Willow	*Salix alba*		-3	-2	3	SNA				G5	IX		x		x						x
Peach-leaved Willow	*Salix amygdaloides*	6	-3			S5				G5	C	X	x	x							
Bebb Willow	*Salix bebbiana*	4	-4			S5				G5	C	C	x		x		x				x
Narrow-leaf Willow	*Salix exigua*	3	-5			S5				GNR	C	C	x	x		x				x	
Crack Willow	*Salix fragilis*		-1	-3	3	SE				GNR	IC	IX	x	x							

COMMON NAME	BOTANICAL NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	INVASIVE SPECIES ONTARIO	PROVINCIAL RANK	ESA STATUS	COSEWIC STATUS (2016-08-19)	SARA STATUS (2016-08-19)	GLOBAL RANK	REGIONAL STATUS 7E - CAROLINIAN ZONE - 2017	LOCAL STATUS BRANT	STUDY AREA	FOD7	CUT1	MAM3-5	CUM1-1	MAM2	MAS2-1	SWT2-2	CUM1/CUT1
Sandbar Willow	*Salix interior*										C	C	x			x	x				x
Figwort Family	**Scrophulariaceae**																				
Butter-and-eggs	*Linaria vulgaris*		5	-1	4	SNA				GNR	IC	IX	x				x				x
Common Mullein	*Verbascum thapsus*		5	-2		SNA				GNR	IC	IX	x	x			x				x
Nightshade Family	**Solanaceae**																				
Bittersweet Nightshade	*Solanum dulcamara*		0	-2	3	SNA				GNR	IC	IX	x	x		x		x	x		
Linden Family	**Tiliaceae**																				
American Basswood	*Tilia americana*	4	3			S5				G5	C	C	x		x						x
Elm Family	**Ulmaceae**																				
Common Hackberry	*Celtis occidentalis*	8	1			S4				G5	C	U	x	x							
Grape Family	**Vitaceae**																				
Virginia Creeper	*Parthenocissus quinquefolia*	6	1			S4?				G5	U	U	x	x			x				x
Riverbank Grape	*Vitis riparia*	0	-2			S5				G5	C	C	x	x	x	x	x	x	x		x
MONOCOTS	**MONOCOTYLEDONS**																				
Water-plantain Family	**Alismataceae**																				
Common Water-plantain	*Alisma plantago-aquatica*	3	-5			S5				G5			x			x					
Sedge Family	**Cyperaceae**																				
Sedge species	*Carex sp.*												x			x			x		
Bebb's Sedge	*Carex bebbii*	3	-5			S5				G5	C	C	x			x					
Awl-fruited Sedge	*Carex stipata*	3	-5			S5				G5	C	C	x			x					
Fox Sedge	*Carex vulpinoidea*	3	-5			S5				G5	C	C	x			x					
Iris Family	**Iridaceae**																				
Yellow Iris	*Iris pseudacorus*		-5	-2	4	SNA				GNR	IU	IX	x			x					
Rush Family	**Juncaceae**																				
Rush Species	*Juncus sp.*												x			x					
Soft Rush	*Juncus effusus*										C	C	x			x					
Grass Family	**Poaceae**																				
Smooth Brome	*Bromus inermis*		5	-3	4	SNA				G5TNR	IC	IX	x	x			x				x
Smooth Crabgrass	*Digitaria ischaemum*		3	-1		SNA				GNR	IC	IX	x	x							
Fowl Manna Grass	*Glyceria striata*	3	-5			S5				G5	C	C	x		x						x
Reed Canary Grass	*Phalaris arundinacea*	0	-4			S5				G5	C	C	x	x	x	x	x	x	x	x	x
Timothy	*Phleum pratense*		3	-1		SNA				GNR	IC	IX	x					x			
European Reed	*Phragmites australis ssp. australis*		-3	-3		SE5					IC	IC	x	x	x	x	x	x	x	x	x
Cattail Family	**Typhaceae**																				
Narrow-leaved Cattail	*Typha angustifolia*	3	-5			SNA				G5	IC	IX	x			x	x		x		
Broad-leaved Cattail	*Typha latifolia*	3	-5			S5				G5	C	C	x					x			

FLORISTIC SUMMARY & ASSESSMENT		STUDY AREA		FOD7		CUT1		MAM3-5		CUM1-1		MAM2		MAS2-1		SWT2-2		CUM1/CUT1	
Species Diversity																			
Total Species:		**116**		**39**		**59**		**28**		**62**		**11**		**25**		**11**		**86**	
Native Species:		65	56.03%	13	33.33%	37	62.71%	18	64.29%	32	51.61%	5	45.45%	16	64.00%	6	54.55%	44	51.16%
Exotic Species		51	43.97%	26	66.67%	22	37.29%	10	35.71%	30	48.39%	6	54.55%	9	36.00%	5	45.45%	42	48.84%
Total Taxa in Region (List Region, Source)		10000		10000		10000		10000		10000		10000		10000		10000		10000	
% Regional Taxa Recorded		1.16%		0.39%		0.59%		0.28%		0.62%		0.11%		0.25%		0.11%		0.86%	
Regionally Significant Species		5		0		3		2		2		0		1		0		3	
S1-S3 Species		0		0		0		0		0		0		0		0		0	
S4 Species		3		1		2		0		0		0		0		0		1	
S5 Species		54		8		31		16		29		5		14		6		116	
Co-efficient of Conservatism and Floral Quality Index																			
Co-efficient of Conservatism (CC) (average)		**3.69**		**3.08**		**3.46**		**2.83**		**2.78**		**2.20**		**2.69**		**2.17**		**3.11**	
CC 0 to 3	*lowest sensitivity*	33	50.77%	7	53.85%	16	43.24%	15	83.33%	20	62.50%	4	80.00%	12	75.00%	5	83.33%	23	52.27%
CC 4 to 6	*moderate sensitivity*	25	38.46%	5	38.46%	17	45.95%	1	5.56%	10	31.25%	1	20.00%	3	18.75%	1	16.67%	19	43.18%
CC 7 to 8	*high sensitivity*	6	9.23%	1	7.69%	4	10.81%	1	5.56%	2	6.25%	0	0.00%	1	6.25%	0	0.00%	2	4.55%
CC 9 to 10	*highest sensitivity*	1	1.54%	0	0.00%	0	0.00%	1	5.56%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Floral Quality Index (FQI)		**29.77**		**11.09**		**21.04**		**12.02**		**15.73**		**4.92**		**10.75**		**5.31**		**20.65**	
Presence of Weedy & Invasive Species																			
mean weediness		**-1.80**		**-1.88**		**-1.86**		**-2.30**		**-1.77**		**-2.17**		**-2.22**		**-2.40**		**-1.83**	
weediness = -1	*low potential invasiveness*	23	45.10%	10	38.46%	8	36.36%	0	0.00%	15	50.00%	1	16.67%	1	11.11%	0	0.00%	19	45.24%
weediness = -2	*moderate potential invasiveness*	15	29.41%	9	34.62%	9	40.91%	7	70.00%	7	23.33%	3	50.00%	5	55.56%	3	60.00%	11	26.19%
weediness = -3	*high potential invasiveness*	13	25.49%	7	26.92%	5	22.73%	3	30.00%	8	26.67%	2	33.33%	3	33.33%	2	40.00%	12	28.57%
Presence of Wetland Species																			
average wetness value		**0.68**		**1.67**		**0.52**		**-1.68**		**1.23**		**-1.45**		**-1.00**		**-1.55**		**1.29**	
upland		23	19.83%	13	33.33%	9	15.25%	2	7.14%	16	25.81%	1	9.09%	3	12.00%	1	9.09%	20	23.26%
facultative upland		33	28.45%	8	20.51%	17	28.81%	4	14.29%	14	22.58%	2	18.18%	3	12.00%	2	18.18%	26	30.23%
facultative		24	20.69%	10	25.64%	14	23.73%	5	17.86%	16	25.81%	1	9.09%	4	16.00%	0	0.00%	20	23.26%
facultative wetland		24	20.69%	7	17.95%	17	28.81%	8	28.57%	14	22.58%	4	36.36%	12	48.00%	6	54.55%	18	20.93%
obligate wetland		13	11.21%	1	2.56%	3	5.08%	9	32.14%	2	3.23%	3	27.27%	3	12.00%	2	18.18%	3	3.49%

Attachment E

Terrestrial Photolog

View of MAM3-5 community within the Stormwater Management Facility (SWMF).

View of SWMF which includes MAM3-5 and MAM2 community.

View of MAS2-1 community on south side of creek and within SWMF.

View of SWT2-2 community within SWMF.

View of CUT1 community near the watercourse and SWMF.

View of two corrugated steel culverts present within the watercourse.

View of watercourse looking upstream towards the weir.

View of concrete weir present in watercourse in proximity to SWMF.

View of watercourse upstream of SWMF and within the concrete gable.

Photo near Adams Boulevard of FOD7 community.

View MAM2 community dominated by common reed (*Phragmities australis*)

Photo of SWMF facility during the summer.

Photo of MAS2-1 community are excavation and disturbance by heavy equipment.

Photo of watercourse flowing through MAS2-1 community prior to its disturbance.

View of MAM2 community along watercourse from the walking trail.

View of watercourse with a dense SWT2 community present on its banks.

Watercourse with dense vegetation established on its banks.

View of watercourse and sand bar.

View of channel, which is relatively hidden under the dense vegetation surrounding it.

View of watercourse confluence.

View of CUT1 community near SWMF.

View of upland.

View of CUM1-1/CUT1 community commonly found within the study area.

View of pedestrian crossing bridge over watercourse.

View of typical upland areas across the study area.

View of CUM1-1 community.

Attachment F

Bird Species

Bird Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Brant	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Accipitridae	**Hawks, Kites, Eagles & Allies**												
Accipiter cooperii	Cooper's Hawk	S4				Level 3 Forest		CONF		x			
Accipiter striatus	Sharp-shinned Hawk	S5				Level 3 Forest		CONF		x			
Buteo jamaicensis	Red-tailed Hawk	S5						CONF		x			x
Circus cyaneus	Northern Harrier	S4B						CONF		x			x
Haliaeetus leucocephalus	Bald Eagle	S2N/S4B	SC							x			
Alaudidae	**Larks**												
Eremophila alpestris	Horned Lark	S5B				Level 3 Open Country		PROB		x			
Alcedinidae	**Kingfishers**												
Megaceryle alcyon	Belted Kingfisher	S4B/S5B						CONF		x			
Apodidae	**Swifts**												
Chaetura pelagica	Chimney Swift	S4B/S4N	THR	THR	THR			CONF		x			
Anatidae	**Ducks, Geese & Swans**												
Aix sponsa	Wood Duck	S5				Level 4 Forest		CONF		x			
Anas discors	Blue-winged Teal	S4				Level 2 Marsh		PROB		x			
Anas platyrhynchos	Mallard	S5						CONF		x			x
Branta canadensis	Canada Goose	S5						CONF		x			
Bucephala albeola	Bufflehead	S4								x			
Cygnus olor	Mute Swan	SNA								x			
Lophodytes cucullatus	Hooded Merganser	S5B, S5N				Level 4 Forest		CONF		x			
Branta bernicla	Brant	S4N								x			
Ardeidae	**Herons and Bitterns**												
Ardea herodias	Great Blue Heron	S4						CONF		x			
Botaurus lentiginosus	American Bittern	S4B				Level 1 Marsh				x			
Butorides virescens	Green Heron	S4B				Level 3 Marsh		CONF		x			
Bombycillidae	**Waxwings**												
Bombycilla cedrorum	Cedar Waxwing	S5B						CONF		x			x
Caprimulgidae	**Nightjars**												
Chordeiles minor	Common Nighthawk	S4B	SC	SC	THR	Level 1 Open Country		CONF					
Cardinalidae	**Cardinals, Grosbeaks & Allies**												
Cardinalis cardinalis	Northern Cardinal	S5						CONF		x			x

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Brant	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Passerina cyanea	Indigo Bunting	S4B						CONF		x			
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B						CONF		x			x
Piranga olivacea	Scarlet Tanager	S4B				Level 2 Forest		POSS		x			x
Cathartidae	**Vultures**												
Cathartes aura	Turkey Vulture	S5B				Level 3 Forest		CONF		x			
Certhiidae	**Creepers**												
Certhia americana	Brown Creeper	S5B				Level 1 Forest				x			
Charadriidae	**Plovers**												
Charadrius vociferus	Killdeer	S5B/S5N						CONF		x			x
Columbidae	**Pigeons & Doves**												
Columba livia	Rock Pigeon	SNA						CONF		x			
Zenaida macroura	Mourning Dove	S5						CONF		x			x
Corvidae	**Crows & Jays**												
Corvus brachyrhynchos	American Crow	S5B/S4N						CONF		x			x
Corvus corax	Common Raven	S5								x			
Cyanpcitta cristata	Blue Jay	S5						CONF		x			x
Cuculidae	**Cuckoo & Anis**												
Coccyzus americanus	Yellow-billed Cuckoo	S4B				Level 3 Forest				x			
Coccyzus erythropthalmus	Black-billed Cuckoo	S5B				Level 2 Forest	RD	PROB					
Emberizidae	**New World Sparrows & Allies**												
Ammodramus savannarum	Grasshopper Sparrow	S4B	SC			Level 3 Open Country		PROB					
Junco hyemalis	Dark-eyed Junco	S5B				Level 4 Forest				x			
Melospiza georgiana	Swamp Sparrow	S5B				Level 1 Marsh		POSS		x			x
Melospiza lincolnii	Lincoln's Sparrow	S5B								x			
Melospiza melodia	Song Sparrow	S5B/S4N						CONF		x			x
Passerculus sandwichensis	Savannah Sparrow	S4B				Level 1 Open Country		CONF		x			
Passerella iliaca	Fox Sparrow	S4B								x			
Pipilo erythrophthalmus	Eastern Towhee	S4B				Level 2 Forest		POSS		x			x
Pooecetes gramineus	Vesper Sparrow	S4B				Level 2 Open Country		CONF		x			
Spizella arborea	American Tree Sparrow	S4B								x			
Spizella passerina	Chipping Sparrow	S5B/S4N						CONF		x			x

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Brant	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Zonotrichia albicollis	White-throated Sparrow	S5B								x			
Zonotrichia leucophrys	White-crowned Sparrow	S4B								x			
Spizella pusilla	Field Sparrow	S4B				Level 3 Open Country		CONF		x			x
Falconidae	**Carcaras & Falcons**												
Falco columbarius	Merlin	S5B								x			
Falco sparverius	American Kestrel	S4				Level 2 Open Country		CONF		x			x
Fringillidae	**Finches & Allies**												
Haemorhous mexicanus	House Finch	SNA						CONF		x			x
Haemorhous purpureus	Purple Finch	S4B				Level 3 Forest				x			
Spinus tritis	American Goldfinch	S5B/S4N				Level 3 Open Country		CONF		x			x
Gruidae	**Cranes**												
Grus canadensis	Sandhill Crane	S5B								x			
Hirundinidae	**Swallows**												
Hirundo rustica	Barn Swallow	S4B	THR	THR	THR	Level 3 Open Country		CONF		x			x
Petrochelidon pyrrhonota	Cliff Swallow	S4B				Level 3 Open Country				x			
Progne subis	Purple Martin	S3/S4B				Level 2 Marsh				x			
Riparia riparia	Bank Swallow	S4B	THR	THR	THR	Level 1 Open Country		CONF		x			x
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B				Level 2 Open Country		CONF		x			x
Tachycineta bicolor	Tree Swallow	S4B						CONF		x			x
Icteridae	**New World Blackbird**												
Agelaius phoeniceus	Red-winged Blackbird	S4/S5						CONF		x			x
Dolichonyx oryzivorus	Bobolink	S4B	THR	THR	THR	Level 2 Open Country	RD	CONF		x			
Euphagus carolinus	Rusty Blackbird	S4B	SC	SC	SC					x			
Icterus galbula	Baltimore Oriole	S4B						CONF		x			x
Icterus spurius	Orchard Oriole	S4B				Level 3 Forest		PROB		x			
Molothrus ater	Brown-headed Cowbird	S4B						CONF		x			x
Quiscalus quiscula	Common Grackle	S5B/S4N						CONF		x	x		x

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Brant	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Sturnella magna	Eastern Meadowlark	S4B	THR	THR	THR	Level 2 Open Country		CONF		x			
Laridae	**Gulls, Terns & Skimmers**												
Larus argentatus	Herring Gull	S5B,S5N								x			
Larus delawarensis	Ring-billed Gull	S5B/S4N								x			x
Mimidae	**Mockingbirds, Thrashers & Allies**												
Dumetella carolinsis	Gray Catbird	S4B				Level 4 Forest		CONF		x			x
Mimus polyglottos	Northern Mockingbird	S4				Level 1 Open Country		POSS		x			x
Toxostoma rufum	Brown Thrasher	S4B				Level 1 Open Country		CONF		x			x
Motacillidae													
Anthus rubescens	American Pipit	S4								x			
Pandionidae	**Osprey**					Level 3 Marsh							
Pandion haliaetus	Osprey	S5B				Level 3 Marsh				x			
Paridae	**Chickadees and Titmice**												
Poecile atricapillus	Black-capped Chickadee	S5				Level 4 Forest		CONF		x			
Baeolophus bicolor	Tufted Titmouse	S4				Level 3 Forest				x			
Parulidae	**Wood Warblers**												
Cardellina pusilla	Wilson's Warbler	S4B								x			
Geothlypis philadelphia	Mourning Warbler	S4B				Level 2 Forest				x			
Geothylupis trichas	Common Yellowthroat	S5B						PROB		x			x
Mniotilta varia	Black-and-white Warbler	S5B				Level 3 Forest				x			
Oreothlypis celata	Orange-crowned Warbler	S4B								x			
Oreothlypis peregrina	Tennessee Warbler	S5B								x			
Oreothlypis ruficapilla	Nashville Warbler	S5B				Level 2 Forest				x			
Parkesia noveboracensis	Northern Waterthrush	S5B				Level 1 Forest		PROB					
Setophaga americana	Northern Parula	S4B								x			
Setophaga castanea	Bay-breasted Warbler	S5B								x			
Setophaga citrina	Hooded Warbler	S4B				Level 1 Forest				x			
Setophaga coronata	Yellow Rumped Warbler	S5B								x			
Setophaga dominica	Yellow-throated Warbler	SNA											x
Setophaga fusca	Blackburnian Warbler	S5B				Level 2 Forest				x			

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Brant	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Setophaga pensylvanica	Chestnut-sided warbler	S5B				Level 1 Forest				x			x
Setophaga petechai	Yellow Warbler	S5B						CONF		x			x
Setophaga pinus	Pine Warbler	S5B				Level 2 Forest				x			
Setophaga ruticilla	American Redstart	S5B				Level 2 Forest		PROB		x			
Setophaga striata	Blackpoll Warbler	S4B								x			
Setophaga tigrina	Cape May Warbler	S5B					RD			x			
Setophaga virens	Black-throated Green Warbler	S5B				Level 2 Forest				x			
Vermivora cyanoptera	Blue-winged Warbler	S4B				Level 1 Forest				x			
Passeridae	**Sparrows**												
Passer domesticus	House Sparrow	SNA						CONF		x	x		
Phasianidae	**Patridges, Grouse, Turkeys**												
Meleagris gallopavo	Wild Turkey	S5						CONF		x			
Phasianus colchicus	Ring-necked Pheasant	SNA						PROB					
Bonasa umbellus	Ruffed Grouse	S4				Level 3 Forest		PROB					
Picidae	**Woodpeckers**												
Colaptes auratus	Northern Flicker	S4B						CONF		x			x
Leuconotopicus villosus	Hairy Woodpecker	S5						CONF		x			
Melanerpes carolinus	Red-bellied Woodpecker	S4				Level 2 Forest		CONF		x			
Picoides pubescens	Downy Woodpecker	S5						CONF		x			
Picoides villosus	Hairy Woodpecker	S5						CONF		x			
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B				Level 1 Forest				x			
Polioptilidae	**Gnatcatchers**												
Polioptila caerulea	Blue-gray Gnatcatcher	S4B				Level 4 Forest		POSS		x			
Regulidae	**Kinglets**												
Regulus calendula	Ruby-crowned Kinglet	S4B				Level 4 Forest				x			
Regulus satrapa	Golden-crowned Kinglet	S5B				Level 3 Forest				x			
Scolopacidae	**Sandpipers, Phalaropes &Allies**												
Actitis macularius	Spotted Sandpiper	S5				Level 3 Open Country		CONF		x			
Calidris melanotos	Pectoral Sandpiper	SHB,S5N								x			
Calidris minutilla	Least Sandpiper	S4B,S5N								x			
Gallinago delicata	Wilson's Snipe	S5B				Level 2 Marsh				x			x

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Brant	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Scolopax minor	American Woodcock	S4B				Level 4 Forest		CONF		x			
Tringa flavipes	Lesser Yellowlegs	S4B,S4N								x			
Tringa melanoleuca	Greater Yellowlegs	S4B,S4N								x			
Tringa solitaria	Solitary Sandpiper	S4B								x			
Sittidae	**Nutchatches**												
Sitta canadensis	Red-breasted Nuthatch	S5				Level 3 Forest				x			
Sitta carolinensis	White-breasted Nuthatch	S5						CONF		x			
Stercorariidae	**Skuas**												
Bubo virginianus	Great Horned Owl	S5						CONF		x			
Sturnidae	**Starlings**												
Sturnus vulgaris	European Starling	SNA						CONF		x			x
Threskiornithidae													
Eudocimus albus	White Ibis	SNA						#REF!					
Trochillidae	**Hummingbirds**												
Archilochus colubris	Ruby-throated Hummingbird	S5B				Level 2 Forest		CONF					
Troglodytidae	**Wrens**												
Thyrothorus ludovicianus	Carolina Wren	S4				Level 3 Forest		PROB		x			
Troglodytes aedon	House Wren	S5B						CONF		x			x
Troglodytes hiemalis	Winter Wren	S5B				Level 4 Forest				x			
Turdidae	**Thrushes**												
Catharus guttatus	Hermit Thrush	S5B								x			
Hylocichla mustelina	Wood Thrush	S4B	SC	THR	THR	Level 4 Forest	RD	CONF		x			
Sialia sialis	Eastern Bluebird	S5B				Level 1 Open Country		CONF		x			
Turdus migratorius	American Robin	S5B						CONF		x			x
Tyrannidae	**Tyrant Flycatchers**												
Contopus virens	Eastern Wood-pewee	S4B	SC	SC	SC			PROB		x			
Empidonax alnorum	Alder Flycatcher	S5B				Level 3 Forest		PROB					
Empidonax minimus	Least Flycatcher	S4B				Level 3 Forest		CONF		x			x
Empidonax traillii	Willow Flycatcher	S5B						PROB		x			
Myiarchus crinitus	Great Crested Flycatcher	S4B						CONF		x			
Sayornis phoebe	Eastern Phoebe	S5B/S4N				Level 3 Forest		CONF		x			x

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Brant	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Tyrannus tyrannus	Eastern Kingbird	S4B				Level 3 Open Country		CONF		x			x
Vireonidae	**Vireos**												
Vireo gilvus	Warbling Vireo	S5B						CONF		x			x
Vireo olivaceus	Red-eyed Vireo	S5B						CONF		x			x
Vireo solitarius	Blue-headed Vireo	S5B				Level 3 Forest				x			
Vireo flavifrons	Yellow-throated Vireo	S4B				Level 3 Forest		PROB					
Total:	145							88	0	134	2	0	45

Attachment G

Breeding Bird Survey

Braneida SWM Facility Retrofit Breeding Bird Survey #1 - May 22, 2020 (1/2)

Breeding Bird Survey Station	Common Name	Scientific Name	#	Notes
Station 1	Red-winged Blackbird	Agelaius phoeniceus	12+	Male and female courtship, visual and call
May 22, 2020	Brown-headed Cowbird	Molothrus ater	2	Calling
7:35 am - 7:45 am	Ring-billed Gull	Larus delawarensis		Flying, visual, calling
	Rose-breasted Grosbeak	Pheucticus ludovicianus	1	Male, visual and call
	European Starling	Sturnus vulgaris	8+	Flying with food
	Chestnut-sided Warbler	Setophaga pensylvanica	1	Calling
	American Robin	Turdus migratorius	2	Calling
	Yellow Warbler	Setophaga petechia	2	2 males calling
	Northern Cardinal	Cardinalis cardinalis	2	Calling in distance
	Northern Rough-winged Swallow	Stelgidopteryx serripennis	3	Flying and calling
	Killdeer	Charadrius vociferus	1	Calling
	Song Sparrow	Melospiza melodia	1	Female, visual
	American Goldfinch	Spinus tristis	2	One pair, flying
	Warbling Vireo	Vireo gilvus	1	Call - incidental
	Brown-headed Cowbird	Molothrus ater	1	Male, visual - incidental
	Common Grackle	Quiscalus quiscula	2	Flying, calling - incidental
	Barn Swallow	Hirundo rustica	1	Flying - incidental
	American Crow	Corvus brachyrhynchos	1	Calling
Station 2	Brown-headed Cowbird	Molothrus ater	1	Calling
May 22, 2020	American Robin	Turdus migratorius	1	Male calling in tree
7:55 am - 8:05 am	Yellow Warbler	Setophaga petechia	1	Calling, visual
	Song Sparrow	Melospiza melodia	1	Calling
	Common Grackle	Quiscalus quiscula	3	Flying overhead
	Blue Jay	Cyanocitta cristata	2	Immature, flying overhead
	American Goldfinch	Spinus tristis	3	Agitated
	American Robin	Turdus migratorius	2	Males fighting
	Common Grackle	Quiscalus quiscula	2	In tree, calling to each other
	Northern Rough-winged Swallow	Stelgidopteryx serripennis	2	Flying overhead
	Gray Catbird	Dumetella carolinensis	1	Flying around in thicket
	Yellow Warbler	Setophaga petechia	1	Male feeding in tree
	European Starling	Sturnus vulgaris	10+	Flying overhead
	American Robin	Turdus migratorius	1	Calling in distance
	Warbler sp.	Warbler sp.	1	Visual, flying in distance
	Chipping Sparrow	Spizella passerina	1	
Station 3	Northern Rough-winged Swallow	Stelgidopteryx serripennis	3+	
May 22, 2020	Chipping Sparrow	Spizella passerina	1	
8:15 am - 8:25 am	Red-winged Blackbird	Agelaius phoeniceus	7	Copulation and agitated fighting
	Gray Catbird	Dumetella carolinensis	1	Calling in distance
	Yellow Warbler	Setophaga petechia	1	Calling in distance
	Tree Swallow	Tachycineta bicolor	1	
	American Robin	Turdus migratorius	1	Calling in distance
	Song Sparrow	Melospiza melodia	1	Visual
	American Goldfinch	Spinus tristis	2	Pair, flying, landed on tree
	European Starling	Sturnus vulgaris	2	Flying overhead
	Common Grackle	Quiscalus quiscula	1	Perched in tree
	Tree Swallow	Tachycineta bicolor	1	Flying overhead
	Killdeer	Charadrius vociferus	1	Calling - incidental

Breeding Bird Survey Station	Common Name	Scientific Name	#	Notes
Station 4	Killdeer	Charadrius vociferus	1	Agitated call
May 22, 2020	American Goldfinch	Spinus tristis	8	Calling, flying; male and female foraging
8:30 am - 8:40 am	Red-winged Blackbird	Agelaius phoeniceus	7	3 flying, 4 calling
	Song Sparrow	Melospiza melodia	1	Calling
	Tree Swallow	Tachycineta bicolor	12	Within and on top of nest boxes, territorial
	Common Grackle	Quiscalus quiscula	1	In tree
	Northern Cardinal	Cardinalis cardinalis	1	Calling in distance
	American Robin	Turdus migratorius	1	Calling from tree
	Yellow Warbler	Setophaga petechia	1	
	Brown-headed Cowbird	Molothrus ater	3	In brush - incidental
Station 5	Northern Flicker	Colaptes auratus	1	Calling
8:50 am - 9:00 am	American Goldfinch	Spinus tristis	5+	Calling
	American Kestrel	Falco sparverius	1	Calling
	Tree Swallow	Tachycineta bicolor	10+	
	Eastern Phoebe	Sayornis phoebe	1	
	Red-winged Blackbird	Agelaius phoeniceus	5+	Males fighting
	Yellow Warbler	Setophaga petechia	2	Calling
	Red-tailed Hawk	Buteo jamaicensis	1	Flying in the distance
	Song Sparrow	Melospiza melodia	1	Calling
	Field Sparrow	Spizella pusilla	1	Calling
	Mallard	Anas platyrhynchos	1	Female mallard flying overhead
	Tree Swallow	Tachycineta bicolor	N/A	Nesting boxes in close proximity
	Common Grackle	Quiscalus quiscula	1	Flying overhead
	Mallard	Anas platyrhynchos	2	Males, flying overhead
	House Finch	Haemorhous mexicanus	1	In distance, sitting on tree

Braneida SWM Facility Retrofit Breeding Bird Survey #2- June 30, 2020 (2/2)

Breeding Bird Survey Station	Common Name	Scientific Name	#	Notes
Station 1	European Starling	*Sturnus vulgaris*	8+	Calling, with food
6:00 am - 6:10 am	Mourning Dove	*Zenaida macroura*	2	Pair, going to nest
	Red-winged Blackbird	*Agelaius phoeniceus*	12	Male and female, aggitaged
	Song Sparrow	*Melospiza melodia*	2	Calling
	Tree Swallow	*Tachycineta bicolor*	8	Flying
	American Goldfinch	*Spinus tristis*	2	Calling and flying
	American Robin	*Turdus migratorius*	1	Calling
	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	3	Flying
	House Wren	*Troglodytes aedon*	1	Calling
	Yellow Warbler	*Setophaga petechia*	1	
	Gray Catbird	*Dumetella carolinensis*	1	Calling in bushes
	Common Grackle	*Quiscalus quiscula*	2	
	Chipping Sparrow	*Spizella passerina*	3	2 calling and 1 visual
	Ring-billed Gull	*Larus delawarensis*	1	Flying overhead
	Eastern Phoebe	*Sayornis phoebe*	1	
	Least Flycatcher	*Empidonax minimus*	1	Calling
Station 2	Red-winged Blackbird	*Agelaius phoeniceus*	8+	Male and female
6:35 am - 6:45 am	Common Yellowthroat	*Geothlypis trichas*	1	Calling
	American Robin	*Turdus migratorius*	3	Fighting males
	Chestnut-sided warbler	*Setophaga pensylvanica*	1	Calling

Breeding Bird Survey Station	Common Name	Scientific Name	#	Notes
	Cedar Waxwing	*Bombycilla cedrorum*	6	Flying overhead
	Tree Swallow	*Tachycineta bicolor*	6+	Visual
	American Goldfinch	*Spinus tristis*	7+	Flying
	Chipping Sparrow	*Spizella passerina*	2	Calling
	Red-eyed Vireo	*Vireo olivaceus*	1	Visual
	Warbling Vireo	*Vireo gilvus*	1	
	Common Grackle	*Quiscalus quiscula*	2	Flying
	European Starling	*Sturnus vulgaris*	6	Flying with food
	American Robin	*Turdus migratorius*	1	Calling
	Killdeer	*Charadrius vociferus*	1	Calling
	Northern Cardinal	*Cardinalis cardinalis*	2	Calling
	Song Sparrow	*Melospiza melodia*	1	Calling
Station 3	Red-winged Blackbird	Agelaius phoeniceus	8+	Male and female, agitated
6:53 am - 7:03 am	Chipping Sparrow	Spizella passerina	3+	Calling
	Yellow Warbler	Setophaga petechia	2+	Calling
	Song Sparrow	*Melospiza melodia*	2	Calling
	Tree Swallow	*Tachycineta bicolor*	6	Flying overhead
	Mourning Dove	*Zenaida macroura*	4	Flying
	American Robin	*Turdus migratorius*	1	Calling
	American Goldfinch	*Spinus tristis*	2	Pair, flying overhead
	Common Grackle	*Quiscalus quiscula*	1	Flying overhead
	Northern Cardinal	*Cardinalis cardinalis*	1	Calling
	Baltimore Oriole	*Icterus galbula*	1	Calling
	Chipping Sparrow	*Spizella passerina*	3	Calling
	Gray Catbird	*Dumetella carolinensis*	1	Calling
	Wild Turkey	*Meleagris gallopavo*		
	Red-tailed Hawk	*Buteo jamaicensis*	1	Flying
	Cedar Waxwing	*Bombycilla cedrorum*	2	Flying
	Swamp Sparrow	*Melospiza georgiana*	3	Calling
	Bank Swallow	*Riparia riparia*	2	Flying
	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	1	Flying overhead
Station 4	Common Yellowthroat	*Geothlypis trichas*	2	Calling
7:19 am - 7:29 am	American Goldfinch	*Spinus tristis*	2	Calling, flying, male and female
	European Starling	*Sturnus vulgaris*	3	Flying overhead
	Red-winged Blackbird	*Agelaius phoeniceus*	8+	Calling, male and female, agitated
	Tree Swallow	*Tachycineta bicolor*	10+	Nesting
	Gray Catbird	*Dumetella carolinensis*	1	Calling in bush
	American Robin	*Turdus migratorius*	1	Male visual
	Song Sparrow	*Melospiza melodia*	2	Calling
	Eastern Kingbird	*Tyrannus tyrannus*	1	Visual
Station 5	Tree Swallow	*Tachycineta bicolor*	5+	Flying
7:35 am - 7:45 am	Cedar Waxwing	*Bombycilla cedrorum*	3	Flying
	Red-winged Blackbird	*Agelaius phoeniceus*	8+	agitated, male and female
	Song Sparrow	*Melospiza melodia*	1	Calling
	American Goldfinch	*Spinus tristis*	1	Flying
	Mourning Dove	*Zenaida macroura*	3	Flying
	Ring-billed Gull	*Larus delawarensis*	1	Flying
	American Robin	*Turdus migratorius*	1	Male, calling and flying
	Gray Catbird	*Dumetella carolinensis*	1	Calling
	Common Grackle	*Quiscalus quiscula*	1	Flying

Breeding Bird Survey Station	Common Name	Scientific Name	#	Notes
	Yellow Warbler	*Setophaga petechia*	1	Calling
	Song Sparrow	*Melospiza melodia*	1	Calling
	Baltimore Oriole	*Icterus galbula*	1	Incidental
	Barn Swallow	*Hirundo rustica*	2	Flying

Attachment H

Reptiles and Amphibians

Reptile and Amphibian Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	ORAA	iNaturalist	LIO	ERI Observations
Cryptodeira	**Turtles**										
Chelydra serpentina	Snapping Turtle	S3	SC	SC	SC			x		x	
Chrysemys picta marginata	Midland Painted Turtle	S4					x	x	x		
Graptemys geographica	Northern Map Turtle	S3	SC	SC	SC			x			
Trachemys scripta elegans	Red-eared Slider	SNA						x			
Squamata	**Snakes**										
Lampropeltis triangulum	Milksnake	S4		SC	SC			x			
Storeria dekayi	DeKay's Brownsnake	S5						x			
Storeria occipitomaculata	Red-bellied snake	S5						x			
Thamnophis sirtalis sirtalis	Eastern Gartersnake	S5						x			
Caudata	**Salamanders**										
Ambystoma laterale	Blue-spotted Salamander	S4						x			
Ambystoma maculatum	Spotted Salamander	S4						x			
Notophthalmus viridescens viridescens	Red-spotted Newt	S5						x			
Plethodon cinereus	Eastern Red-backed Salamander	S5						x			
Anura	**Frogs and Toads**										
Anaxyrus americanus	American Toad	S5						x			
Hyla versicolor	Gray Treefrog	S5						x			
Lithobates catesbeianus	American Bullfrog	S4						x			
Lithobates clamitans	Green Frog	S5						x			x
Lithobates pipiens	Northern Leopard Frog	S5						x			x
Lithobates sylvaticus	Wood Frog	S5						x			
Pseudacris crucifer	Spring Peeper	S5						x			x
Pseudacris trisetaria pop. 1	Western Chorus Frog (Great Lakes / St. Lawrence - Canadian Shield population)	S3		THR	THR			x			
					Total:	0	1	20	1	1	3

Attachment I

Mammals

Mammal Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Mammal Atlas	iNaturalist	ERI Observations
Artiodactyla	**Deer and Bison**									
Odocoileus virginianus	White-tailed Deer	S5						x		x
Carnivora	**Carnivores**									
Canis latrans	Coyote	S5						x		x
Mephitis mephitis	Striped Skunk	S5						x		
Mustela erminea	Ermine	S5						x		
Mustela frenata	Long-tailed Weasel	S4						x		
Procyon lotor	Northern Raccoon	S5						x		x
Vulpes vulpes	Red Fox	S5						x		
Chiroptera	**Bats**									
Eptesicus fuscus	Big Brown Bat	S4						x		
Lasiurus cinereus	Hoary Bat	S4						x		
Perimyotis subflavus	Tricolored Bat	S3	END	END	END			x		
Myotis leibii	Eastern Small-footed Myotis	S2/S3	END					x		
Myotis lucifugus	Little Brown Myotis	S4	END	END	END			x		
Myotis septentrionalis	Northern Myotis	S3	END	END	END			x		
Didelphimorphia	**Oppossums**									
Didelphis virginiana	Virginia Opossum	S4						x		
Lagomorphia	**Rabbits and Hares**									
Lepus europaeus	European Hare	SNA						x		
Sylvilagus floridanus	Eastern Cottontail	S5						x		x
Rodentia	**Rodents**									
Castor canadensis	Beaver	S5						x		
Erethizon dorsatum	Porcupine	S5						x		
Glaucomys sabrinus	Northern Flying Squirrel	S5						x		
Marmota monax	Woodchuck	S5						x	x	
Microtus pennsylvanicus	Meadow Vole	S5						x		
Mus musculus	House Mouse	SNA						x		x
Ondatra zibethicus	Muskrat	S5						x		
Peromyscus leucopus	White-footed Mouse	S5						x		
Peromyscus maniculatus	Deer Mouse	S5						x		
Rattus norvegicus	Norway Rat	SNA						x		
Sciurus carolinensis	Eastern Grey Squirrel	S5						x	x	
Tamias striatus	Eastern Chipmunk	S5						x		
Tamiasciurus hudsonicus	Red Squirrel	S5						x		
Zapus hudsonius	Meadow Jumping Mouse	S5						x		
Soricomorpha										
Blarina brevicauda	Northern Short-tailed Shrew	S5						x		
Condylura cristata	Star-nosed Mole	S5						x		

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Mammal Atlas	iNaturalist	ERI Observations
Sorex cinereus	Masked Shrew	S5						x		
Sorex fumeus	Smoky Shrew	S5						x		
					Total:	0	0	34	2	5

Attachment J

Insects

Insect Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Ontario Butterfly Atlas	iNaturalist	ERI Observations
Blattodea	**Cockroaches and Termites**	SNR								
Ectobius lapponicus	Dusky Cockroach	SNA					x			
Lepidoptera	**Butterflies**									
Catocala cerogama	Yellow-banded Underwing	S5						x		
Ctenucha virginica	Virginia Ctenucha Moth	S5						x		x
Hyphantria cunea	Fall Webworm Moth	S5						x		
Lophocampa caryae	Hickory Tussock Moth	SNR						x		
Spilosoma virginica	Virginian Tiger Moth	S5						x		
Thymelicus lineola	European Skipper	SNA						x		
Hylephila phyleus	Fiery Skipper	SNA						x		
Epargyreus clarus	Silver-spotted Skipper	S4						x		
Erynnis juvenalis	Juvenal's Duskywing	S5						x		
Erynnis baptisiae	Wild Indigo Duskywing	S4						x		
Pyrgus communis	Common Checkered Skipper	SNA						x		
Pholisora catullus	Common Sootywing	S4						x		
Ancyloxypha numitor	Least Skipper	S5						x		
Polites peckius	Peck's Skipper	S5						x		
Polites themistocles	Tawny-edged Skipper	S5						x		
Polites origenes	Crossline Skipper	S4						x		
Wallengrenia egeremet	Northern Broken-Dash	S5						x		
Poanes viator	Broad-winged Skipper	S4						x		
Euphyes bimacula	Two-spotted Skipper	S4						x		
Feniseca tarquinius	Harvester	S4						x		
Satyrium calanus	Banded Hairstreak	S4						x		
Satyrium caryaevorus	Hickory Hairstreak	S4						x		
Cupido comyntas	Eastern Tailed Blue	S5						x		
Acronicta oblinita	Smeared Dagger Moth	S5							x	
Phyciodes cocyta	Northern Crescent	S5						x		
Polygonia interrogationis	Question Mark	S5						x		
Polygonia comma	Eastern Comma	S5						x		
Euptoieta claudia	Variegated Fritillary	SNA						x		
Phyciodes tharos	Pearl Crescent	S4						x		
Nymphalis antiopa	Mourning Cloak	S5						x		
Vanessa cardui	Painted Lady	S5						x		
Vanessa atalanta	Red Admiral	S5						x		
Junonia coenia	Common Buckeye	SNA						x		
Limenitis arthemis astyanax	Red-spotted Purple	S5						x		
Limenitis archippus	Viceroy	S5						x		
Lethe anthedon	Northern Pearly-Eye	S5						x		

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Ontario Butterfly Atlas	iNaturalist	ERI Observations
Megisto cymela	Little Wood-Satyr	S5						x		
Coenonympha tullia	Common Ringlet	S5						x		
Cercyonis pegala	Common Wood-Nymph	S5						x		
Danaus plexippus	Monarch	S2N,S4B	SC	END	SC			x		x
Papilio polyxenes	Black Swallowtail	S5						x	x	
Papilio cresphontes	Giant Swallowtail	S4						x		
Papilio glaucus	Eastern Tiger Swallowtail	S5						x		
Pieris rapae	Cabbage White	SNA						x		x
Colias philodice	Clouded Sulphur	S5						x		
Colias eurytheme	Orange Sulphur	S5						x		
Antheraea polyphemus	Polyphemus Moth	S5						x		
Hyalophora cecropia	Cecropia Moth	S5						x		
Odonata	**Damselflies and Dragonflies**									
Enallagma signatum	Orange Bluet	S4								x
Ischnura verticalis	Eastern Forktail	S5								x
Stylurus spiniceps	Arrow Clubtail	S2							x	
Libellula pulchella	Twelve-spotted Skimmer	S5								x
						Totals:	1	47	3	6

Attachment K

Significant Wildlife Habitat

Table 1. Seasonal Concentration Areas of Animals.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Waterfowl Stopover and Staging Areas (Terrestrial) Rationale: Habitat important for migrating waterfowl.	American Black Duck Blue-winged Teal Gadwall Green-winged Teal Northern Shoveler Tundra Swan American Wigeon Northern Pintail	CUM1 CUT1 • Plus evidence of annual spring flooding from melt water or run-off within these Ecosites. • Fields with seasonal flooding and waste grain in the Long Point, Rondeau, Pt. Pelee, Lake St. Clair, Grand Bend areas may be important for Tundra Swans.	• Fields with sheet water during Spring (mid March to May). • Field flooding during spring melt and run-off provides important invertebrate foraging habitat for migrating waterfowl. • Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available [cxlviii]. Information Sources: • Reports and other information available from Conservation Authorities • Sites documented through waterfowl planning processes (eg. EHJV implementation plan). • Field Naturalists Clubs. • Ducks Unlimited Canada . • Natural Heritage Information Center (NHIC) Waterfowl Concentration Area. • Anecdotal information from the landowners, adjacent landowners or local naturalist clubs may be good information in determining occurrence.	• Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • Any mixed aggregations of 100Ⓔ or more individuals required. • SWH MIST [cxlix] Index #7 provides development effects and mitigation measures. • Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). • The flooded Field Ecosite habitat plus a 100 – 300 m radius, dependant on local site conditions and adjacent land use is the significant wildlife habitat [cxlviii].	Study area contained does not contain spring flooding within appropriate communities. **SWH type not present.**
Waterfowl Stopover and Staging Areas (Aquatic) Rationale: Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district.	Canada Goose Cackling Goose Snow Goose American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Green-winged Teal Blue-winged Teal Hooded Merganser Common Merganser Lesser Scaup Greater Scaup Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Ring-necked duck Common Goldeneye Bufflehead Redhead Ruddy Duck Red-breasted Merganser Brant Canvasback Ruddy Duck	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	• Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water). Information Sources: • Environment Canada • Naturalist clubs often are aware of staging / stopover areas. • OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (eg. EHJV implementation plan). • Ducks Unlimited projects. • Element occurrence specification by Nature Serve: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area.	Studies carried out and verified presence of: • Aggregations of 100Ⓔ or more of listed species for 7 daysⒺ, results in > 700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH [cxlix]. • The combined area of the ELC Ecosites and a 100 m radius area is the SWH [cxlviii]. • Wetland area and shorelines associated with sites identified within the SWHTG [cxlviii] Appendix K [cxlix] are significant wildlife habitat. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWH MIST[cxlix] Index #7 provides development effects and mitigation measures.	Study area contained marsh habitat. However, species aggregations were not observed during breeding bird surveys. **SWH type not present.**
Shorebird Migratory	Greater Yellowlegs Lesser Yellowlegs	BBO1 BBO2	• Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats.	Studies confirming:	None of the listed species were observed

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Stopover Area Rationale: High quality shorebird stopover habitat is extremely rare and typically has a long history of use.	Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	• Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. • Sewage treatment ponds and storm water ponds do not qualify as a SWH. Information Sources: • Western hemisphere shorebird reserve network. • Canadian Wildlife Service (CWS) Ontario Shorebird Survey. • Bird Studies Canada. • Ontario Nature. • Local birders and naturalist clubs. • Natural Heritage Information Centre (NHIC) Shorebird Migratory Concentration Area.	• Presence of 3 or more of listed species and > 1000Ⓔ shorebird use days during spring or fall migration period (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period). • Whimbrel stop briefly (< 24 hrs) during spring migration, any site with > 100Ⓔ Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC Shoreline Ecosites plus a 100 m radius area [cxlviii]. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #8 provides development effects and mitigation measures.	at the study area during breeding bird surveys. **SWH type not present.**
Raptor Wintering Area Rationale: Sites used by multiple species, a high number of individuals and used annually are most significant.	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl **Special Concern:** Short-eared Owl Bald Eagle	Hawks / Owls: Combination of ELC Community Series; need to have present one Community Series from each land class Forest: FOD, FOM, FOC. Upland: CUM, CUT, CUS, CUW. Bald Eagle: Forest community Series: FOD, FOM, FOC, SWD, SWM or SWC on shoreline areas adjacent to large rivers or lakes with open water (hunting area).	• The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. • Raptor wintering (hawk / owl) sites need to be > 20 ha [cxlviii, cxlix] with a combination of forest and upland. [xvi, xvii, xviii, xix, xx, xxi]. • Least disturbed sites, idle / fallow or lightly grazed field / meadow (> 15 ha) with adjacent woodlands [cxlix]. • Field area of the habitat is to be wind swept with limited snow depth or accumulation. • Eagle sites have open water and large trees and snags available for roosting [cxlix]. Information Sources: • OMNRF Ecologist or Biologist. • Naturalist clubs. • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area. • Data from Bird Studies Canada. • Results of Christmas Bird Counts. • Reports and other information available from Conservation Authorities.	Studies confirm the use of these habitats by: • One or more Short-eared Owls or; One of more Bald Eagles or; At least10 individuals and two of the listed hawk / owl species Ⓔ. • To be significant a site must be used regularly (3 in 5 years) [cxlix] for a minimum of 20 days by the above number of birds Ⓔ. • The habitat area for an Eagle winter site is the Shoreline Forest Ecosites directly adjacent to the prime hunting area Ⓔ. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #10 and #11 provides development effects and mitigation measures.	Study area is not of sufficient size and does not contain large body of water. **SWH type not present.**
Bat Hibernacula Rationale:	Big Brown Bat Tri-coloured Bat	Bat Hibernacula may be found in these Ecosites: CCR1	• Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. • Active mine sites should not be considered as SWH.	• All sites with confirmed hibernating bats are SWH Ⓔ. • The area includes 200 m radius around the entrance of the hibernaculum [cxlviii, ccvii, Ⓔ] for most development types and 1000 m for wind farms [ccv].	Study area did not contain CCR or CCA ecosites.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Bat hibernacula are rare habitats in all Ontario landscapes		CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	• The locations of bat hibernacula are relatively poorly known. Information Sources • OMNRF for possible locations and contact for local experts. • Natural Heritage Information Centre (NHIC) Bat Hibernaculum. • Ministry of Northern Development and Mines for location of mine shafts. • Clubs that explore caves (eg. Sierra Club). • University Biology Departments with bat experts.	• Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv]. • SWH MIST [cxlix] Index #1 provides development effects and mitigation measures.	**SWH type not present.**
Bat Maternity Colonies Rationale: Known locations of forested bat maternity colonies are extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	• Maternity colonies can be found in tree cavities, vegetation and often in buildings [xxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario [xxii]. • Maternity colonies located in Mature deciduous or mixed forest stands [ccix, ccx, ccv] with > 10 / ha large diameter (> 25 cm dbh) wildlife trees [ccvii]. • Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3 [ccxiv] or class 1 or 2 [ccxii]. • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags / ha are preferred [ccx, lxiv]. Information Sources: • OMNRF for possible locations and contact for local experts. • University Biology Departments with bat experts.	• Maternity Colonies with confirmed use by; • > 10 Big Brown Bats(E) • > 5 Adult Female Silver haired Bats(E). • The area of the habitat includes the entire woodland or a forest stand ELC Ecosite or an Ecoelement containing the maternity colonies(E). • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv]. • SWH MIST [cxlix] Index #12 provides development effects and mitigation measures.	Forest communities are small and linear not contiguous with larger features. **SWH type not present.**
Turtle Wintering Areas Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle **Special Concern:** Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles; ELC Community Classes; SW, MA, OA and SA, ELC Community Series; FEO and BOO Northern Map Turtle; Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat	• For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen [cix, cx, cxi, cxii]. • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH. Information Sources: • EIS studies carried out by Conservation Authorities. • Field Naturalists Clubs. • OMNRF Ecologist or Biologist. • Natural Heritage Information Centre (NHIC).	• Presence of 5 over-wintering Midland Painted Turtles is significant(E). • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant(E). • The mapped ELC Ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar– May) [cvii]. Congregation of turtles is more common where wintering areas are limited and therefore significant [cix, cx, cxi, cxii]. • SWH MIST [cxlix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	Suitable habitat may be present within the cattail shallow marsh. **Candidate SWH.**
Reptile Hibernaculum Rationale: Generally sites are the only known sites in the area. Sites with the highest	**Snakes:** Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brown snake Smooth Green Snake Northern Ring-necked Snake	For all snakes, habitat may be found in any Ecosite other than very wet ones. Talus, Rock Barren, Crevice, Cave, and Alvar sites may be directly related to these habitats. Observations or	• For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. • Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line [xliv, l, li, lii, cxii]. • Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr / May) and Fall (Sept / Oct) (E). • Note: If there are Special Concern Species present, then site is SWH. • Note: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by	Study area did not contain evidence of hibernacula. **SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
number of individuals are most significant.	**Special Concern:** Milk snake Eastern Ribbonsnake	congregations of snakes on sunny warm days in the spring or fall is a good indicator.	with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. Information Sources: • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs. • University herpetologists. • Natural Heritage Information Centre (NHIC).	many of the same individuals of a local population (e.g. strong hibernation site fidelity). Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30 m radius area is the SWH(E). • SWH MIST [cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula.	
Colonially - Nesting Bird Breeding Habitat (Bank and Cliff) Rationale: Historical use and number of colony nests make this habitat signif-icant. An iden-tified colony can be impor-tant to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns. Habitat found in the following Ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed / permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. • Does not include a licensed / permitted Mineral Aggregate Operation. Information Sources: • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas. • Bird Studies Canada; NatureCounts http://www.birdscanada.org/birdmon/ • Field Naturalist Clubs.	Studies confirming: • Presence of 1 or more nesting sites with 8 [cxlix] or more cliff swallow pairs and / or rough-winged swallow pairs during the breeding season. • A colony identified as SWH will include a 50 m radius habitat area from the peripheral nests [ccvii]. • Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • SWH MIST [cxlix] Index #4 provides development effects and mitigation measures.	Study area did not contain any steep, exposed banks. **SWH type not present.**
Colonially-Nesting Bird Breeding Habitat (Trees and Shrubs) Rationale: Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	• Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. Information Sources: • Ontario Breeding Bird Atlas ccv, colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony. • Aerial photographs can help identify large heronries. • Reports and other information available from Conservation Authorities. • MNRF District Offices. • Field Naturalist Clubs.	Studies confirming: • Presence of 2(E) or more active nests of Great Blue Heron or other listed species. • The habitat extends from the edge of the colony and a minimum 300 m radius or extent of the Forest Ecosite containing • • the colony or any island < 15.0 ha with a colony is the SWH [cc, ccvii]. • Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and / or eggshells. • SWH MIST [cxlix] Index #5 provides development effects and mitigation measures.	Suitable habitat was not observed during field investigations. **SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Colonially-Nesting Bird Breeding Habitat (Ground) Rationale: Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird). MAM1 – 6 MAS1 – 3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. Information Sources: • Ontario Breeding Bird Atlas, rare / colonial species records. • Canadian Wildlife Service. • Reports and other information available from Conservation Authorities. • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area. • MNRF District Offices. • Field Naturalist Clubs.	Studies confirming: • Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, > 5 active nests for Common Tern or > 2 active nests for Caspian Tern[E]. • Presence of 5 or more pairs for Brewer's Blackbird[E]. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant[E]. • The edge of the colony and a minimum 150m radius area of habitat, or the extent of the ELC Ecosites containing the colony or any island < 3.0 ha with a colony is the SWH [cc, ccvii]. • Studies would be done during May / June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi] • SWH MIST [cxlix] Index #6 provides development effects and mitigation measures.	No nests of the wildlife species were identified during site visits. **SWH type not present.**
Migratory Butterfly Stopover Areas Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter.	Painted Lady Red Admiral **Special Concern**: Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate site for butterfly stopover will have a history of butterflies being observed.	• A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and forest habitat present, and will be located within 5 km of Lake Erie or Lake Ontario [cxlix]. • The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south [xxxii, xxxiii, xxxiv, xxxv, xxxvi]. • The habitat should not be disturbed, fields / meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat [cxlviii, cxlix]. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes [xxxvii, xxxviii, xxxix, xl, xli]. Information Sources: • MNRF District Offices. • Natural Heritage Information Centre (NHIC). • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs. • Toronto Entomologists Association. • Conservation Authorities.	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug / Oct) [xliii]. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500 / day [xxxvii], significant variation can occur between years and multiple years of sampling should occur [xl, xlii]. • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD. • MUD of > 5000 or > 3000 with the presence of Painted Ladies or Red Admiral's is to be considered significant[E]. • SWH MIST [cxlix] Index #16 provides development effects and mitigation measures.	Study area was insufficient in size and was not located within 5 km of Lake Erie or Ontario. **SWH type not present.**
Landbird Migratory Stopover Rationale: Sites with a high diversity of species as well as high	All migratory songbirds. Canadian Wildlife Service Ontario website: http://www.ec.gc.ca/nature/default.asp?lang=En&	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Woodlots > 5 ha[E] in size and within 5 km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Erie and Lake Ontario. If woodlands are rare in an area of shoreline, woodland fragments 2 – 5 ha can be considered for this habitat[E]. • If multiple woodlands are located along the shoreline those Woodlands < 2 km from Lake Erie and Lake Ontario are more significant [cxlix]. • Sites have a variety of habitats; forest, grassland and wetland complexes [cxlix].	Studies confirm: • Use of the habitat by > 200 birds / day and with > 35 spp with at least 10 bird spp. recorded on at least 5 different survey dates[E]. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (Mar to May) and fall (Aug to Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi].	Study area was not located within 5 km of Lake Erie or Lake Ontario. **SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
numbers are most significant.	n=421B7A9D-1 All migrant raptors species: Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors).		• The largest sites are more significant [cxlix]. • Woodlots and forest fragments are important habitats to migrating birds [ccxviii], these features located along the shore and located within 5 km of Lake Erie and Lake Ontario are Candidate SWH [cxlviii]. Information Sources: • Bird Studies Canada. • Ontario Nature. • Local birders and field naturalist clubs. • Ontario Important Bird Areas (IBA) Program.	• SWH MIST [cxlix] Index #9 provides development effects and mitigation measures.	
Deer Winter Congregation Areas Rationale: Deer movement during winter in the southern areas of EcoRegion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions [cxlviii].	White-tailed Deer	All Forested Ecosites with these ELC Community Series; FOC FOM FOD SWC SWM SWD Conifer plantations much smaller than 50 ha may also be used.	• Woodlots > 100 ha in size or if large woodlots are rare in a planning area woodlots > 50 ha [E]. • Deer movement during winter in the southern areas of EcoRegion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands [cxlviii]. • Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer / ha [ccxxiv]. • Woodlots with high densities of deer due to artificial feeding are not significant[E]. Information Sources: • MNRF District Offices. • LIO/NRVIS.	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF [cxlviii]. • Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF [E]. • Studies should be completed during winter (Jan / Feb) when > 20 cm of snow is on the ground using aerial survey techniques [ccxxiv], ground or road surveys or a pellet count deer density survey [ccxxv]. • SWH MIST [cxlix] Index #2 provides development effects and mitigation measures.	Study area was an insufficient size. **SWH type not present.**

Table 2. Rare Vegetation Communities.

Rare Vegetation Community	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources	Defining Criteria	Assessment Details
Cliffs and Talus Slopes Rationale:	Any ELC Ecosite within Community Series: TAO CLO	A Cliff is vertical to near vertical bedrock > 3 m in height.	Most cliff and talus slopes occur along the Niagara Escarpment. Information Sources: • The Niagara Escarpment Commission has detailed information on location of these habitats.	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes [lxxviii]. • SWH MIST [cxlix] Index #21 provides development effects and mitigation measures.	Study area did not include any cliffs. **SWH type not present.**

Rare Vegetation Community	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources	Defining Criteria	Assessment Details
Cliffs and Talus Slopes are extremely rare habitats in Ontario.	TAS CLS TAT CLT	A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris.	• OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalist Clubs. • Conservation Authorities.		
Sand Barren Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry.	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always < or equals to 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered, but less than 60%.	• A sand barren area > 0.5 ha in size[Ⓔ]. Information Sources: • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalist Clubs. • Conservation Authorities.	• Confirm any ELC Vegetation Type for Sand Barrens [lxxviii]. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.)[Ⓔ]. • SWH MIST [cxlix] Index #20 provides development effects and mitigation measures.	Study area did not include any sand barren ecosites. **SWH type not present.**
Alvar Rationale: Alvars are extremely rare habitats in EcoRegion 7E.	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 Five Alvar Indicator Species: 1) *Carex crawei* 2) *Panicum philadelphicum* 3) *Eleocharis compressa* 4) *Scutellaria parvula* 5) *Trichostema brachiatum* These indicator species are very specific to Alvars within EcoRegion 7E [Ⓔ cxlix].	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plants. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover [lxxviii].	• An Alvar site > 0.5 ha in size [lxxv]. Alvar is particularly rare in EcoRegion 7E where the only known sites are found in the western islands of Lake Erie [cxcix]. Information Sources: • Alvars of Ontario (2000). • Federation of Ontario Naturalists [lxxvi]. • Ontario Nature – Conserving Great Lakes Alvars [ccviii]. • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Staff. • Field Naturalist Clubs. • Conservation Authorities.	• Field studies that identify four of the five [Ⓔ] **Alvar Indicator Species** [lxxv, cxlix] at a Candidate Alvar site is Significant. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses [lxxv]. • SWH MIST [cxlix] Index #17 provides development effects and mitigation measures.	Study area did not include any alvar ecosites. **SWH type not present.**

Rare Vegetation Community	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources	Defining Criteria	Assessment Details
Old Growth Forest Rationale: Due to historic logging practices and land clearance for agriculture, old growth forest is rare in EcoRegion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old Growth forests are characterized by heavy mortality or turnover of overstorey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	• Woodland area is > 0.5 ha [E]. Information Sources: • OMNRF Forest Resource Inventory mapping. • OMNRF Districts. • Field Naturalist Clubs. • Conservation Authorities. • Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. • Municipal forestry departments.	Field Studies will determine: • If dominant trees species of the are > 140 years old, then the area containing these trees is Significant Wildlife Habitat [cxlviii]. • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities [cxlviii] (cut stumps will not be present). • The area of Forest Ecosites combined or an Ecoelement within an Ecosite that contain the old growth characteristics is the SWH. • Determine ELC vegetation types for the forest area containing the old growth characteristics [lxxviii]. • SWH MIST [cxlix] Index #23 provides development effects and mitigation measures.	Study area did not include any forest communities. **SWH type not present.**
Savannah Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60% [lxxix, lxxx, lxxxi, lxxxii, lxxxiii]. In EcoRegion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario).	• No minimum size to site [E]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources: • Natural Heritage Information Centre (NHIC) has location data available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	• Field studies confirm one or more of the Savannah indicator species listed in [cxlix] Appendix N should be present [E]. Note: Savannah plant spp. list from EcoRegion 7E should be used [cxlviii]. • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (< 50% vegetation cover are exotic sp.). • SWH MIST [cxlix] Index #18 provides development effects and mitigation measures.	Study area did not include savannah ecosites. **SWH type not present.**
Tallgrass Prairie Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover [lxxix, lxxx, lxxxi, lxxxii, lxxxiii]. In EcoRegion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario).	• No minimum size to site [E]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources: • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalists Clubs. • Conservation Authorities.	• Field studies confirm one or more of the Prairie indicator species listed in [cxlix] Appendix N should be present [E]. Note: Prairie plant spp. list from EcoRegion 7E should be used [cxlviii]. • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.). • SWH MIST [cxlix] Index #19 provides development effects and mitigation measures.	Study area did not contain any tallgrass prairie habitats. **SWH type not present.**
Other Rare Vegetation Communities Rationale: Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG [cxlviii]. Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	• ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M [cxlviii]. • The OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources: • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	• Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG [cxlviii]. • Area of the ELC Vegetation Type polygon is the SWH. • SWH MIST [cxlix] Index #37 provides development effects and mitigation measures.	No rare vegetation communities or provincially rare plants were identified at the study area. **SWH type not present.**

Rare Vegetation Community	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources	Defining Criteria	Assessment Details
	Rare is Candidate SWH.				

Table 3. Specialized Habitats of Wildlife considered SWH.

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Waterfowl Nesting Area Rationale: Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant.	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 **Note: includes adjacency to Provincially Significant Wetlands**	• A waterfowl nesting area extends 120 m [cxlix] from a wetland (> 0.5 ha) or a wetland (> 0.5 ha) and any small wetlands (0.5 ha) within 120m or a cluster of 3 or more small (< 0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur [cxlix]. • Upland areas should be at least 120 m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (40cm dbh) in woodlands for cavity nest sites. Information Sources: • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from Conservation Authorities.	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards[Ⓔ], or; • Presence of 10 or more nesting pairs for listed species including Mallards[Ⓔ]. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m [cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWH MIST [cxlix] Index #25 provides development effects and mitigation measures.	Communities are not of sufficient size and species were not observed during breeding bird surveys. **SWH type not present.**
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat Rationale: Nest sites are fairly uncommon in EcoRegion 7E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey **Special Concern:** Bald Eagle	ELC Forest Community Series: FOD FOM FOC SWD SWM SWC Directly adjacent to riparian areas – rivers, lakes, ponds and wetlands.	• Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. • Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree’s canopy. • Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms). Information Sources: • Natural Heritage Information Centre (NHIC) compiles all known nesting sites for Bald Eagles in Ontario. • MNRF values information (LIO/NRVIS) will list known nesting locations. Note: data from NRVIS is provided as a point and does not represent all the habitat. • Nature Counts, Ontario Nest Records Scheme data.	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an area [cxlviii]. • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300 m radius around the nest or the contiguous woodland stand is the SWH [ccvii], maintaining undisturbed shorelines with large trees within this area is important [cxlviii]. • For a Bald Eagle the active nest and a 400 - 800 m radius around the nest is the SWH [cvi, ccvii]. Area of the habitat from 400 - 800m is dependant on site lines from the nest to the	No evidence of Bald Eagle or Osprey Nests or sightings were observed during breeding bird survey or other site visits. **SWH type not present.**

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
			• OMNRF District. • Check the Ontario Breeding Bird Atlas [ccv] or Rare Breeding Birds in Ontario for species documented. • Reports and other information available from Conservation Authorities. • Field Naturalists Clubs.	development and inclusion of perching and foraging habitat [cvi]. • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for equal or > 3 years or suspected of not being used for > 5 years before being considered not significant [ccvii]. • Observational studies to determine nest site use, perching sites and foraging areas need to be done from early March to mid August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #26 provides development effects and mitigation measures.	
Woodland Raptor Nesting Habitat Rationale: Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by these species.	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in SWC, SWM,SWD and CUP3	• All natural or conifer plantation woodland/forest stands > 30 ha with > 4 ha of interior habitat [lxxxviiii, lxxxix, xc, xci, xciii, xciv, xcv, xcvi, cxxxiii]. Interior habitat determined with a 200 m buffer [cxlviii]. • Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. Information Sources: • OMNRF Districts. • Check the Ontario Breeding Bird Atlas [ccv] or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of 1 or more active nests from species list is considered significant [cxlviii]. • Red-shouldered Hawk and Northern Goshawk – A 400 m radius around the nest or 28 ha area of habitat is the SWH [ccvii] (the 28 ha habitat area would be applied where optimal habitat is irregularly shaped around the nest). • Barred Owl – A 200 m radius around the nest is the SWH [ccvii]. • Broad-winged Hawk and Coopers Hawk – A 100 m radius around the nest is the SWH [ccvii]. • Sharp-Shinned Hawk – A 50 m radius around the nest is the SWH [ccvii]. • Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting / nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWH MIST [cxlix] Index #27 provides development effects and mitigation measures.	Study area did not contain forested area of sufficient size to support raptor nesting. **SWH type not present.**
Turtle Nesting Areas Rationale: These habitats are rare and when identified will often be the only breeding site for local populations for turtles.	Midland Painted Turtle **Special Concern:** Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (< 100 m) [cxlviii] or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons, or other animals. • For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes and rivers are most frequently used. Information Sources: • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels).	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles[E]. • One or more Northern Map Turtles or Snapping Turtle nesting is a SWH[E]. • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30 – 100 m around the nesting area dependant on slope, riparian vegetation and adjacent land use in the SWH [cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30 – 100 m area of habitat [cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational	Turtle nest and eggs were identified during field survey. The nest was predated so unable to determine species. **Confirmed SWH.**

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
			• Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Centre (NHIC). • Field Naturalist Clubs.	studies observing the turtles nesting is a recommended method. • SWH MIST [cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat.	
Seeps and Springs Rationale: Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams.	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps / Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps / springs.	Any forested area (with < 25 % meadow / field / pasture) within headwaters of a stream or river system [cxvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species [cxix, cxx, cxxi, cxxii, cxiii, cxiv]. Information Sources: • Topographical Map. • Thermography. • Hydrological surveys conducted by Conservation Authorities and MOE. • Field Naturalists Clubs and landowners. • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped.	Field Studies confirm: • Presence of a site with 2 or more[E] seeps / springs should be considered SWH. • The area of an ELC Forest Ecosite or an Ecoelement within Ecosite containing the seeps / springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat [cxlviii]. • SWH MIST [cxlix] Index #30 provides development effects and mitigation measures.	Study area did not contain forested area. **SWH type not present.**
Amphibian Breeding Habitat (Woodland) Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations.	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians.	• Presence of a wetland, pond or woodland pool (including vernal pools) > 500 m^2 (about 25 m diameter) [ccvii] within or adjacent (within 120 m) to a woodland (no minimum size) [clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat [cxlviii]. Information Sources: • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records. • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF Districts and wetland evaluations. • Field Naturalist Clubs. • Canadian Wildlife Service Amphibian Road Call Survey. • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm: • Presence of breeding population of 1 or more of the listed newt / salamander species or 2 or more of the listed frog species with at least 20 individuals (adults or eggs masses) [lxxi] or 2 or more of the listed frog species with Call Level Codes of 3[E]. • A combination of observational study and call count surveys [cviii] will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland / wetlands. • The habitat is the wetland area plus a 230 m radius of woodland area [lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi]. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWH MIST [cxlix] Index #14 provides development effects and mitigation measures.	Study area did not include any woodland habitat. **SWH type not present.**
Amphibian Breeding Habitat (Wetland) Rationale: Wetlands supporting breeding for these amphibian species are extremely important and	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these Wetland Ecosites will be isolated (> 120 m) from Woodland Ecosites, however larger wetlands containing predominantly aquatic	• Wetlands > 500 m^2 (about 25 m diameter) [ccvii], supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats [clxxxii]. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators.	Studies confirm: • Presence of breeding population of 1 or more of the listed newt / salamander species or 2 or more of the listed frog / toad species with at least 20 individuals (adults or eggs masses) [lxxi] or 2 or more of the listed frog/toad species with Call Level Codes of 3[E]. or; Wetland with confirmed breeding Bullfrogs are significant[E].	Study area contained suitable marsh ecosites of sufficient size, including MAM and MAS communities.

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
fairly rare within Central Ontario landscapes.	Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	species (e.g. Bull Frog) maybe adjacent to woodlands.	• Bullfrogs require permanent water bodies with abundant emergent vegetation. Information Sources: • Ontario Herpetofaunal Summary Atlas (or other similar atlases). • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations. • Reports and other information available from Conservation Authorities.	• The ELC Ecosite Wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys [cviii] will be required during the spring (March - June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST [cxlix] Index #15 provides development effects and mitigation measure	**Candidate SWH.**
Woodland Area-Sensitive Bird Breeding Habitat Rationale: Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler, Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager, Winter Wren Pileated Woodpecker **Special Concern**: Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Habitats where interior forest breeding birds are breeding, typically large mature (> 60 yrs old) forest stands or woodlots > 30 ha [cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix]. • Interior forest habitat is at least 200 m from forest edge habitat [clxiv]. Information Sources: • Local birder clubs. • Canadian Wildlife Service (CWS) for the location of forest bird monitoring. • Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species Ⓔ. • Note: any site with breeding Cerulean Warblers or Canada Warblers is to be considered SWH Ⓔ. • Conduct field investigations in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • SWH MIST [cxlix] Index #34 provides development effects and mitigation measures.	Study area only contain a small stretch of deciduous thicket and are of insufficient size. **SWH type not present.**

Table 4. Habitats of Species of Conservation Concern considered SWH.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Marsh Breeding Bird Habitat Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Moorhen American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1	• Nesting occurs in wetlands. • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present [cxxiv]. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it many be found in upland shrubs or forest a considerable distance from water. Information Source:	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren **or** breeding by any combination of 4 or more of the listed species Ⓔ. • Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH Ⓔ. • Area of the ELC Ecosite is the SWH.	Study area contains MAM ecosites; however, species were not observed during breeding bird surveys.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
	Green Heron Trumpeter Swan **Special Concern:** Black Tern Yellow Rail	FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	• OMNRF District and wetland evaluations. • Field Naturalists Clubs. • Natural Heritage Information Centre (NHIC) Records. • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas.	• Breeding surveys should be done May / June when these species are actively nesting in wetland habitats. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #35 provides development effects and mitigation measures.	**SWH type not present.**
Open Country Bird Breeding Habitat Rationale: This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow **Special Concern:** Short-eared Owl	CUM1 CUM2	• Large grassland areas (includes natural and cultural fields and meadows > 30 ha [clx, clxi, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. • Grassland not Class 1 or 2 agricultural lands, and not being actively used for farming (e.g. no row cropping or intensive hay or livestock pasturing in the last 5 years) [E]. • Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. • The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. Information Sources: • Agricultural land classification maps, Ministry of Agriculture. • Local Bird Clubs. • Ontario Breeding Bird Atlas. • EIS Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species [E]. • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC Ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #32 provides development effects and mitigation measures.	Study area included meadow habitat, but it was of insufficient size. **SWH type not present.**
Shrub / Early Successional Bird Breeding Habitat Rationale: This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp: Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher **Special Concern:** Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of Shrub Ecosites can be complexed into a larger habitat for some bird species.	• Large field areas succeeding to shrub and thicket habitats > 10 ha [clxiv] in size. • Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (e.g. no row-cropping, haying or live-stock pasturing in the last 5 years) [E]. • Shrub thicket habitats (> 10 ha) are most likely to support and sustain a diversity of these species [clxxiii]. • Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. Information Sources: • Agricultural land classifications maps, Ministry of Agriculture. • Local Bird Clubs. • Ontario Breeding Bird Atlas. • Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species [E]. • A habitat with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as SWH [E]. • The area of the SWH is the contiguous ELC Ecosite field / thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #33 provides development effects and mitigation measures.	Study area contained deciduous thickets, but this ecosite was of insufficient size. **SWH type not present.**
Terrestrial Crayfish Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare [ccii].	Chimney or Digger Crayfish (*Fallicambarus fodiens*) Devil Crayfish or Meadow Crayfish (*Cambarus diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM	• Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground cannot be too moist. Can often be found far from water. • Both species are semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. Information Sources: • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998.	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable meadow marsh, swamp or moist terrestrial sites [cci]. • Area of ELC Ecosite or an Ecoelement area of meadow marsh or swamp within the larger Ecosite area is the SWH. • Surveys should be done in April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals in very difficult [cci].	Study area contained muddy-bottomed marsh habitats; however no evidence of chimneys were observed during field investigations. **SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
		CUM1 with inclusions of above Meadow Marsh Ecosites can be used by terrestrial crayfish.		• SWH MIST [cxlix] Index #36 provides development effects and mitigation measures.	
Special Concern and Rare Wildlife Species Rationale: These species are quite rare or have experienced significant population declines in Ontario.	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10 km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy.	• When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or Provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites [lxxviii]. Information Sources: • Natural Heritage Information Centre (NHIC) will have Special Concern and Provincially Rare (S1-S3, SH) species list with element occurrences data. • NHIC Website "Get Information" – http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas. • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Studies Confirm : • Assessment / inventory of the site for the identified Special Concern or rare species needs to be completed during the time of the year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat for foraging habitat. • SWH MIST [cxlix] Index #37 provides development effects and mitigation measures.	**Confirmed** Several Monarch were observed during field investigations.

Table 5. Animal Movement Corridors.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Amphibian Movement Corridors Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	Corridors may be found in all Ecosites associated with water. Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1.	• Movement corridors between breeding habitat and summer habitat [clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi]. • Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat –Wetland) of this Schedule [E]. Information Sources: • MNRF District Office. • Natural Heritage Information Centre (NHIC). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs.	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant [cxlix]. • Corridors should have at least 15 m of vegetation on both sides of waterway [cxlix] or be up to 200 m [cxlix] wide of woodland habitat and with gaps < 20 m [cxlix]. • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat [cxlix]. • SWH MIST [cxlix] Index #40 provides development effects and mitigation measures	Study area contained sections of the Garden Avenue tributary of Fairchild Creek and may provide suitable movement corridors. **Candidate SWH.**

Table 6. Significant Wildlife Habitat Exceptions for EcoDistricts within EcoRegion 7E.

EcoDistrict	Wildlife Habitat and Species	Candidate SWH			Confirmed SWH	Study Area
		Ecosite	Habitat Description	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details

7E-2	**Bat Migratory Stopover Area** Rationale: Stopover areas for long distance migrant bats are important during fall migration. Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types.		• Long distance migratory bats typically migrate during late summer and early fall from summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migration may concentrate these species of bats at stopover areas. • This is the only known bat migratory stopover habitats based on current information. Information Sources: • OMNRF for possible locations and contact for local experts. • University of Waterloo, Biology Department.	• Long Point (42°35'N, 80°30'E, to 42°33'N, 80°03'E) has been identified as a significant stop-over habitat for fall migrating Silver-haired Bats, due to significant increases in abundance, activity and feeding that was documented during fall migration [ccxv]. • The confirmation criteria and habitat areas for this SWH are still being determined. • SWH MIST [cxlix] Index #38 provides development effects and mitigation measures	Study area is not located in appropriate habitat. **SWH type not present.**

Attachment L

Fish Permitting and Approvals

Fisheries and Oceans Canada
Pêches et Océans Canada

Ontario and Prairie Region
Fish and Fish Habitat Protection Program
867 Lakeshore Rd.
Burlington, ON
L7S 1A1

Région de l'Ontario et des Prairies
Programme de protection du poisson et de son habitat
867 chemin Lakeshore
Burlington, ON
L7S 1A1

December 15, 2020

Our file *Notre référence*
20-HCAA-02198

Nahed Ghbn
City of Brantford
100 Wellington Square, P.O. Box 818
Brantford, ON N3T 5R7

Subject: Stormwater Facility Retrofit, Garden Avenue Creek, Brantford (20-HCAA-02198) – Implementation of Measures to Avoid and Mitigate the Potential for Prohibited Effects to Fish and Fish Habitat

Dear Nahed Ghbn:

The Fish and Fish Habitat Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on October 22, 2020. We understand that you propose to:

- Remove the existing control structures and accumulated sediment at the Braneida Industrial Stormwater Management Facility in Brantford;
- Conduct grading works and install a new facility liner;
- Install new control structures (manholes, concrete weirs, CSP riser, headwall and piping); and,
- Work in isolation of flow or open water to avoid sedimentation of the watercourse.

Our review considered the following information:

- Request for Review form and associated documents submitted on October 22, 2020; and,
- Email correspondence from J. Piette to S. Arevalo on November 16 to December 1, 2020 confirming additional project details.

Your proposal has been reviewed to determine whether it is likely to result in:

- the death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*; and,
- effects to listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*.

The aforementioned impacts are prohibited unless authorized under their respective legislation and regulations.

To avoid and mitigate the potential for prohibited effects to fish and fish habitat (as listed above), we recommend implementing the measures listed below:

- Plan in-water works, undertakings and activities to respect timing windows to protect fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed and migrate;
- Conduct in-water undertakings and activities during periods of low water levels;
- Limit the duration of in-water works, undertakings and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (spawning, rearing, feeding, migrating);
- Capture, relocate and monitor for fish trapped within isolated, enclosed, or dewatered areas;
    - Dewater gradually to reduce the potential for stranding fish;
- Screen intake pipes to prevent entrainment or impingement of fish;
    - Use the code of practice for water intake screens;
- Maintain an appropriate depth and flow (i.e., base flow and seasonal flow of water) for the protection of fish and fish habitat;
- Develop and implement an erosion and sediment control plan to avoid the introduction of sediment into any waterbody during all phases of the work, undertaking or activity;
    - Conduct all in-water works, undertakings or activities in isolation of open or flowing water to reduce the introduction of sediment into the watercourse;
        - Use the code of practice for temporary cofferdams and diversion channels;
    - Schedule work to avoid wet, windy and rainy periods (and heed weather advisories) that may result in high flow volumes and/ or increase erosion and sedimentation;
    - Monitor the watercourse to observe signs of sedimentation during all phases of the work, undertaking or activity and take corrective action; and,
- Develop and implement a response plan to avoid a spill of deleterious substances.

Provided that you incorporate these measures into your plans, the Program is of the view that your proposal will not require an authorization under the *Fisheries Act*, or the *Species at Risk Act*.

Should your plans change or if you have omitted some information in your proposal, further review by the Program may be required. Consult our website (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or consult with a qualified environmental consultant to determine if further review may be necessary. It remains your responsibility to remain in compliance with the *Fisheries Act*, and the *Species at Risk Act*.

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to (http://www.dfo-mpo.gc.ca/pnw-ppe/CONTACT-eng.html).

We recommend that you notify this office at least 10 days before starting your project and that a copy of this letter be kept on site while the work is in progress. It remains your responsibility to meet all other federal, territorial, provincial and municipal requirements that apply to your proposal.

If you have any questions with the content of this letter, please contact Samantha Arevalo by email at Samantha.Arevalo@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Samantha Arevalo
Biologist, Triage and Planning
Fish and Fish Habitat Protection Program

COPY:

Lisa Wren – Fisheries and Oceans Canada

Ontario

Ministry of Natural Resources

Ministère des Richesses naturelles

Licence to Collect Fish for Scientific Purposes

Permis pour faire la collecte de poissons à des fins scientifiques

Licence No. / N° de permis	
Local Reference No. / N° de référence local	GL2020-1637
Issuer Account No. / N° de compte du delivreur de permis.	10003116

This licence is issued under Part I of the Fish Licensing Regulation made under the Fish and Wildlife Conservation Act, 1997 to:

Ce permis est délivré en vertu de la Partie I du règlement sur la délivrance de permis de pêche formulé conformément à la Loi sur la protection du poisson et de la faune de 1997 à:

	Last Name / Nom de famille	First Name / Prénom	Middle Name / Second Prénom
Name of Licencee / *Nom du titulaire du permis*	Keele	Kierian	

Name of Business/Organization/Affiliation (if applicable) / Nom de l'entreprise/de l'organisme/de l'affiliation (le cas échéant)

Ecosystem Recovery Inc.

	Street Name & No./PO Box/RR#/Gen.Del./N° rue/C.P/R.R./poste restante		
Mailing Address of Licencee / *Addresse postale du titulaire du permis*	80 Courtland Avenue		
	City/Town/Municipality / Ville/village/municipalité	Province/State Province/Etat	Postal Code/ZipCode Code Postal/Zip
	Kitchener	ON	N2G 2T8

to collect the species, size and quantites of fish from the waters as set out below.
Pour faire la collecte des espèces suivantes (stade et nombre indiqués ci-dessous):

Species Espèces	Eggs Oeuf X	Juvenile Fretin X	Adults Adulte X	Numbers Nombre	Name of Waterbody Nom de l'étendue d'eau
All Fish Species		X	X		As per Schedule A

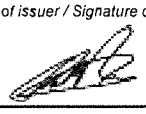
Yes/Oui ☐ Additional species/Waterbody list attached / Liste d'espèces/d'étendue d'eau additionnelles ci-jointe

Purpose of collection / *But de la collecte*: SWM Pond Cleanout

Licence Dates / *Dates du permis*	Effective Date / Date d'entrée en vigueur (YYYY-MM-DD)	Expiry Date / Date d'expiration (YYYY-MM-DD)
	2020-07-02	2020-12-31

Licence conditions / *Conditions du permis*: This licence is subject to the conditions contained in Schedule A if included. / Ce permis doit respecter les conditions de l'annexe A si celle-ci est jointe.

Yes/Oui ☒ No/Non ☐ Schedule A included. / Annexe A ci-jointe

Issued by (please print) / *Délivré par (veuillez écrire en caractères d'imprimerie)*	*Signature of issuer / Signature du délivreur*	Date of Issue / Date de délivrance (YYYY-MM-DD)
Al Murray		2020-07-02

Signature of Licencee / Signature du titulaire du permis	Date (YYYY-MM-DD)
Kim Keele	2020-07-21

Personal information contained on this form is collected under the authority of the Fish and Wildlife Conservation Act, 1997 and will be used for the purpose of licencing, identification, enforcement, resource management and customer service surveys. Please direct further inquiries to the District Manager of the MNR issuing district.

Les renseignements personnels dans ce formulaire sont recueillis conformément à la Loi sur la protection du poisson de la faune, 1997, et ils seront utilisés aux fins de délivrance de permis, d'identification, d'application des règlements, de gestion des resources et de sondage sur les services a la clientèle. Veuillez communiquer avec le chef du district du MRN qui délivré le permis si vous avez des questions.

Attachment M

Species at Risk

Species at Risk

Species	ESA Status	SARA Status	COSEWIC Status	Habitat Preferences (MNRF/COSEWIC)	Known Species Range	Source Identifying Species Record	Probability of Occurrence Within Study Area	Conclusions/ Recommendations
Eastern Small-footed Myotis (Eastern Small-footed Bat) *Myotis leibii*	END	N/A	N/A	- Summer habitat includes rock outcrops, in buildings, under bridges, or in caves, mines or hollow trees. - Roosting locations are typically changed every night. - Winter hibernation occurs in caves or mines, typically drier and colder than sites selected by other bats.	- South of Georgian Bay to Lake Erie and east to the Pembroke area, the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park.	Ontario Mammal Atlas	**Low probability.** Study area did not contain suitable ELC communities.	No further action required.
Little Brown Myotis (Little Brown Bat) *Myotis lucifugus*	END	END Schedule 1	END	- Large-diameter trees, attics, abandoned buildings, and barns often used for summer colonies. - Foraging occurs over water, along waterways, and forest edges. - Hibernacula used in winter include mines and caves that are humid and remain above freezing.	- All across Ontario; concentrated in southern Ontario.	Ontario Mammal Atlas	**Low probability.** Study area did not contain suitable ELC communities or other built structures.	No further action required.
Tri-colored Bat *Perimyotis subflavus*	END	END Schedule 1	END	- Day roost and maternity colonies are formed in older forests with large-diameter trees, barns, or other structures. - Foraging occurs over water or along streams in a forest. - Winter hibernacula include caves and mines.	- Southern Ontario north to Sudbury.	Ontario Mammal Atlas	**Low probability**. Study area did not contain suitable ELC communities or other built structures.	No further action required.
Northern Myotis (Northern Long-eared Bat) *Myotis septentrionalis*	END	END Schedule 1	END	- Typically within the boreal forest, under loose bark or in the cavitiies of trees - Foraging occurs over water, along waterways, and forest edges, while open areas such as clearcuts or fields are typically avoided - Overwintering occurs in cold and humid sites such as caves or mines	- Forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon.	Ontario Mammal Atlas	**Low probability.** Study area did not contain suitable ELC communities or other built structures.	No further action required.
Chimney Swift *Chaetura pelagica*	THR	THR Schedule 1	THR	- Historically included hollow trees. - More commonly found in and around urban settlements, including chimneys and other manmade structures. - Tend to stay close to water. - **TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, SAF1 adjacent to suitable nesting habitat.**	- Southern Ontario north to Timmins.	OBBA, eBird	**Low probability.** Suitable urban settlements are found adjacent to the study area. Species was not obsered during field investigations.	No further action required as surrounding manmade structures will be unaffected by proposed works.
Barn Swallow *Hirundo rustica*	THR	THR Schedule 1	THR	- Cup-shaped mud nests built on human-made structures such as open barns under bridges, and in culverts. - Prefer rough-cut wood surfaces. - Foraging habitat includes grassy fields, pastures, cropland, lake and river shorelines, cottage areas and farmyards, islands, wetlands, and tundra. - **TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, and SAF1, adjacent to suitable nesting structures.**	- From southern Ontario north to Hudson Bay.	OBBA, ERI	**Confirmed.** Species observed foraging, however, no suitable nesting structures were observed. Two individuals were observed during ERI breeding bird surveys.	Vegetation disturbance will be limited and temporary in nature for the proposed works. Vegetation removal should occur outside of April 1 - August 31. Man-made structures should be carefully inspected prior to disturbance/removal. Should nest cups be observed a Registration under Section 23.5 of the ESA may be required prior to construction.

Species	ESA Status	SARA Status	COSEWIC Status	Habitat Preferences (MNRF/COSEWIC)	Known Species Range	Source Identifying Species Record	Probability of Occurrence Within Study Area	Conclusions/ Recommendations
Bank Swallow *Riparia riparia*	THR	THR Schedule 1	THR	- Requires vertical faces in sand or silt deposits; river and lake banks, active/inactive sand and gravel pits, road cuts, soil stockpiles. - Breeding sites located close to aerial foraging areas such as grasslands, meadows, pastures, and cropland. - Large wetlands used for nocturnal roost sites during post-breeding, migration and wintering periods.	- Common across southern Ontario, especially along Lake Erie and Lake Ontario shorelines and the Saugeen River. - Sparse population scattered across northern Ontario.	OBBA, ERI	**Confirmed.** Species was observed foraging, no suitable nesting banks were observed. One individual was observed during ERI breeding bird surveys.	Vegetation disturbance will be limited and temporary in nature for the proposed works. Vegetation removal should occur outside of April 1 - August 31.
Bobolink *Dolichonyx oryzivorus*	THR	THR Schedule 1	THR	- Hayfields, pastures, wet prairie, graminoid peatlands, abandoned farm fields dominated by tall grasses, no-till cropland, small-grain fields, restored surface mining sites. - Small nests often built on the ground in dense grasses. - Typically not abundant in short-grass prairie, alfalfa, or in row crop monocultures (corn, soybean, wheat). - **TPO, TPS, CUM1, and MAM2.**	- Southern Ontario north to James Bay.	OBBA	**Low probability**. Study area contains suitable cultural meadow habitat. Species was not observed by ERI during breeding bird surveys.	Vegetation disturbance will be limited and temporary in nature for the proposed works. Vegetation removal should occur outside of April 1 - August 31.
Eastern Meadowlark *Sturnella magna*	THR	THR Schedule 1	THR	- Moderately tall grasslands; prairies, savannahs, pastures and hayfields, alfalfa, weedy borders of croplands, roadsides, orchards, airports, overgrown fields. - Small trees, shrubs, or fence posts used as elevated song perches. - **TPO, TPS, CUM1, CUS, and MAM2.**	- Southern Ontario north to Timmins, as well as Lake of the Woods area.	OBBA, eBird	**Low probability.** Study area contains suitable cultural meadow habitat; however species was not observed during breeding bird surveys.	Vegetation disturbance will be limited and temporary in nature for the proposed works. Vegetation removal should occur outside of April 1 - August 31.
Blanding's Turtle (Great Lakes / St. Lawrence population) *Emydoidea blandingii*	THR	THR Schedule 1	END	- Shallow, nutrient-rich habitats; typically large wetlands and shallow lakes with lots of water plants. - Nesting occurs in sand, organic soil, gravel, cobblestone, and soil-filled crevices of rock outcrops. - Overwintering occurs in pools about 1 metre in depth. - **SWT2, SWT3, SWD, SWM, MAS2, SAS1, SAM1, where open water is present**	- Southern Ontario north to Sudbury, with isolated reports as far north as Timmins.	Local species records	**Low probability.** Study area contains wetland habitat, however no individuals were identified during turtle surveys.	No further action required.
Bald Eagle *Haliaeetus leucocephalus*	SC	No Status	Not at Risk	- Wide variety of habitat near major lakes or rivers. - Tall trees (ie, pine or poplar) typically used for nesting. - Diet consists of fish and dead animals (ie, white-tailed deer). - **FOC, FOM, FOD, SWC, SWM and SWD.**	- Can be found across Ontario, from US border north to Lake of the Woods.	eBird	**Low probability.** Study area does not contain suitable trees for nesting	No further action required.
Common Nighthawk *Chordeiles minor*	SC	THR Schedule 1	SC	- Open areas with little to no ground vegetation; logged or burned areas, rock barrens, peat bogs, lakeshores, dunes, beaches, and mine tailings. - Less commonly found in cultivated fields, orchards, mine tailings, and along gravel roads and railways. - Nesting habitat also typically open and vegetation free; may include grasslands, pastures, marshes, and riverbanks. - May also include mixed and coniferous forests. - **SD, BB, RB, CUM, BO, FOM, FOC and FOD with sparsely vegetated openings.**	- All of Ontario except for coastal regions of James Bay and Hudson Bay.	OBBA	**Low probability.** Study area contains open meadow habitat; however, ground vegetation is present.	Vegetation disturbance will be limited and temporary in nature for the proposed works. Vegetation clearing should take place outside of the breeding bird window of April 1 to August 31.

Species	ESA Status	SARA Status	COSEWIC Status	Habitat Preferences (MNRF/COSEWIC)	Known Species Range	Source Identifying Species Record	Probability of Occurrence Within Study Area	Conclusions/ Recommendations
Grasshopper Sparrow *Ammodramus savannarum*	SC	SC Schedule 1	SC	- Open grassland habitats, usually 5 ha or greater with well-drained, sandy soil; hayfields, pasture, alvars, prairies, grain crops (ie, barley). - Preferably sparsely vegetated areas. - Nests are woven from grasses into a small, cup-like shape. **-CUM, TPO.**	- Southern Ontario north to North Bay.	OBBA	**Low probability.** suitable cultural meadow habitat covers a large portion of the study area, however, was not dominated by grasses and the area totalled fewer than 5 ha in size	Vegetation disturbance will be limited and temporary in nature for the proposed works. Vegetation clearing should take place outside of the breeding bird window of April 1 to August 31.
Rusty Blackbird *Euphagus carolinus*	SC	SC Schedule 1	SC	- Wet woodlands, swamps, pond edges. - Forages in agricultural lands. - Breeds in the boreal forest; conifer-dominated forests adjacent to wetlands, peat bogs, sedge meadows, marshes, swamps, and beaver ponds.	- Breeding habitat spans Hudson Bay south to Orillia. - May be seen in southern Ontario during migration	OBBA	**Low probability.** The study area does not contain suitable boreal forest breeding grounds and it not within the specified range.	No further action required.
Wood Thrush *Hylocichla mustelina*	SC	THR Schedule 1	THR	- Mature deciduous and mixed forests; moist stands of trees with well-developed undergrowth. - Tall trees are used for singing perches. - Nests are built in live saplings, trees, or shrubs, especially sugar maple or American beech. - Prefer large forest mosaics. - **FOD and FOM greater than 1 ha.**	- Southern Ontario north to Hearst.	OBBA, eBird	**Low probability**. Study area did not contain forested areas of sufficient size.	No further action required.
Eastern Wood-pewee *Contopus virens*	SC	SC Schedule 1	SC	- Mid-canopy layer of forest clearings, edges of deciduous and mixed forests, early successional clearings - **FOC, FOM, FOD, SWD, SWM, CUW**	- Southern Ontario north to Sudbury.	OBBA, eBird	**Low probability.** Study did not contain suitable forested areas.	No further action required.
Snapping Turtle *Chelydra serpentina*	SC	SC Schedule 1	SC	- Shallow wetland habitats with slow-moving water and soft bottoms; ponds, sloughs, shallow bays, river edges, or slow streams. - Nesting occurs on sandy or gravel banks or man-made structures such as roads, dams, and aggregate pites. - Overwintering occurs underwater, underneath logs, sticks, or overhanging banks, deep in mud in marshy areas, or underneath floating mats of vegetation. - **OAO, SA near gravelly or sandy areas.**	- Primarily southern Ontario north to Timmins; also found near Thunder Bay and Kenora.	ORAA	**High probability**. Study area contains a turbid shallow pond with gravel banks. A predated turtle nest was found onsite.	A wildlife scientific collectors permit is required before any water works may be performed. A relocation plan should be developed if a species is found. No water-related works should be completed during the turtle hibernation period between October to April, unless this area has already been cleared and isolated with exclusion fencing.
Northern Map Turtle *Graptemys geographica*	SC	SC Schedule 1	SC	- Both lakes and rivers, preferably with slow-moving currents, muddy bottoms, high-quality water, and abundant vegetation. - Habitat must contain suitable basking sites such as rocks and deadheads. - Hibernation occurs at the bottom of deep, slow-moving sections of river. - **OAO, SA** with emergent rocks and fallen trees.	- Southern Ontario, primarily on the shores of Georgian Bay, Lake St. Clair, Lake Erie, and Lake Ontario, and along larger rivers including the Thames, Grand, and Ottawa. - Has also been recorded on Manitoulin Island and north of Timmins.	ORAA	**Low probability.** Study area did not contain river habitat with high quality water.	No further action required.

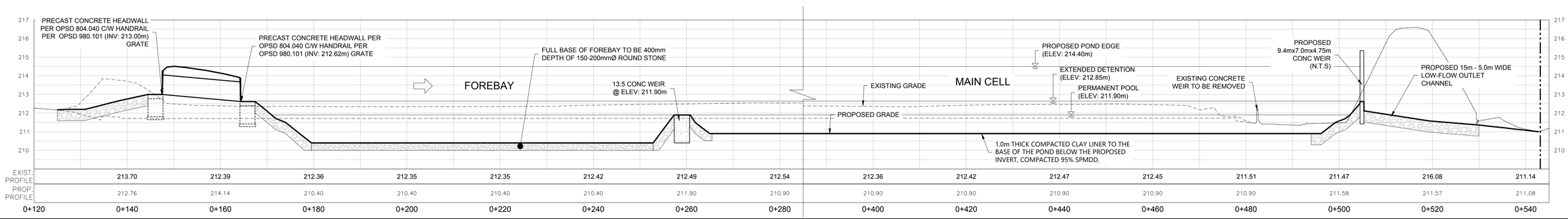
Species	ESA Status	SARA Status	COSEWIC Status	Habitat Preferences (MNRF/COSEWIC)	Known Species Range	Source Identifying Species Record	Probability of Occurrence Within Study Area	Conclusions/ Recommendations
River Redhorse *Moxostoma carinatum*	SC	SC Schedule 1	SC	- Medium to large sized rivers with substantial flows and stone, rubble, or bedrock substrate with very little siltation. - **OAO characterized as medium to large-sized rivers with substantial flow**.	- Bay of Quinte and the Trent, Grand, Thames, Ottawa, and Madawaska Rivers.	Local species records	**Low probability.** Electrofishing surveys were completed and river redhorse was not found.	No further action required.
Monarch *Danaus plexippus*	SC	SC Schedule 1	END	- Open or disturbed habitats such as roadsides, fields, wetlands, prairies, and open forests. - Trees along the north shore of the Great Lakes are used for roosting before migrating across open water. - Caterpillars are confined to meadows and open areas where milkweed grows. - **AL, TP, and CUM where milkweed is present.**	- South of 50° of latitude.	Ontario Butterfly Atlas	**Confirmed.** Milkweed is found through the study area in suitable meadow communities and species were observed by ERI.	Recommend removing vegetation outside of the Active season April 1 to August 31. Milkweed species should be included within planting plans.

Attachment N

Concept Design Drawings

LIMIT OF GRADING
10:1-2m WIDE AQUATIC SAFETY BENCH INNER ELEV: 211.50m (TYP)
1.0m THICK COMPACTED CLAY LINER TO THE BASE OF THE POND BELOW THE PROPOSED INVERT, COMPACTED 95% SPMDD.
PROPOSED POND EDGE (ELEV: 214.50m)
EXTENDED DETENTION (ELEV: 212.64m)
PERMANENT POOL (ELEV: 211.90m)
POND BOTTOM (ELEV: 210.90m)
EXISTING 2x2.0mØ CSP CULVERTS TO BE REMOVED
PROPOSED 25m - 5.0m WIDE LOW-FLOW OUTLET CHANNEL
PROPOSED 9.4mLx5.2mHx0.5mD CONCRETE WEIR
PROPOSED PLUNGE POOL AT OUTLET
HYDRO EASEMENT
CONCRETE HEADWALL (OPSD 804.030) C/W SLUICE GATE (INV=211.58m)
VEHICLE TURNAROUND HAMMER HEAD
MAIN CELL
FULL BASE OF FOREBAY TO BE 400mm DEPTH OF 150-200mmØ ROUND STONE
TOP OF BERM ELEV: 212.5m)
FOREBAY BOTTOM (ELEV: 210.40m)
PROPOSED CUT-OFF WALL
32.0m-525mmØ STM @ 0.6%
PERFORATED RISE C/W 370mmØ ORIFICE PLATE @ ELEV: 211.90m
13.5 CONC WEIR @ ELEV: 211.90m
PRECAST CONCRETE HEADWALL PER OPSD 804.040 C/W HANDRAIL PER OPSD 980.101 (INV: 212.62m) GRATE
PROPOSED 3x4m ANGULAR STONE MAT
11.0m-450mmØ STM @ 2.0%
PROPOSED CUT-OFF WALL
ROAD ASPHALT
PROPOSED 4.0m MAINTENANCE ACCESS ROAD
FOREBAY
TP1
BH2 [212.91]
TP2
TP3
BH1 [212.47]
TP4
16.5m-1050mmØ CONC. STM @ 2.0%
STONE ACCESS ROAD 50mm BEDDING SAND 150mm GRANULAR "A" 450mm GRANULAR "B"
ROAD ASPHALT
EXTEND EXISTING OUTFALL FROM 112 ADAMS BLVD. 16m BEYOND EX MH VIA 16m-200mmØ PVC STRM @ 4% C/W 3mx6m ANGULAR STONE PAD MIN DEPTH 0.30m.
PRECAST CONCRETE HEADWALL PER OPSD 804.040 C/W HANDRAIL PER OPSD 980.101 (INV: 213.00m) GRATE
PROPOSED 16.0m WEIR/SPILLWAY OVER ACCESS ROAD (ELEV: 214.35m)
CONCRETE HEADWALL (OPSD 804.030) C/W SLUICE GATE (INV=213.50m)
MATCH TO EXISTING
66 BURY COURT
90 ADAMS BLVD

SWM FACILITY DATA	
CATCHMENT AREA	145 ha
PERMANENT POOL VOLUME (m³)	12,800
EROSION CONTROL STORAGE VOLUME (m³)	25,495
PEAK FLOW ATTENUATION STORAGE VOLUME (m³)	
TOTAL STORAGE VOLUME (m³)	59,880
POND BOTTOM ELEVATION (m)	210.90
PERMANENT POOL ELEVATION (m)	211.90
EROSION CONTROL PONDING ELEVATION (m)	212.64
100-YEAR PONDING ELEVATION (m)	213.72
REGULATORY ELEVATION (m)	214.14



	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+400	0+420	0+440	0+460	0+480	0+500	0+520	0+540
EXIST. PROFILE	213.70	212.39	212.36	212.35	212.35	212.42	212.49	212.54	212.36	212.42	212.47	212.45	211.51	211.47	216.08	211.14	
PROP. PROFILE	212.76	214.14	210.40	210.40	210.40	210.40	211.90	210.90	210.90	210.90	210.90	210.90	210.90	211.58	211.57	211.08	

NO.	DATE	DESCRIPTION	APP'D.	NO.	DATE	DESCRIPTION	APP'D.
-	-	-					

REVISIONS

LEGEND

EXISTING
- GRCA REGULATORY FLOOD LIMIT
- CONTOURS
- FENCE LINE
- PROPERTY LIMIT
- HYDRO EASEMENT
- OVERHEAD HYDRO LINES
- EDGE OF PAVEMENT

PROPOSED
- WATERLEVEL
- CONTOURS
- BOTTOM OF BANK
- TOP OF BANK/SLOPE
- LIMIT OF GRADING
- ROCK
- FOREBAY LINING
- ASPHALT ACCESS ROUTE
- STONE ACCESS ROUTE

SITE BENCHMARK:
MH10A AND MH11A AS DEFINED ON THE ADAMS BOULEVARD PLAN AND PROFILE DRAWING (AS CONSTRUCTED, PHILLIPS 1990). BENCHMARKS WERE SURVEYED WITH A TRIMBLE GPS AND ELEVATIONS WERE RECORDED AS:
MH10A T/G: 216.34
MH11A T/G: 215.70

STAMP

STAMP

ecosystem recovery Inc. PROFESSIONAL ENGINEERS

BRANEIDA SWMF RETROFIT AND DOWNSTREAM CHANNEL REHABILITATION

SWM POND PROPOSED PLAN AND PROFILE

DATE: 2020/05/20 | CHK/APP: CM | DRAWING NUMBER
SCALE: H1:400 V1:100 | DSN: JC | C201
PRO. No: 1839 | DRN: KV

Attachment O

Channel Concept Plan

EXISTING TRAIL

EXISTING FOOTBRIDGE

LIMIT OF CREEK CONSTRUCTION

RED: APPROXIMATE LOCATION OF FEATURES TO PROTECT KICKPOINTS FROM FURTHER REGRESSION BY PROTECTING THE TILL BED AND MANAGING CHANGE IN ELEVATION THROUGH A NATURALIZED CASCADE OR STEP POOL CONFIGURATION, REFER TO TYPICAL DETAIL.

YELLOW: APPROXIMATE LOCATION OF PROTECTION TO PREVENT EXPOSED TILL BED FROM EROSION AND INTEGRATION OF HABITAT ELEMENTS SUCH AS LARGE WOODY DEBRIS, REFER TO TYPICAL DETAIL

GRCA REGULATORY FLOOD LIMIT

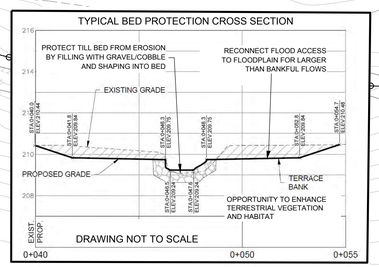
EXISTING CHANNEL CENTRELINE

GARDEN AVE TRIBUTARY

LIMIT OF CREEK CONSTRUCTION

0+720 0+730 0+740 0+750 0+760 0+770 0+780 0+790 0+800 0+810 0+820 0+830 0+840 0+860 0+870 0+880 0+890 0+900 0+910 0+920 0+940 0+950 0+960 0+970 0+980 0+990 1+000 1+010 1+020 1+030

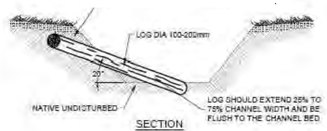
TYPICAL BED PROTECTION CROSS SECTION



DRAWING NOT TO SCALE

0+040 0+050 0+055

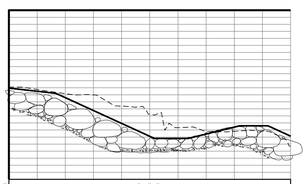
EXAMPLE OF LARGE WOODY DEBRIS



SECTION

DRAWING NOT TO SCALE

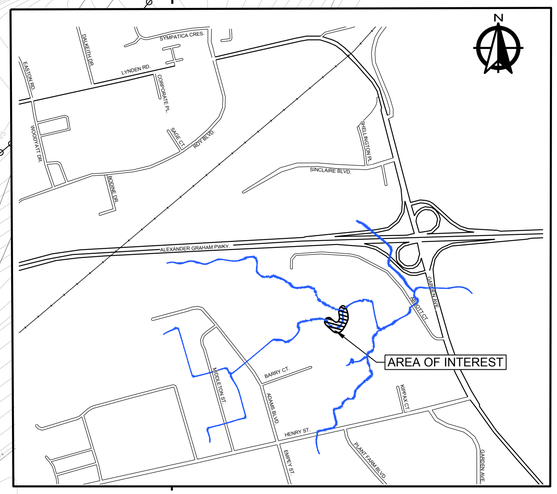
TYPICAL CASCADE STEP POOL CONFIGURATION

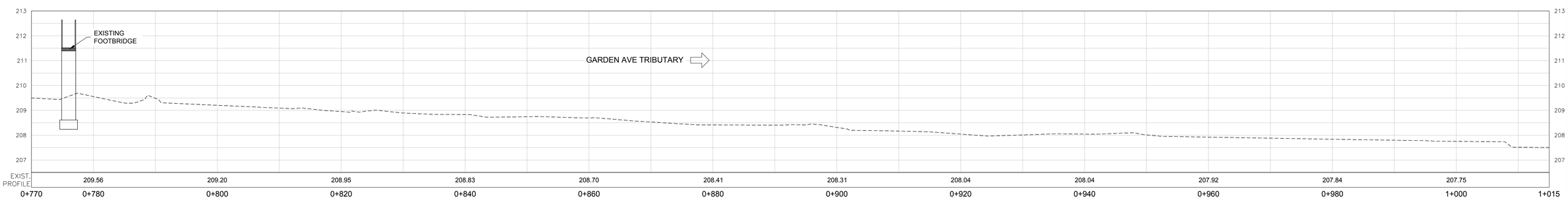


PROFILE 345.31
PROFILE 344.53
0+070

DRAWING NOT TO SCALE

47 BURY COURT





NO.	DATE	DESCRIPTION	APP'D.	NO.	DATE	DESCRIPTION	APP'D.

REVISIONS

LEGEND

EXISTING

- GRCA REGULATORY FLOOD LIMIT
- EXISTING CONTOURS
- EXISTING FENCE LINE
- PROPERTY LIMIT
- HYDRO EASEMENT
- OVERHEAD HYDRO LINES
- EDGE OF PAVEMENT

SITE BENCHMARK:
MH10A AND MH11A AS DEFINED ON THE ADAMS BOULEVARD PLAN AND PROFILE DRAWING (AS CONSTRUCTED, PHILLIPS 1990). BENCHMARKS WERE SURVEYED WITH A TRIMBLE GPS AND ELEVATIONS WERE RECORDED AS:
MH10A T/G: 216.34
MH11A T/G: 215.70

STAMP

STAMP

ecosystem recovery Inc. PROFESSIONAL ENGINEERS

BRANEIDA SWMF RETROFIT AND DOWNSTREAM CHANNEL REHABILITATION

GARDEN AVE TRIBUTARY PROPOSED PLAN AND PROFILE

DATE: 2020/05/20	CHK/APP: CM	DRAWING NUMBER
SCALE: H1:300 V1:75	DSN: JC	C202
PRO. No: 1839	DRN: KV	

Appendix G

Geotechnical Background

Geotechnical Investigation - Proposed Reconstruction of Braneida Park SWMF

Braneida Park
Brantford, Ontario

REVISED

Prepared for:

Ecosystem Recovery Inc. (ERI)
80 Courtland Avenue East, Unit 2
Kitchener, Ontario N2G 2T8

Attn: Chris Moon

July 24, 2019

Pinchin File: 228873

MEMBER OF
THE PINCHIN GROUP

Issued to:	**Ecosystem Recovery Inc. (ERI)**
Contact:	**Chris Moon**
Issued on:	**July 24, 2019**
Pinchin file:	**228873**
Issuing Office:	**283 Northfield Drive E, Unit 9, Waterloo, ON N2J 4G8**
Primary Contact:	**Kyle Rundle Drake, P.Eng.**

Author:
Kyle Rundle Drake, P.Eng.
Project Manager, Geotechnical Services
1-226-898-4682
krundledrake@pinchin.com

Reviewer:
Vanessa Marshall, M.Eng., P. Eng.
National Practice Leader, Geotechnical Services
1-519-746-4210 Ext. 3756
vmarshall@pinchin.com

TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION

Pinchin Ltd. (Pinchin) was retained by Ecosystem Recovery Inc. (ERI) (Client) to conduct a Geotechnical Investigation and provide subsequent geotechnical design recommendations for the proposed reconstruction of the Braneida Park Stormwater Management Facility (SWMF) to be located northeast of Adams Boulevard in Braneida Park in Brantford, Ontario (Site). The Site location is shown on Figure 1.

Based on information provided by the Client, it is Pinchin's understanding that the existing Braneida Park SWMF is to be reconstructed.

Pinchin's geotechnical comments and recommendations are based on the results of the Geotechnical Investigation and our understanding of the project scope.

The purpose of the Geotechnical Investigation was to delineate the subsurface conditions and soil engineering characteristics by advancing a total of four (4) sampled boreholes (Boreholes BH1 to BH4) and four (4) test pits (Test Pits TP1 to TP4) within the Site limits. The approximate location of the boreholes was directed by ERI. The information gathered from the Geotechnical Investigation will allow Pinchin to provide geotechnical design recommendations for the proposed SWMF redevelopment.

Based on a desk top review and the results of the Geotechnical Investigation, the following geotechnical data and engineering design recommendations are provided herein:

- A review of relevant area geology and Site background information;
- A detailed description of the soil and groundwater conditions;
- Site service trench design;
- Open cut excavations;
- Anticipated groundwater management; and,
- Stormwater Management Facility Design.

Abbreviations terminology and principle symbols commonly used throughout the report, borehole logs and appendices are enclosed in Appendix I.

2.0 SITE DESCRIPTION AND GEOLOGICAL SETTING

The Site is located in Braneida Park, northeast of Adams Boulevard, approximately 250 m northwest of Bury Court, in Brantford, Ontario. The Site is bordered by commercial/industrial properties to the north, west, and south, and a hydro easement to the east. The Site is currently comprised of the existing SWMF, and includes creeks, grassed areas, shrubs and trees. The topography of the Site is generally higher towards the perimeter, sloping down towards the centre of the Site. Elevations at the borehole locations vary from 212.4 to 216.4 metres above sea level (masl) with a total elevation change of up to approximately 4.0 m.

Data obtained from the Ontario Geological Survey Maps, as published by the Ontario Ministry of Energy, Northern Development and Mines, indicates that the Site is located primarily on fine-textured glaciolacustrine deposits of silt and clay, minor sand and gravel (Ontario Geological Survey 2010, Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV). The underlying bedrock at this Site is of the Salina formation consisting of dolostone, shale, and evaporites (Armstrong, D.K. and Dodge, J.E.P. 2007, Paleozoic geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 219).

3.0 GEOTECHNICAL FIELD INVESTIGATION AND METHODOLOGY

Pinchin completed a field investigation at the Site on January 28, February 1, and June 27, 2019 by advancing a total of four (4) sampled boreholes and four (4) test pits throughout the Site. The boreholes were advanced to depths ranging from approximately 5.0 to 6.6 mbgs and the test pits were each advanced to a depth of 3.0 mbgs. The approximate spatial locations of the boreholes and test pits advanced at the Site are shown on Figure 2.

The boreholes were advanced with the use of a track-mounted mobile drill rig which was equipped with conventional geotechnical soil sampling equipment. Soil samples were collected at 0.76 and 1.52 m intervals using a 51 mm outside diameter (OD) split spoon barrel in conjunction with Standard Penetration Tests (SPT) ‘N’ values (ASTM D1586). The SPT ‘N’ values were used to assess the compactness condition of the non-cohesive soil. Shear strengths of the cohesive deposits were measured using a hand held pocket penetrometer. The SPT ‘N’ values and measured shear strengths are plotted on the appended borehole logs.

The test pits were advanced with the use of an 8-tonne track-mounted excavator.

Monitoring wells were installed in Boreholes BH2 and BH4 to allow measurement of groundwater levels. The monitoring wells were constructed using flush-threaded 50 mm diameter Trilock pipe with 3.0 meter long 10-slot well screens, delivered to the Site in pre-cleaned individually sealed plastic bags. The screen and riser pipes were not allowed to come into contact with the ground or drilling equipment prior to installation.

A completed well record was submitted to the property owner and the Ontario Ministry of the Environment, Conservation and Parks (MECP) as per Ontario Regulation 903, as amended. A licensed well technician must properly decommission the monitoring wells prior to construction according to Regulation 903 of the Ontario Water Resources Act.

Groundwater observations and measurements were obtained from the open boreholes during and upon completion of drilling. The groundwater observations and measurements recorded are included on the appended borehole logs. Groundwater observations and measurements were obtained from the open test pits during and upon completion of excavation. The groundwater observations and measurements recorded are provided in Section 4.2.

The boreholes locations and ground surface elevations were surveyed by Pinchin using a Sokkia Model GCX2 Global Navigation Satellite System (GNSS) rover. The ground surface elevations are geodetic, based on GNSS and local base station telemetry with a precision static of less than 20 mm. The test pit locations were located relative to existing site features by Pinchin personnel, and the ground surface elevations at the test pits were not measured.

The field investigation was monitored by experienced Pinchin personnel. Pinchin logged the drilling operations and identified the soil samples as they were retrieved. The recovered soil samples were sealed into plastic bags and carefully transported to an independent and accredited materials testing laboratory for detailed analysis and testing. All soil samples were classified according to visual and index properties by the project engineer.

The field logging of the soil and groundwater conditions was performed to collect geotechnical engineering design information. The borehole logs include textural descriptions of the subsoil in accordance with a modified Unified Soil Classification System (USCS) and indicate the soil boundaries inferred from non-continuous sampling and observations made during the borehole advancement. These boundaries reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The modified USCS classification is explained in further detail in Appendix I. Details of the soil and groundwater conditions encountered within the boreholes are included on the Borehole Logs within Appendix II.

Select soil samples collected from the boreholes were submitted to a material testing laboratory to determine the grain size distribution and moisture content of the soil, and the results are presented in Appendix III. In addition, the collected samples were compared against previous geotechnical information from the area, for calibration of results.

4.0 SUBSURFACE CONDITIONS

4.1 Borehole Soil Stratigraphy

In general, the soil stratigraphy at the Site predominantly consists of topsoil overlying silt deposits to the maximum borehole depth of approximately 6.6 mbgs.

Surficial topsoil material was encountered in all the boreholes and is approximately 0.5 to 0.8 metres thick. The topsoil varies in composition from silt with trace sand to sandy silt. Organics such as rootlets were encountered in the topsoil at each borehole location. The topsoil material was generally frozen at the time of sampling.

The silt deposit was encountered below the topsoil in all of the boreholes and extends below the maximum borehole termination depth of 6.6 mbgs. The silt deposit generally consists of clayey silt with trace to some sand. Dilatant seams, as well as saturated sandy silt seams were encountered throughout the silt deposit. The cohesive silt deposits have a soft to hard consistency based on approximate shear strengths of 25 to greater than 225 kPa. The silt deposit was generally About the Plastic Limit (APL) to Wetter than the Plastic Limit (WTPL) at the time of sampling.

The results of three particle size distribution analyses performed on samples of the silt are provided in Appendix III and indicated the samples contain 0% gravel, 1% sand, 66 to 77% silt, and 22 to 33% clay.

4.2 Test Pits

The test pit soil stratigraphy was generally consistent with the soil stratigraphy observed in the boreholes, consisting of variable thicknesses of topsoil, underlain by native silt to the maximum test pit termination depth of 3.0 mbgs. In general, minimal water was encountered in the test pits, and it consisted of surface water infiltration and water from seams in the clayey silt material. The following table summarizes the observations and measurements at each test pit location:

Test Pit No.	Topsoil Thickness (mm)	Notes
TP1	500	-No groundwater observed during and upon completion of test pit excavation. -Test pit caved to 2.1 mbgs approximately 140 minutes after completion of excavation and no groundwater was observed at this time.
TP2	700	-No groundwater observed during and upon completion of test pit excavation. -Surface water infiltration was observed approximately 75 minutes after completion of excavation, with 200 mm of water measured at the base of the excavation. The west side wall was beginning to cave at this time. -The test pit caved to 1.9 mbgs approximately 85 minutes after completion of excavation. -50 to 100 mm of water was measured at the base of the excavation approximately 130 minutes after completion of excavation.
TP3	400	-The ground surface between TP2 and TP3 was saturated and soft. -No groundwater observed during and upon completion of test pit excavation. -No groundwater infiltration observed approximately 60 mins after completion of excavation. -Surface water infiltration was observed approximately 120 minutes after completion of excavation, with 50 to 100 mm of water measured at the base of the excavation. The side walls were beginning to cave at this time.
TP4	400	-No groundwater observed during and upon completion of test pit excavation. -Infiltration of water from wet seams at approximately 1.8 mbgs to 3.0 mbgs was observed approximately 55 minutes after completion of excavation, with 50 to 100 mm of water measured at the base of the excavation. -No additional water measured at the base of the excavation approximately 115 minutes after completion of excavation.

4.3 Groundwater Conditions

Groundwater observations and measurements were obtained in the open boreholes at the completion of drilling and are summarized on the appended borehole logs. In addition, groundwater levels were measured in the monitoring wells installed in Boreholes BH2 and BH4 on June 27, 2019. The measured groundwater levels are summarized below:

Borehole No.	Date	Water Level	Water Elevation (masl)
BH2	May 10, 2019	1.04 m above grade	213.99
BH4	May 10, 2019	0.95 m above grade	213.31

Based on the measured water levels in the monitoring wells and at the time of drilling completion the groundwater is perched above the relatively impermeable silt deposits encountered at the Site and in the saturated seams within the silt deposits.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions.

5.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

5.1 General Information

The recommendations presented in the following sections of this report are based on the information available regarding the proposed development, the results obtained from the geotechnical investigation, and Pinchin's experience with similar projects. Since the investigation only represents a portion of the subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different than those encountered during the investigation. If these situations are encountered, adjustments to the design may be necessary. A qualified geotechnical engineer should be on-Site during the subgrade preparation to ensure the subsurface conditions are the same/similar to what was observed during the investigation.

Based on information provided by the Client, it is Pinchin's understanding that the existing Braneida Park Stormwater Management Facility (SWMF) is to be reconstructed. It is not known whether a headwall (or similar) outlet structure is proposed for the SWMF. If such a structure is required, Pinchin should be contacted to review our recommendations. Additional geotechnical fieldwork may be required depending on the design and location of the structure.

5.2 Open Cut Excavations and Anticipated Groundwater Management

It is anticipated that the invert elevations for any new storm pipes will be at conventional depths of approximately 2 to 4 metres below finished grade.

Based on the subsurface information obtained from within the boreholes, it is anticipated that the excavated material will predominately consist of silt. Groundwater measurements in the monitoring wells ranged from 0.95 to 1.04 above ground surface, and the dilatant seams and grey colour of the soil between Elevation 210.0 to 212.0 masl would generally indicate permanent saturated conditions.

Where workers must enter trench excavations deeper than 1.2 m, the trench excavations should be suitably sloped and/or braced in accordance with the Occupational Health and Safety Act (OHSA), Ontario Regulation 213/91, Construction Projects, July 1, 2011, Part III - Excavations, Section 226. Alternatively, the excavation walls may be supported by either closed shoring, bracing, or trench boxes complying with sections 235 to 239 and 241 under O. Reg. 231/91, s. 234(1).

Based on the OHSA, the soils encountered at the site would be classified as Type 3 soils and all excavations through these soils must be cut back at 1 horizontal to 1 vertical from the base of the excavation. Excavations extending below the groundwater table would have to be sloped back at 3 horizontal to 1 vertical from the base of the excavation.

Alternatively, the excavation walls may be supported by either closed shoring, bracing, or trench boxes complying with sections 235 to 239 and 241 under O. Reg. 231/91, s. 234(1). The use of trench boxes can most likely be used for temporary support of vertical side walls. The appropriate trench should designed/confirmed for use in this soil deposit.

In addition to compliance with the OHSA, the excavation procedures must also be in compliance to any potential other regulatory authorities, such as federal and municipal safety standards.

Minor to moderate groundwater inflow through the silt is expected where the excavations extend less than 0.6 m below the groundwater table. It is believed that this groundwater inflow can be controlled using a gravity dewatering system with perimeter interceptor ditches and high capacity pumps. It is not expected that the dewatering volumes will trigger an EASR or PTTW by exceeding 50,000 L/day or 400,000 L/day, respectively.

Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions. If construction commences during wet periods (typically spring or fall), there is a greater potential that the groundwater elevation could be higher and/or perched groundwater may be present. Any potential precipitation of perched groundwater should be able to be controlled from pumping from filtered sumps, and should be pumped away immediately (not allowed to pond).

Prior to commencing excavations, it is critical that all existing surface water and potential surface water is controlled and diverted away from the Site to prevent infiltration and subgrade softening. At no time should excavations be left open for a period of time that will expose them to precipitation and cause subgrade softening.

All collected water is to discharge a sufficient distance away from the excavation to prevent re-entry. Sediment control measures, such as a silt fence should be installed at the discharge point of the dewatering system. The utmost care should be taken to avoid any potential impacts on the environment.

5.3 Site Servicing

5.3.1 Pipe Bedding and Cover Materials for Flexible and Rigid Pipes

The subgrade soil conditions beneath the storm pipes will comprise natural silt soils. Soft clay deposits were encountered in several of the boreholes at depths of 2.3 mbgs. It is critical that the pipe subgrade is inspected by a geotechnical engineer prior to placement of pipe bedding material to ensure adequate support is available for the services. If the soft or weak areas are encountered below the pipe, the soft material could be subexcavated and replaced with well compacted granular material, or the pipes could be constructed in structurally supported pipe conduits. Once the final plans are complete, Pinchin should review the above recommendation.

Service pipes require an adequate base to ensure proper pipe connection and positive flow is maintained post construction. As such, pipe bedding should be placed to be of uniform thickness and compactness. The pipe bedding and cover material should conform to OPSD 802.010 and 802.013 specifications for flexible pipes and to OPSD 802.031 to 802.033 with Class “B” bedding for rigid pipes. The pipe bedding material should consist of a minimum thickness of 150 mm Granular “A” (OPSS 1010) below the pipe and extend up the sides to the spring line. However, the bedding thickness may have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered. The pipe cover material from the spring line should consist of a Granular “B” Type I (OPSS 1010) and should extend to a minimum of 300 mm above the top of the pipe. All granular fill material is to be placed in maximum 200 mm thick loose lifts compacted to a minimum of 98% SPMDD.

The bedding material, pipe and cover material should be installed as soon as practically possible after the excavation subgrade is exposed. The longer the excavated subgrade soil remains open to weather conditions and groundwater seepage, the greater the chance for construction problems to occur. Where it is difficult to stabilize the subgrade due to groundwater or the material is higher than the optimum moisture content, a Granular “B” Type II material may be required. Alternatively, if constant groundwater infiltration becomes an issue, than an approximate 150 mm granular pad consisting of 19 mm clear stone gravel (OPSS 1004) wrapped in a non-woven geotextile should be considered to maintain the integrity of the natural subgrade soil. The clear stone should contain a minimum of 50% crushed particles. Water collected within the stone should be controlled through sumps and filtered pumps.

5.3.2 Trench Backfill

Following placement of the pipe bedding cover the trench shall be backfilled. Based on the results of the natural overburden deposits, the on-Site silt excavated from above the groundwater table will be suitable for use as trench backfill. The native silt soils will have a blocky/lumpy texture, and a sheepsfoot roller is recommended in order to achieve proper compaction and ensure that all air voids are removed to avoid long term softening and settlement. The soil should be compacted in maximum 200 mm thick lifts to 98% SPMDD within 4% of the optimum moisture content. The natural material must be free of organics or other deleterious material.

All stockpiled material should be protected from deleterious materials, additional moisture and be kept from freezing.

Quality control will be the utmost importance when selecting the material. The selection of the material should be done as early in the contract as possible to allow sufficient time for gradation and proctor testing on representative samples to ensure it meets the projects specifications.

Where the natural soil will be exposed, adequate compaction may prove difficult if the material becomes wet (i.e., above the optimum moisture content). Depending on the moisture content of the natural materials at the time of construction, they may either require moisture to be added or stockpiled and left to dry to achieve moisture content within plus 2% to minus 4% of optimum. This will be the case for soil excavated below the groundwater table. The natural soil at this site is subject to moisture content increase during wet weather. As such, stockpiles should be protected to help minimize moisture absorption during wet weather.

Depending on weather conditions at the time of construction, an imported material may be required regardless to achieve adequate compaction. If the imported material is not the same/similar to the soil observed on the side walls of the excavation then a horizontal transition between the materials should be sloped as per frost heave taper OPSD 205.60. Any natural material is to be placed in maximum 200 mm thick lifts compacted to 95% SPMDD within plus 2% to minus 4% optimum moisture content. Imported material should consist of a Granular “A”, Granular “B” Type I, or Select Subgrade Material (OPSS 1010). Heavy construction equipment and truck traffic should not cross any pipe until at least 1 m of compacted soil is placed above the top of the pipe.

Post compaction settlement of finer grained soil can be expected, even when placed to compaction specifications. As such, fill materials should be installed as far in advance as possible before finishing the roadway in order to mitigate post compaction settlements.

5.3.3 Frost Protection

The frost penetration depth in Brantford, Ontario for these types of soil conditions is estimated to extend to approximately 1.2 mbgs in open roadways cleared of snow. As such, it is recommended to place storm sewers at a minimum depth of 300 mm below this elevation with the top of the pipe located at 1.5 mbgs, as dictated by City of Brantford requirements. If a minimum of 1.5 m of soil cover cannot be provided, then the pipe should be insulated with a rigid polystyrene insulation or a pre-insulated pipe should be utilized. The pipe insulation must meet the requirements of Table 2 in Section 10.3 of *Design and Construction Manual – Linear Municipal Infrastructure – Storm Sewers, City of Brantford, dated October 2017.*

The insulation design configuration may either consist of placing horizontal insulation to a specified design distance beyond the outside edge of the pipe or an inverted “U” surrounding the top and sides of the pipe. Any method chosen requires suitable design and installation in accordance with the manufactures recommendations. To accommodate the placement of horizontal insulation a wider excavation trench may be required.

5.4 Stormwater Management Facility Design

5.4.1 Hydraulic Conductivity and Infiltration Rates

Due to the relatively impermeable nature of the natural silt soils, it is assumed that the SWMF will be designed as a retention pond. Three particle size distribution analyses have been completed on the natural silt soils from the Site. The results of the particle size distribution analyses were used to empirically determine the hydraulic conductivity values of the soils. Several formulas were reviewed when calculating the hydraulic conductivity based on select formula criteria and limitations for the particle size distribution analyses results. The calculated hydraulic conductivity values are summarized in the following table.

The estimated design infiltration rate is based on recommendations found in the ‘’Low Impact Development Stormwater Management Planning and Design Guide, Appendix C’’, published by the Toronto and Region (TRCA) and the Credit Valley (CVC) Conservation Authority, and the approximate relationship between hydraulic conductivity and infiltration rate.

It should be noted that hydraulic conductivity and infiltration rate are two different concepts, and that conversion from one parameter to another cannot be done through unit conversion. A factor of safety was applied to the approximate infiltration rate to account for soil variability, gradual accumulation of fine soil sediments during the lifespan of the facility, and compaction during construction.

Sample Number	Sample Depth (mbgs)	Soil Type	K Value (m/sec)	Factored Infiltration Rate (mm/hr)
BH2 SS3	3.0 – 3.5	Silt	2.89×10^{-12}	0.3
BH3 SS3	1.5 – 2.0	Silt	9.38×10^{-12}	0.4
BH4 SS6	4.6 – 5.0	Silt	2.34×10^{-12}	0.3

5.4.2 Liner Recommendations

Based on information from the Client, it is anticipated that the pond bottom of the SWMF will be at Elevation 210.0 masl, approximately 2.5 mbgs. The existing subsurface soils at the Site comprise topsoil overlying deposits of silt. Based on the saturated condition of the subsoils and saturated seams encountered throughout the Site, an impermeable clay liner should be installed as part of the SWMF design. There are two options for clay liners, either a Compacted Clay Liner (CCL) or Geosynthetic Clay Liner (GCL). A CCL typically involves compaction a blend of native clay soils and bentonite, and a GCL is typically comprised of a layer of bentonite between layers of geotextiles.

Due to the native subsoils fine texture and the high groundwater levels at the Site, it is recommended that the GCL be used for the pond base. The GCL should be installed as per the manufacturer's recommendations.

It is understood that the Client preferred liner is a CCL for this Site. If this approach is used, it is likely that the soft native soils at Elevation 210.0 and below will become heavily disturbed as a result of using vibration and heavy equipment for the installation of a CCL. The equipment may also cause "pumping" of the groundwater, bringing it to the surface. If this approach is used, the clay liner should consist of a 1 m thick clay-based material meeting the following requirements (in accordance with the Government of Manitoba document *Technical Reference Document for Liquid Manure Storage Structures, Compacted Clay Liners,* dated Winter 2007, a best practice guideline):

- Hydraulic conductivity of 1×10^{-9} or less;
- Acceptable particle size ranges by weight: Percent fines ≥ 50%; Clay content ≥ 20%; Sand content ≥ 45% (where fines are defined as the soil fraction passing a No. 200 (75 µm) sieve, and clay and sand are defined by ASTM D2487-00;
- Acceptable Atterberg Limits: Plasticity Index ≥ 20%; Liquid Limit ≥ 30%; and

- Poorly graded materials with high silt content may not be considered acceptable. These materials do not compact well and are highly erodible. The materials encountered at the Site are thus not acceptable for use in a clay liner.

The CCL should be compacted using a sheepsfoot roller to a minimum of 95% SPMDD.

5.4.3 Damage Prevention

Regardless of which pond liner is selected (GCL or CCL), a 300 mm thick layer of rip-rap should be installed above the finished liner grade, to prevent damage to the liner from machinery during maintenance activities.

5.4.4 Embankment Recommendations

For the SMWF embankments, the finished earth slopes should be sloped back at 3.0 horizontal to 1.0 vertical or flatter above the stabilized water level and 5.0 horizontal to 1.0 vertical below. Additionally, to reduce surface seepage pressures along the slope faces of the pond (which could cause instability of the side slopes), it is recommended to install subdrains around the perimeter of the pond. The subdrains should consist of a minimum 150 mm diameter fabric wrapped perforated drainage tile surrounded by 19 mm diameter clear stone (OPSS 1004) with a minimum cover of 150 mm on all sides. Since the natural soil contains a significant amount of silt sized particles, the clear stone gravel should be wrapped in a non-woven geotextile.

6.0 SITE SUPERVISION AND QUALITY CONTROL

It is recommended that all geotechnical aspects of the project be reviewed and confirmed under the appropriate geotechnical supervision, to routinely check such items. This includes but is not limited to inspection and confirmation of the undisturbed natural subgrade material prior to subgrade preparation, backfilling, or engineered fill installation to ensure that the actual conditions are not markedly different than what was observed at the borehole locations and geotechnical components are constructed as per Pinchin's recommendations. Compaction quality control of engineered fill material (full-time monitoring) is recommended as standard practice, as well as regular sampling and testing of aggregates and concrete, to ensure that physical characteristics of materials for compliance during installation and satisfies all specifications presented within this report.

7.0 DISCLAIMER

This Geotechnical Investigation was performed for the exclusive use of Ecosystem Recovery Inc. (Client) in order to evaluate the subsurface conditions at Braneida Park in Brantford, Ontario.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practises in the field of geotechnical engineering for the Site. Classification and identification of soil, and geologic units have been based upon commonly accepted methods employed in professional geotechnical practice. No warranty or other conditions, expressed or implied, should be understood. Conclusions derived are specific to the immediate area of study and cannot be extrapolated extensively away from sample locations.

Performance of this Geotechnical Investigation to the standards established by Pinchin is intended to reduce, but not eliminate, uncertainty regarding the subgrade soil at the Site, and recognizes reasonable limits on time and cost.

Regardless how exhaustive a Geotechnical Investigation is performed, the investigation cannot identify all the subsurface conditions. Therefore, no warranty is expressed or implied that the entire Site is representative of the subsurface information obtained at the specific locations of our investigation. If during construction, subsurface conditions differ from then what was encountered within our test location and the additional subsurface information provided to us, Pinchin should be contacted to review our recommendations.

This report does not alleviate the contractor, owner, or any other parties of their respective responsibilities.

This report has been prepared for the exclusive use of the Client and their authorized agents. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

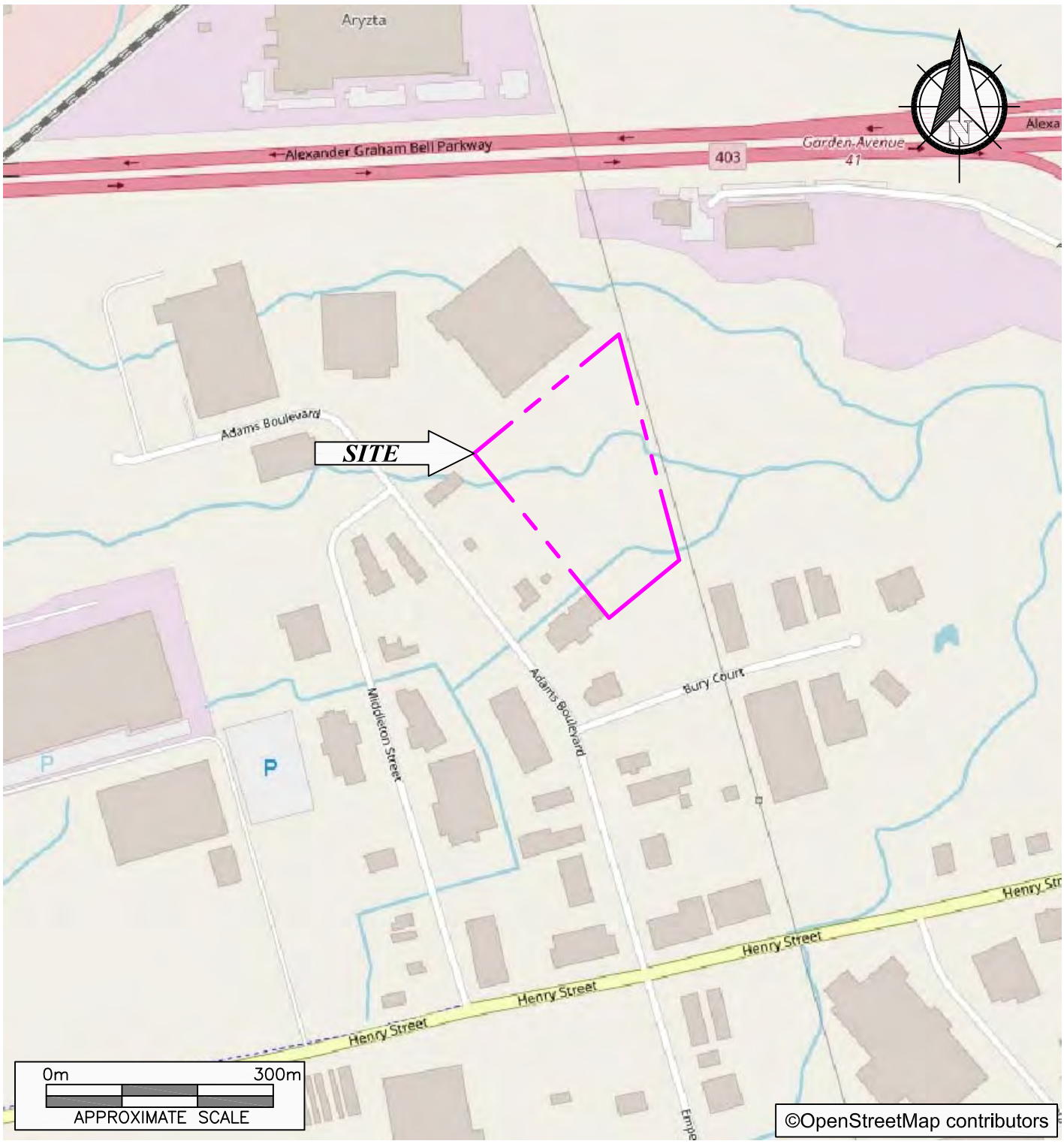
The liability of Pinchin or our officers, directors, shareholders or staff will be limited to the lesser of the fees paid or actual damages incurred by the Client. Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered (Claim Period), to commence legal proceedings against Pinchin to recover such losses or damage unless the laws of the jurisdiction which governs the Claim Period which is applicable to such claim provides that the applicable Claim Period is greater than two years and cannot be abridged by the contract between the Client and Pinchin, in which case the Claim Period shall be deemed to be extended by the shortest additional period which results in this provision being legally enforceable.

Pinchin makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and these interpretations may change over time. Please refer to Appendix IV, Report Limitations and Guidelines for Use, which pertains to this report.

J:\228000s\0228873.000 EcoSystemsCityofBrandfordGEOSWMF\Deliverables\Final Rev2\228873 REVISED Geotechnical Investigation Braneida SWMF, Brantford ON EcoSys Jul 24 2019.docx

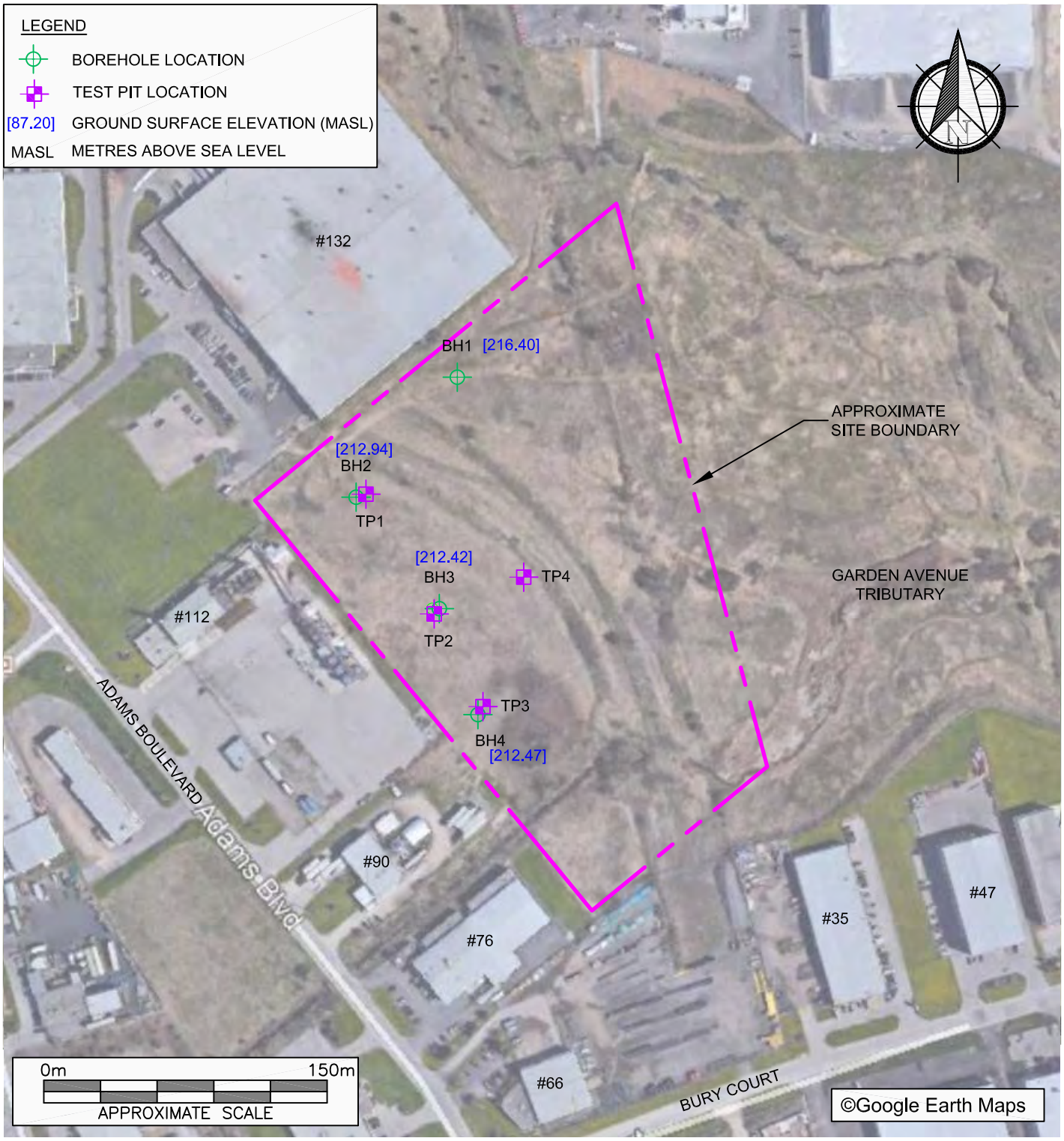
Template: Master Report for Phase I ESA - Ontario, EDR, November 1, 2018

FIGURES



PINCHIN

PROJECT NAME: GEOTECHNICAL INVESTIGATION		
CLIENT NAME: ECOSYSTEM RECOVERY INC.		
PROJECT LOCATION: BRANEIDA PARK, BRANTFORD, ONTARIO		
FIGURE NAME: KEY MAP		FIGURE NO.: 1
APPROXIMATE SCALE: AS SHOWN	PROJECT NO.: 228873	DATE: JULY 2019



PINCHIN

PROJECT NAME: GEOTECHNICAL INVESTIGATION			
CLIENT NAME: ECOSYSTEM RECOVERY INC.			
PROJECT LOCATION: BRANEIDA PARK, BRANTFORD, ONTARIO			
FIGURE NAME: BOREHOLE LOCATION PLAN			FIGURE NO.: 2
APPROXIMATE SCALE: AS SHOWN	PROJECT NO.: 228873	DATE: JULY 2019	

APPENDIX I

Abbreviations, Terminology and Principle Symbols used in Report and Borehole Logs

ABBREVIATIONS, TERMINOLOGY & PRINCIPAL SYMBOLS USED

Sampling Method

AS	Auger Sample	**w**	Washed Sample
SS	Split Spoon Sample	**HQ**	Rock Core (63.5 mm diam.)
ST	Thin Walled Shelby Tube	**NQ**	Rock Core (47.5 mm diam.)
BS	Block Sample	**BQ**	Rock Core (36.5 mm diam.)

In-Situ Soil Testing

Standard Penetration Test (SPT), "N" value is the number of blows required to drive a 51 mm outside diameter spilt barrel sampler into the soil a distance of 300 mm with a 63.5 kg weight free falling a distance of 760 mm after an initial penetration of 150 mm has been achieved. The SPT, "N" value is a qualitative term used to interpret the compactness condition of cohesionless soils and is used only as a very approximation to estimate the consistency and undrained shear strength of cohesive soils.

Dynamic Cone Penetration Test (DCPT) is the number of blows required to drive a cone with a 60 degree apex attached to "A" size drill rods continuously into the soil for each 300 mm penetration with a 63.5 kg weight free falling a distance of 760 mm.

Cone Penetration Test (CPT) is an electronic cone point with a 10 cm2 base area with a 60 degree apex pushed through the soil at a penetration rate of 2 cm/s.

Field Vane Test (FVT) consists of a vane blade, a set of rods and torque measuring apparatus used to determine the undrained shear strength of cohesive soils.

Soil Descriptions

The soil descriptions and classifications are based on an expanded Unified Soil Classification System (USCS). The USCS classifies soils on the basis of engineering properties. The system divides soils into three major categories; coarse grained, fine grained and highly organic soils. The soil is then subdivided based on either gradation or plasticity characteristics. The classification excludes particles larger than 75 mm. To aid in quantifying material amounts by weight within the respective grain size fractions the following terms have been included to expand the USCS:

Soil Classification		Terminology	Proportion
Clay	< 0.002 mm		
Silt	0.002 to 0.06 mm	“trace”, trace sand, etc.	1 to 10%
Sand	0.075 to 4.75 mm	“some”, some sand, etc.	10 to 20%
Gravel	4.75 to 75 mm	Adjective, sandy, gravelly, etc.	20 to 35%
Cobbles	75 to 200 mm	And, and gravel, and silt, etc.	>35%
Boulders	>200 mm	Noun, Sand, Gravel, Silt, etc.	>35% and main fraction

Notes:

- Soil properties, such as strength, gradation, plasticity, structure, etcetera, dictate the soils engineering behaviour over grain size fractions; and
- With the exception of soil samples tested for grain size distribution or plasticity, all soil samples have been classified based on visual and tactile observations. The accuracy of visual and tactile observation is not sufficient to differentiate between changes in soil classification or precise grain size and is therefore an approximate description.

The following table outlines the qualitative terms used to describe the compactness condition of cohesionless soil:

Cohesionless Soil	
Compactness Condition	**SPT N-Index (blows per 300 mm)**
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

The following table outlines the qualitative terms used to describe the consistency of cohesive soils related to undrained shear strength and SPT, N-Index:

Cohesive Soil		
Consistency	**Undrained Shear Strength (kPa)**	**SPT N-Index (blows per 300 mm)**
Very Soft	<12	<2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

Note: Utilizing the SPT, N-Index value to correlate the consistency and undrained shear strength of cohesive soils is only very approximate and needs to be used with caution.

Soil & Rock Physical Properties

General

W Natural water content or moisture content within soil sample
γ Unit weight
γ' Effective unit weight
γ_d Dry unit weight
γ_{sat} Saturated unit weight
ρ Density
ρ_s Density of solid particles
ρ_w Density of Water
ρ_d Dry density
ρ_{sat} Saturated density e Void ratio
n Porosity
S_r Degree of saturation
E_{50} Strain at 50% maximum stress (cohesive soil)

Consistency

W_L	Liquid limit
W_P	Plastic Limit
I_P	Plasticity Index
W_S	Shrinkage Limit
I_L	Liquidity Index
I_C	Consistency Index
e_{max}	Void ratio in loosest state
e_{min}	Void ratio in densest state
I_D	Density Index (formerly relative density)

Shear Strength

C_u, S_u	Undrained shear strength parameter (total stress)
C'_d	Drained shear strength parameter (effective stress)
r	Remolded shear strength
τ_p	Peak residual shear strength
τ_r	Residual shear strength
ø’	Angle of interface friction, coefficient of friction = tan ø’

Consolidation (One Dimensional)

C_C	Compression index (normally consolidated range)
C_r	Recompression index (over consolidated range)
C_S	Swelling index
m_V	Coefficient of volume change
c_V	Coefficient of consolidation
T_V	Time factor (vertical direction)
U	Degree of consolidation
σ'_O	Overburden pressure
σ'_p	Preconsolidation pressure (most probable)
OCR	Overconsolidation ratio

Permeability

The following table outlines the terms used to describe the degree of permeability of soil and common soil types associated with the permeability rates:

Permeability (k cm/s)	Degree of Permeability	Common Associated Soil Type
$> 10^{-1}$	Very High	Clean gravel
10^{-1} to 10^{-3}	High	Clean sand, Clean sand and gravel
10^{-3} to 10^{-5}	Medium	Fine sand to silty sand
10^{-5} to 10^{-7}	Low	Silt and clayey silt (low plasticity)
$>10^{-7}$	Practically Impermeable	Silty clay (medium to high plasticity)

Rock Coring

Rock Quality Designation (RQD) is an indirect measure of the number of fractures within a rock mass, Deere et al. (1967). It is the sum of sound pieces of rock core equal to or greater than 100 mm recovered from the core run, divided by the total length of the core run, expressed as a percentage. If the core section is broken due to mechanical or handling, the pieces are fitted together and if 100 mm or greater included in the total sum.

RQD is calculated as follows:

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of core pieces} > 100 \text{ mm} \times 100}{\text{Total length of core run}}$$

The following is the Classification of Rock with Respect to RQD Value:

RQD Classification	RQD Value (%)
Very poor quality	**<25**
Poor quality	25 to 50
Fair quality	50 to 75
Good quality	75 to 90
Excellent quality	90 to 100

APPENDIX II

Pinchin's Borehole Logs

Log of Borehole: BH1

Project #: 228873 **Logged By:** MA

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Braneida Park, Brantford

Drill Date: January 28, 2019 **Project Manager:** KRD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20, 40, 60)	Shear Strength kPa (100, 200)	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0		Ground Surface	216.40	No Monitoring Well Installed										
		Topsoil Brown sandy silt, trace rootlets, very loose, frozen	215.87		SS	1	100	3			30.7			
1		***Silt*** Light brown clayey silt, trace sand, very stiff, APL Grey mottling			SS	2	100	11			20.7			
2			214.11		SS	3	100	11			28.2			
		Grey/brown			SS	4	100	10			21.5			
3					SS	5	100	14			27.8			
4			211.83											
		Stiff			SS	6	100	6			29.6			
5		End of Borehole Borehole terminated at approximately 5.0 mbgs. At drilling completion, a dry cave was measured at approximately 4.3 mbgs.												
6														
7														
8														
9														

Contractor: Direct Environmental Drilling Inc. **Grade Elevation:** 216.40 masl

Drilling Method: Hollow Stem Auger **Top of Casing Elevation:** NA

Well Casing Size: NA **Sheet:** 1 of 1

Log of Borehole: BH2

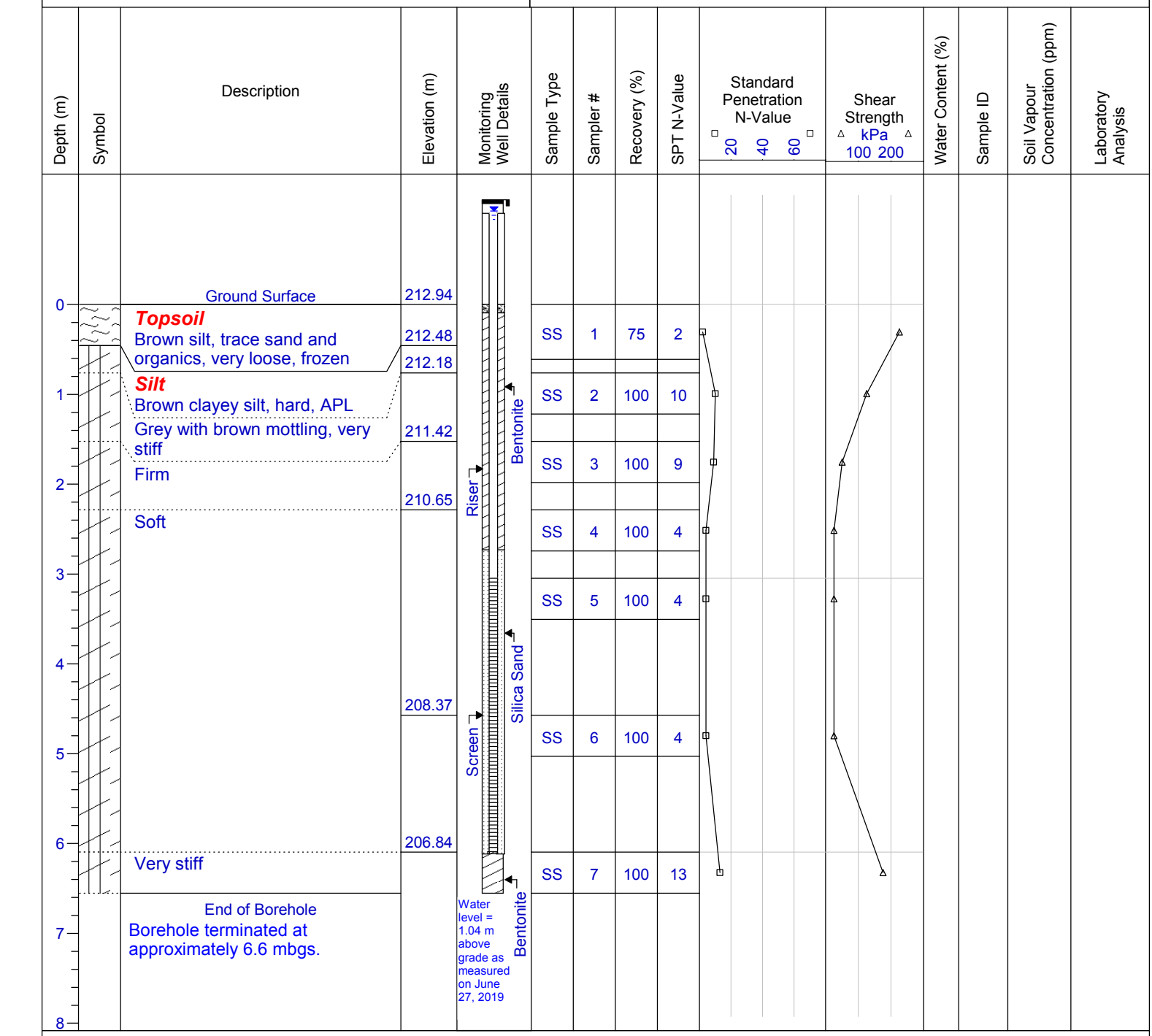
Project #: 228873 **Logged By:** MA

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Braneida Park, Brantford

Drill Date: February 1, 2019 **Project Manager:** KRD



Contractor: Direct Environmental Drilling Inc. **Grade Elevation:** 212.94 masl

Drilling Method: Hollow Stem Auger **Top of Casing Elevation:** NA

Well Casing Size: NA **Sheet:** 1 of 1

Log of Borehole: BH3

Project #: 228873 **Logged By:** MA

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Braneida Park, Brantford

Drill Date: February 1, 2019 **Project Manager:** KRD

SUBSURFACE PROFILE | **SAMPLE**

Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20, 40, 60)	Shear Strength kPa (100, 200)	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0		Ground Surface	212.42	No Monitoring Well Installed										
		Topsoil Brown silt, trace sand and organics, very loose, frozen	211.66		SS	1	13	3						
1		***Silt*** Brown clayey silt, hard, APL	210.90		SS	2	67	8						
		Some dilatant seams, stiff			SS	3	100	11						
2			210.13											
		Soft			SS	4	100	5						
3					SS	5	100	4						
4			207.85											
		Occasional saturated sandy silt seams, stiff			SS	6	100	10						
5														
6			206.32											
		Grey			SS	7	100	3						
		End of Borehole												
7		Borehole terminated at approximately 6.6 mbgs. At drilling completion, a wet cave was measured at 5.8 mbgs and water was measured at 5.0 mbgs.												
8														
9														

Contractor: Direct Environmental Drilling Inc.

Grade Elevation: 212.42 masl

Drilling Method: Hollow Stem Auger

Top of Casing Elevation: NA

Well Casing Size: NA

Sheet: 1 of 1

Log of Borehole: BH4

Project #: 228873 **Logged By:** MA

Project: Geotechnical Investigation

Client: Ecosystem Recovery Inc.

Location: Braneida Park, Brantford

Drill Date: February 1, 2019 **Project Manager:** KRD

SUBSURFACE PROFILE					SAMPLE									
Depth (m)	Symbol	Description	Elevation (m)	Monitoring Well Details	Sample Type	Sampler #	Recovery (%)	SPT N-Value	Standard Penetration N-Value (20 40 60)	Shear Strength kPa (100 200)	Water Content (%)	Sample ID	Soil Vapour Concentration (ppm)	Laboratory Analysis
0		Ground Surface	212.47											
		Topsoil Brown silt, trace sand and organics, very loose, frozen	212.01		SS	1	50	3			37.1			
		Silt Light brown clayey silt, some sand, hard APL	211.71		SS	2	100	15			31.4			
1		Brown, very stiff	210.95		SS	3	33	5			30.4			
		Clayey silt, occasional dilatant seams, stiff, APL	210.18		SS	4	100	4			28.2			
2		Soft, APL to WTPL			SS	5	100	4			28.6			
3					SS	6	100	5			20.6			
4					SS	7	100	4			26.8			
5														
6			205.92											
7		End of Borehole Borehole terminated at approximately 6.6 mbgs.												
8														

Monitoring Well Details: Riser, Bentonite, Silica Sand, Screen, Bentonite

Water level = 0.95 m above grade as measured on June 27, 2019

Contractor: Direct Environmental Drilling Inc.

Grade Elevation: 212.47 masl

Drilling Method: Hollow Stem Auger

Top of Casing Elevation: NA

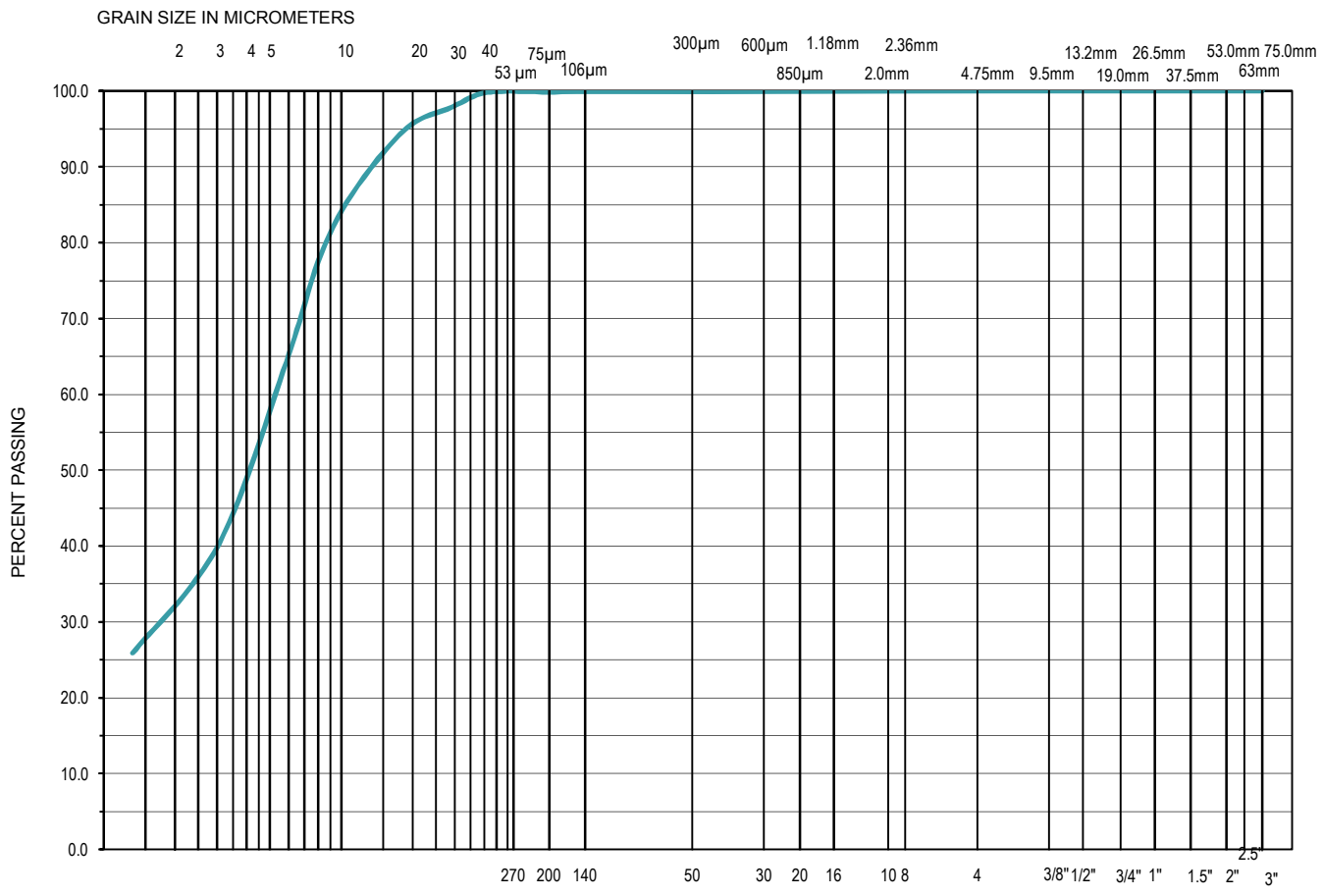
Well Casing Size: NA

Sheet: 1 of 1

APPENDIX III

Analytical Laboratory Testing Reports for Soil Samples

UNIFIED SOIL CLASSIFICATION SYSTEM - GRAINSIZE DISTRIBUTION



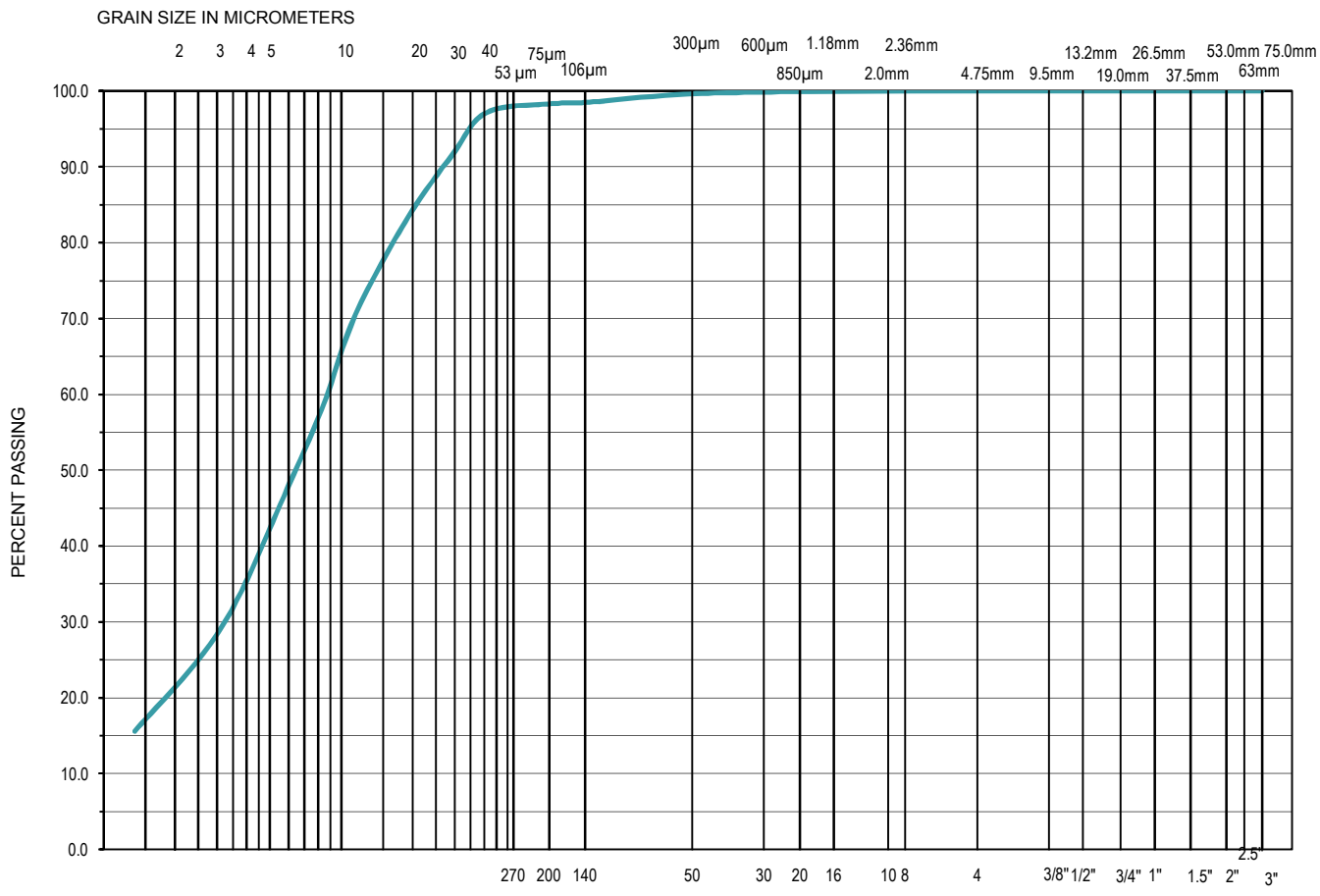
Particle Size	Percent Passing
75	100.0
63	100.0
37.5	100.0
26.5	100.0
19	100.0
16	100.0
13.2	100.0
9.5	100.0
6.7	100.0
4.75	100.0
2	100.0
0.85	99.97
0.425	99.95
0.25	99.93
0.106	99.91
0.075	99.89
0.0412	99.83
0.0293	97.91
0.0187	95.03
0.0111	86.39
0.0081	77.75
0.0059	64.31
0.0031	40.32
0.0013	25.92

Lab No.: 19018

Client:	Pinchin Ltd.	**Soil Class:** CL	**Moisture:** 27.8%	**Date Sampled:** Unknown - Sampled by client	**Enclosure: 1**
Project:	Pinchin project 228873	**Location:** BH 2, SS#3, 10 - 11.5' depth		**Date Received:** 4 February 2019	
Project No.:	SWC178279	**Depth (m):** 3.0 - 3.5		**Report Date:** 11 February 2019	

Wood Environment & Infrastructure Solutions
A Division of Wood Canada Limited
900 Maple Grove Road, Unit 10
Cambridge, ON N3H 4R7
Tel: (519) 650-7100
woodplc.com

UNIFIED SOIL CLASSIFICATION SYSTEM - GRAINSIZE DISTRIBUTION



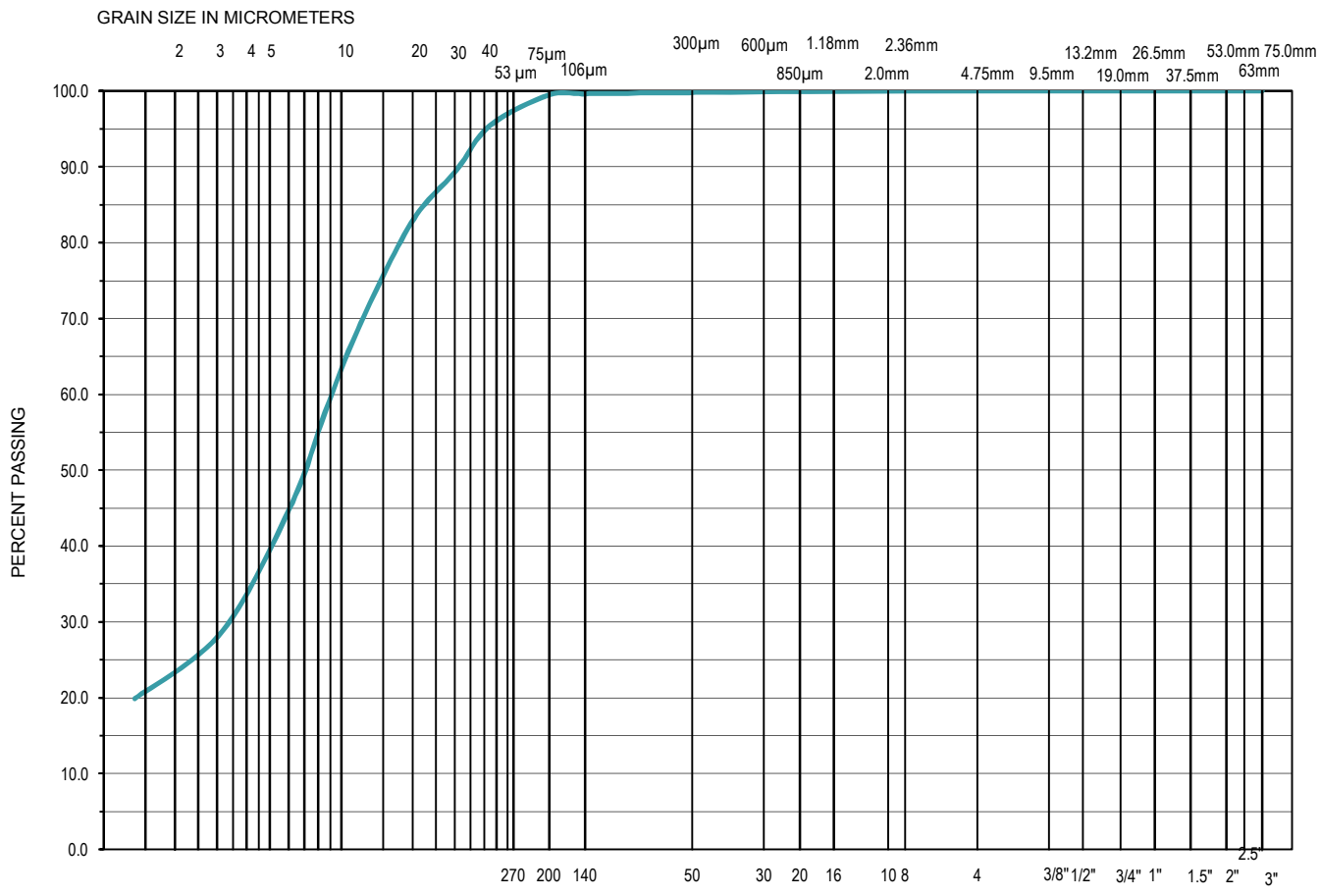
Particle Size	Percent Passing
75	100.0
63	100.0
37.5	100.0
26.5	100.0
19	100.0
16	100.0
13.2	100.0
9.5	100.0
6.7	100.0
4.75	100.0
2	100.0
0.85	99.93
0.425	99.78
0.25	99.52
0.106	98.50
0.075	98.31
0.0409	97.19
0.0295	91.69
0.0191	83.44
0.0115	70.60
0.0084	58.68
0.0061	48.59
0.0031	29.34
0.0014	15.59

Lab No.: 19019

Client: Pinchin Ltd.	**Soil Class:** CL	**Moisture:** 26.6%	**Date Sampled:** Unknown - Sampled by client	**Enclosure: 2**
Project: Pinchin project 228873	**Location:** BH 3, SS#3, 5 - 6.5' depth		**Date Received:** 4 February 2019	
Project No.: SWC178279	**Depth (m):** 1.5 - 2.0		**Report Date:** 11 February 2019	

Wood Environment & Infrastructure Solutions
A Division of Wood Canada Limited
900 Maple Grove Road, Unit 10
Cambridge, ON N3H 4R7
Tel: (519) 650-7100
woodplc.com

UNIFIED SOIL CLASSIFICATION SYSTEM - GRAINSIZE DISTRIBUTION



Particle Size	Percent Passing
75	100.0
63	100.0
37.5	100.0
26.5	100.0
19	100.0
16	100.0
13.2	100.0
9.5	100.0
6.7	100.0
4.75	100.0
2	100.0
0.85	99.94
0.425	99.87
0.25	99.79
0.106	99.65
0.075	99.51
0.0422	95.46
0.0304	89.50
0.0196	82.54
0.0118	68.61
0.0086	57.68
0.0062	45.74
0.0032	28.84
0.0014	19.89

Lab No.: 19020

Client: Pinchin Ltd.	**Soil Class:** CL	**Moisture:** 20.6%	**Date Sampled:** Unknown - Sampled by client	**Enclosure: 3**
Project: Pinchin project 228873	**Location:** BH 4, SS#6, 15 - 16.5' depth		**Date Received:** 4 February 2019	
Project No.: SWC178279	**Depth (m):** 4.6 - 5.0		**Report Date:** 11 February 2019	

Wood Environment & Infrastructure Solutions
A Division of Wood Canada Limited
900 Maple Grove Road, Unit 10
Cambridge, ON N3H 4R7
Tel: (519) 650-7100
woodplc.com

APPENDIX IV

Report Limitations and Guidelines for Use

REPORT LIMITATIONS & GUIDELINES FOR USE

This information has been provided to help manage risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report was prepared for the exclusive use of the Client and their authorized agents, subject to the conditions and limitations contained within the duly authorized work plan. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third parties. If additional parties require reliance on this report, written authorization from Pinchin will be required. Pinchin disclaims responsibility of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs. No other warranties are implied or expressed. Furthermore, this report should not be construed as legal advice.

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical report is based on the existing conditions at the time the study was performed, and Pinchin's opinion of soil conditions are strictly based on soil samples collected at specific test hole locations. The findings and conclusions of Pinchin's reports may be affected by the passage of time, by manmade events such as construction on or adjacent to the Site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations.

LIMITATIONS TO PROFESSIONAL OPINIONS

Interpretations of subsurface conditions are based on field observations from test holes that were spaced to capture a 'representative' snap shot of subsurface conditions. Site exploration identifies subsurface conditions only at points of sampling. Pinchin reviews field and laboratory data and then applies professional judgment to formulate an opinion of subsurface conditions throughout the Site. Actual subsurface conditions may differ, between sampling locations, from those indicated in this report.

LIMITATIONS OF RECOMMENDATIONS

Subsurface soil conditions should be verified by a qualified geotechnical engineer during construction. Pinchin should be notified if any discrepancies to this report or unusual conditions are found during construction.

Sufficient monitoring, testing and consultation should be provided by Pinchin during construction and/or excavation activities, to confirm that the conditions encountered are consistent with those indicated by the test hole investigation, and to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated. In addition, monitoring, testing and consultation by Pinchin should be completed to evaluate whether or not earthwork activities are completed in

accordance with our recommendations. Retaining Pinchin for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions. However, please be advised that any construction/excavation observations by Pinchin is over and above the mandate of this geotechnical evaluation and therefore, additional fees would apply.

MISINTERPRETATION OF GEOTECHNICAL ENGINEERING REPORT

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having Pinchin confer with appropriate members of the design team after submitting the report. Also retain Pinchin to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having Pinchin participate in pre-bid and preconstruction conferences, and by providing construction observation. Please be advised that retaining Pinchin to participation in any 'other' activities associated with this project is over and above the mandate of this geotechnical investigation and therefore, additional fees would apply.

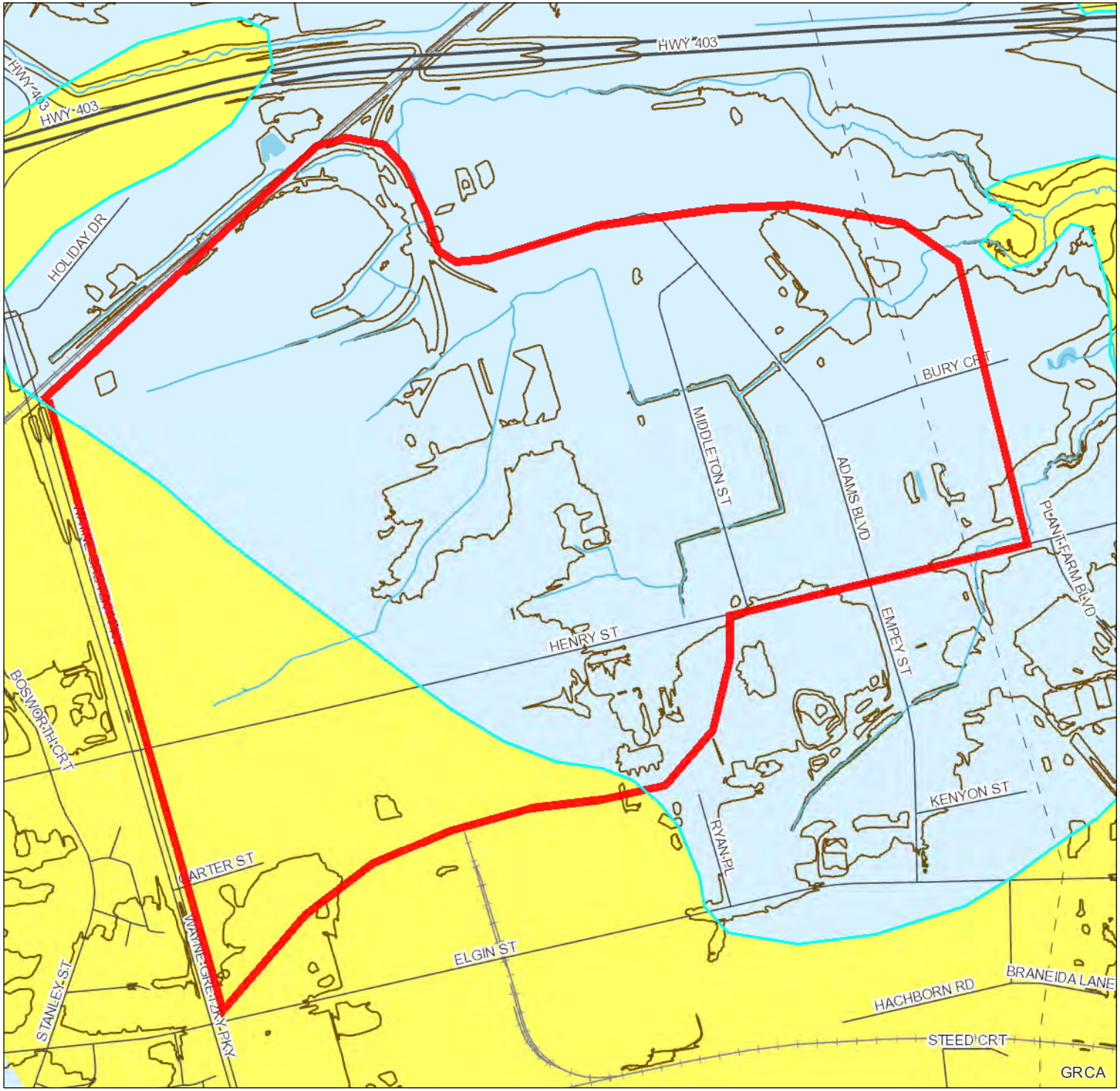
CONTRACTORS RESPONSIBILITY FOR SITE SAFETY

This geotechnical report is not intended to direct the contractor's procedures, methods, schedule or management of the work Site. The contractor is solely responsible for job Site safety and for managing construction operations to minimize risks to on-Site personnel and to adjacent properties. It is ultimately the contractor's responsibility that the Ontario Occupational Health and Safety Act is adhered to, and Site conditions satisfy all 'other' acts, regulations and/or legislation that may be mandated by federal, provincial and/or municipal authorities.

SUBSURFACE SOIL AND/OR GROUNDWATER CONTAMINATION

This report is geotechnical in nature and was not performed in accordance with any environmental guidelines. As such, any environmental comments are very preliminary in nature and based solely on field observations. Accordingly, the scope of services do not include any interpretations, recommendations, findings, or conclusions regarding the, assessment, prevention or abatement of contaminants, and no conclusions or inferences should be drawn regarding contamination, as they may relate to this project. The term "contamination" includes, but is not limited to, molds, fungi, spores, bacteria, viruses, PCBs, petroleum hydrocarbons, inorganics, pesticides/insecticides, volatile organic compounds, polycyclic aromatic hydrocarbons and/or any of their by-products.

Pinchin will not be responsible for any consequential or indirect damages. Pinchin will only be held liable for damages resulting from the negligence of Pinchin. Pinchin will not be liable for any losses or damage if the Client has failed, within a period of two years following the date upon which the claim is discovered within the meaning of the Limitations Act, 2002 (Ontario), to commence legal proceedings against Pinchin to recover such losses or damage.



Grand River Conservation Authority

Date: Dec 04, 2019

Braneida GRCA Soils

Legend

- Municipal Boundary (GRCA)
- Watercourse - Local (GRCA)
- Contour 2018 - Regional (GRCA)
- Park - Local (GRCA)
- Waterbody - Local (GRCA)

Surficial Geology (MNDM)

- Clay
- Diamicton
- Fill
- Gravel
- Organic deposits
- Paleozoic Bedrock
- Sand
- Silt
- Great Lakes - Local (GRCA)

0 65 130 260 390 Metres

N

Map Centre (UTM NAD83 z17): 562,633.53 4,778,709.09

This map is not to be used for navigation

NAD 1983 UTM Zone 17N

Scale: 10,669

EXP Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE SWM POND BOUNDARY
- BOREHOLE LOCATION (EXP, 2017)
- BOREHOLE / MONITORING WELL LOCATION (EXP, 2017)
- BOREHOLE / MONITORING WELL LOCATION (EXP, 2018)
- A-A' CROSS SECTION A-A' (SEE FIGURE 5A)
- B-B' CROSS SECTION B-B' (SEE FIGURE 5B)
- C-C' CROSS SECTION B-B' (SEE FIGURE 5C)

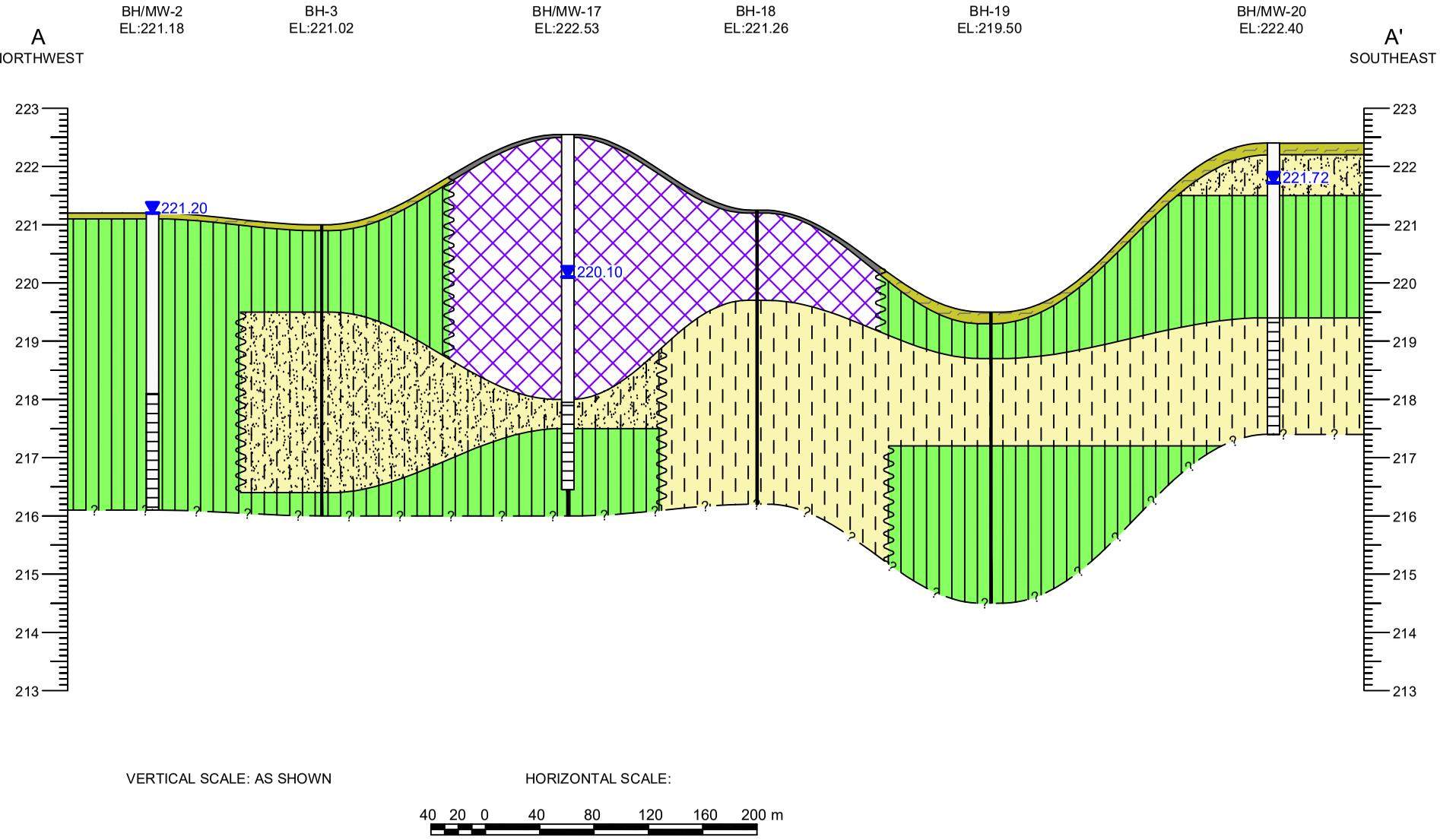
TITLE AND LOCATION:

BOREHOLE / MONITORING WELL LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
225 HENRY STREET,
BRANTFORD, ONTARIO

PROJECT NO.:	DWN.:
BRM-00605810-A0	AS
SCALE:	CK:
AS NOTED	PS
DATE:	FIG. NO.:
MARCH 2018	4

X:\DRAWINGS\605000\605810\605810A\HG INVESTIGATION\MARCH 6 2018\BRM-00605810-A0.dwg



EXP Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

LEGEND:

- TOPSOIL
- ASPHALT
- FILL
- CLAYEY SILT / SILTY CLAY
- SANDY SILT
- SILT

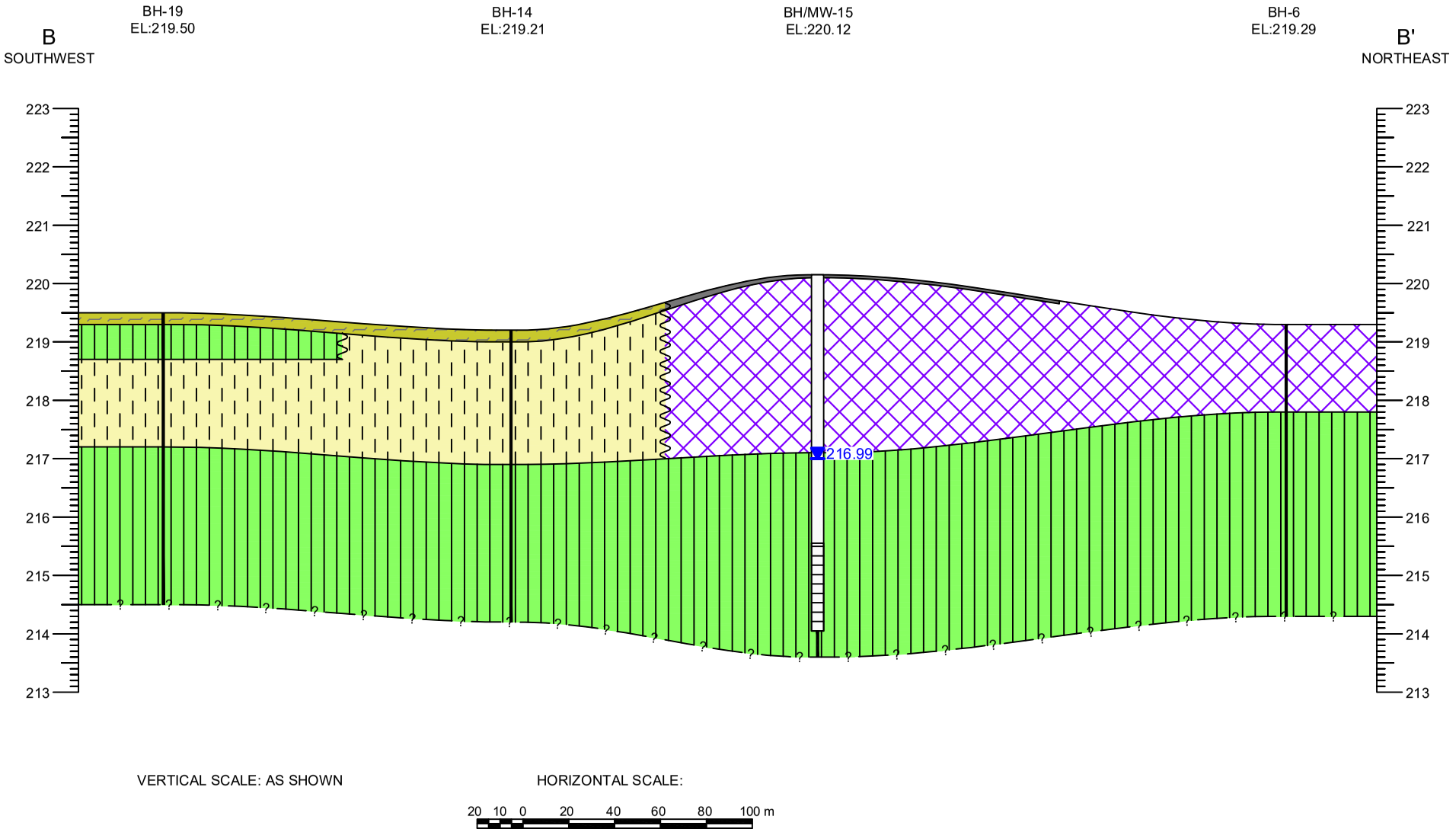
GROUNDWATER LEVEL AS MEASURED ON MARCH 26, 2018

TITLE AND LOCATION:

CROSS SECTION A-A'
HYDROGEOLOGICAL INVESTIGATION
225 HENRY STREET,
BRANTFORD, ONTARIO

PROJECT NO.:	DWN.:
BRM-00605810-A0	AS
SCALE: AS NOTED	CK: PS
DATE: MARCH 2018	FIG. NO.: 5A

X:\DRAWINGS\605000\605810\605810A\HG INVESTIGATION\MARCH 6 2018\BRM-00605810-A0.dwg



EXP Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

LEGEND:

- TOPSOIL
- ASPHALT
- FILL
- CLAYEY SILT / SILTY CLAY
- SILT

GROUNDWATER LEVEL AS MEASURED ON MARCH 26, 2018

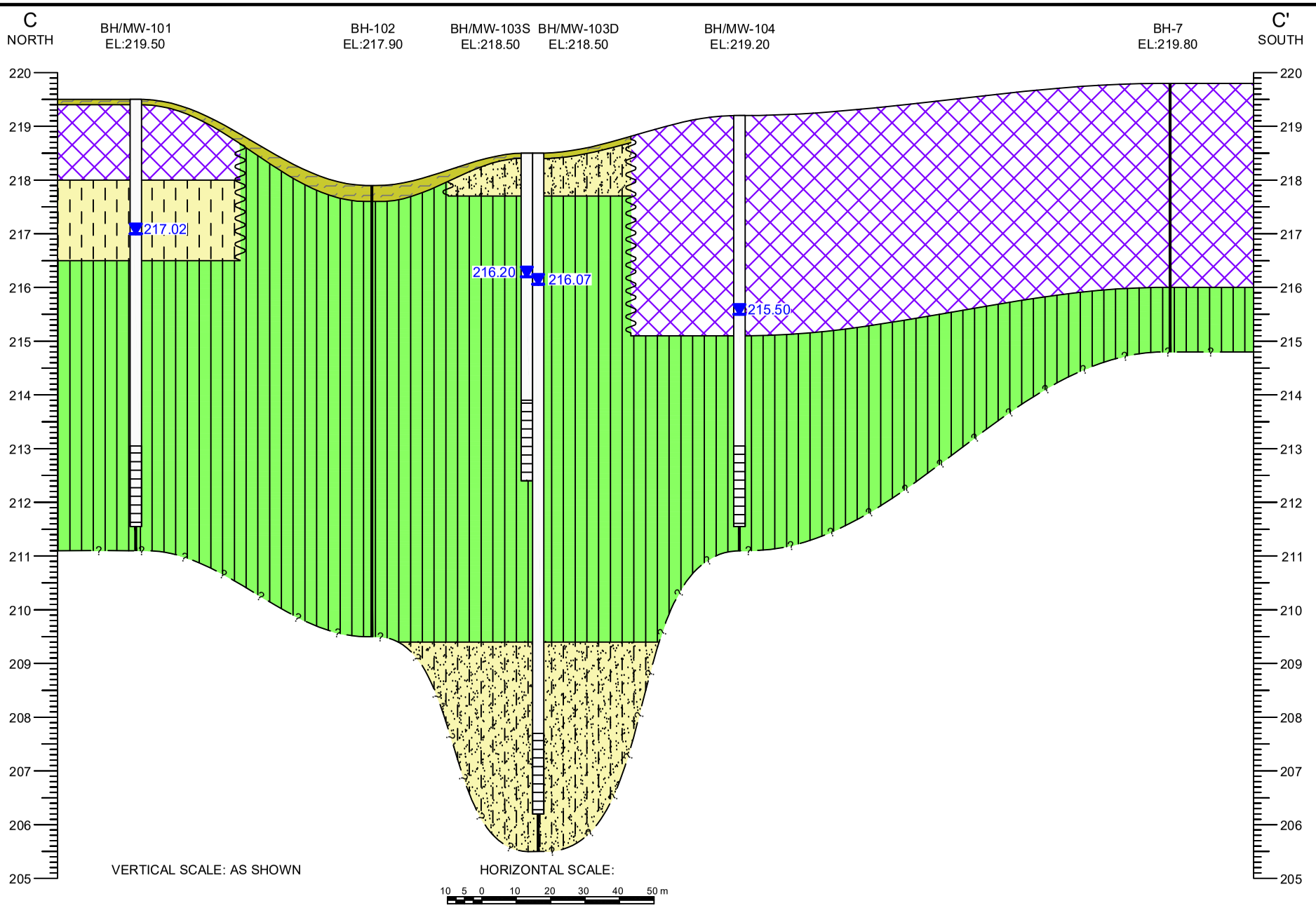
TITLE AND LOCATION:

CROSS SECTION B-B'

HYDROGEOLOGICAL INVESTIGATION
225 HENRY STREET,
BRANTFORD, ONTARIO

PROJECT NO.:	DWN.:
BRM-00605810-A0	AS
SCALE: AS NOTED	CK: PS
DATE: MARCH 2018	FIG. NO.: 5B

X:\DRAWINGS\605000\605810\605810A\HG INVESTIGATION\MARCH 6 2018\BRM-00605810-A0.dwg



EXP Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

LEGEND:

- TOPSOIL
- FILL
- CLAYEY SILT / SILTY CLAY
- SILT AND SAND
- SILT

GROUNDWATER LEVEL AS MEASURED ON MARCH 26, 2018

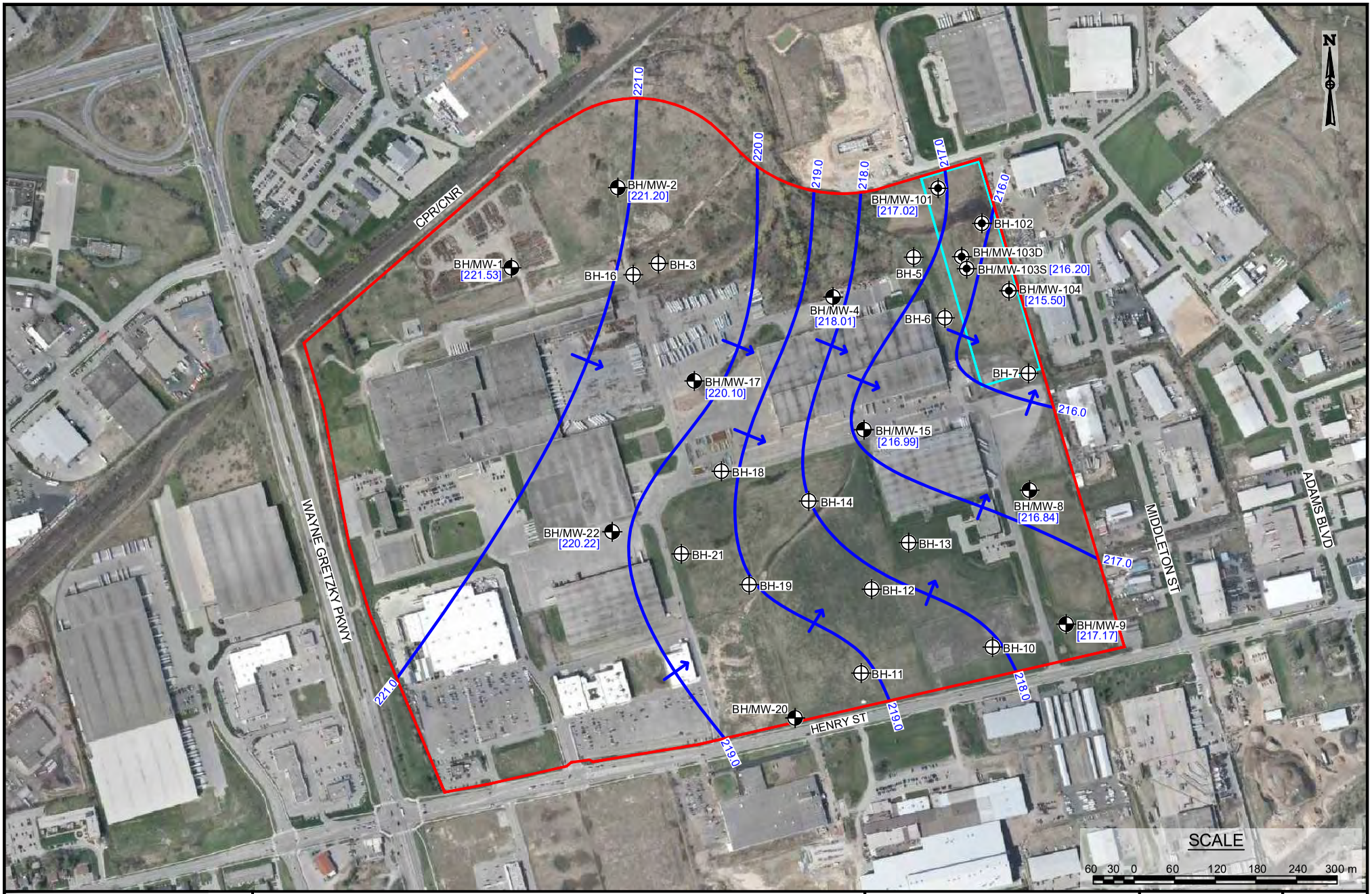
TITLE AND LOCATION:

CROSS SECTION C-C'

HYDROGEOLOGICAL INVESTIGATION
225 HENRY STREET,
BRANTFORD, ONTARIO

PROJECT NO.:	DWN.:
BRM-00605810-A0	AS
SCALE: AS NOTED	CK.: PS
DATE: MARCH 2018	FIG. NO.: 5C

X:\DRAWINGS\605000\605810\605810A\HG INVESTIGATION\MARCH 6 2018\BRM-00605810-A0.dwg



EXP Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY • • INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE SWM POND BOUNDARY
- BOREHOLE LOCATION (EXP, 2017)
- BOREHOLE / MONITORING WELL LOCATION (EXP, 2017)
- BOREHOLE / MONITORING WELL LOCATION (EXP, 2018)
- GROUNDWATER CONTOURS
- [XX.XX] GROUNDWATER ELEVATION AS MEASURED ON MARCH 26, 2018
- GROUNDWATER FLOW DIRECTION

TITLE AND LOCATION:

SHALLOW GROUNDWATER CONTOURS

HYDROGEOLOGICAL INVESTIGATION
225 HENRY STREET,
BRANTFORD, ONTARIO

PROJECT NO.:	DWN.:
BRM-00605810-A0	AS
SCALE:	CK:
AS NOTED	PS
DATE:	FIG. NO.:
MARCH 2018	6

X:\DRAWINGS\605000\605810\605810A\HG INVESTIGATION\MARCH 6 2018\BRM-00605810-A0.dwg

Appendix H

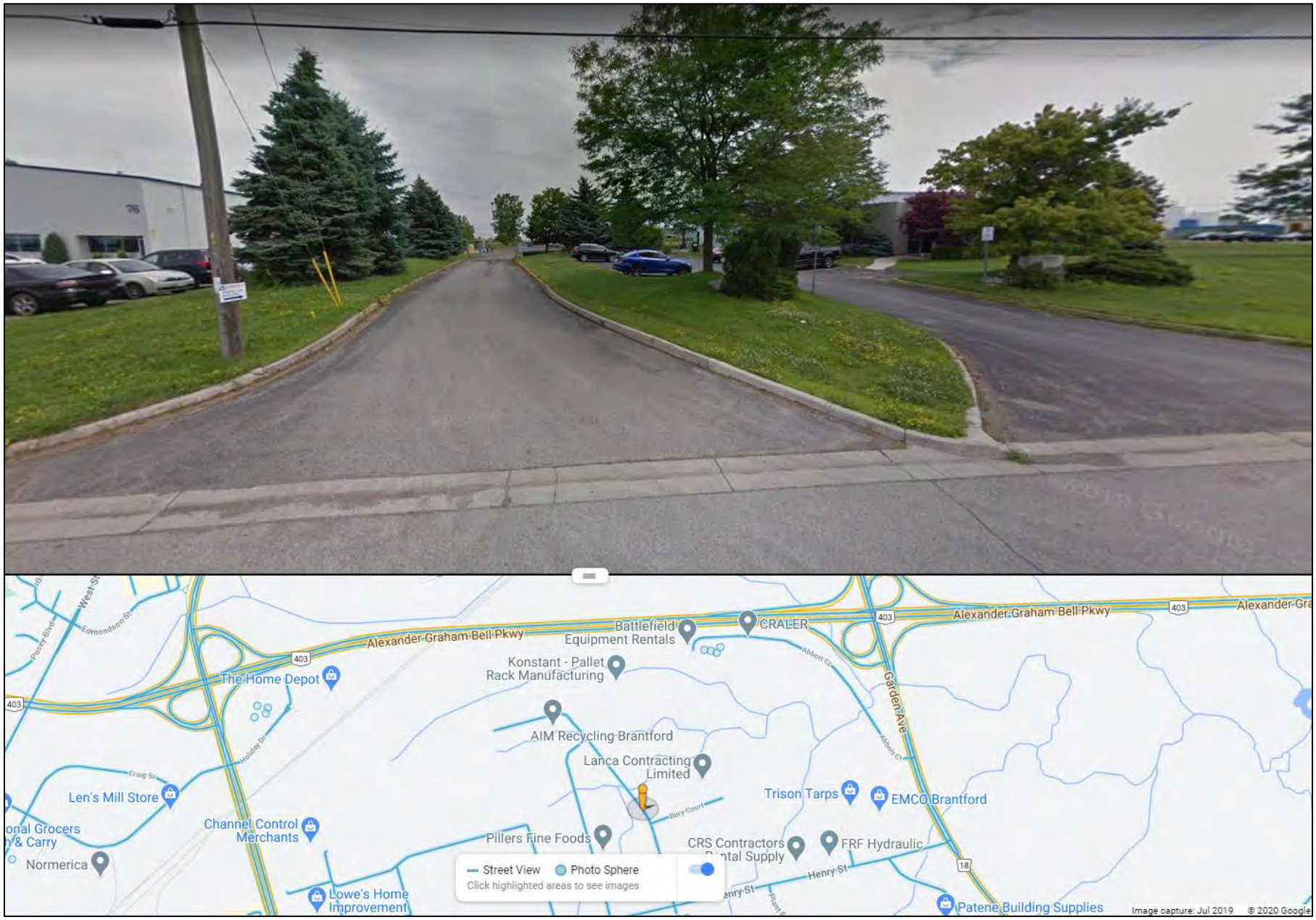
Potential Easement Locations Photographs

Easement Location 1: 132 Adams Boulevard

Easement Location 2: 112 Adams Boulevard

Easement Location 3: 90 Adams Boulevard

Easement Location 4: 66 Adams Boulevard



Easement Location 5: 66 Adams Boulevard (from Bury Court)

Appendix I

Preferred Alternative Stormwater Management Facility Preliminary Calculations

Braneida SWM Facility Retrofit
MOE Volume Requirements

Location: Brantford, Ontario
Project No.: 1839
Date: Thursday, October 15, 2020
Designer: JC
File: E:\1839 - Braneida SWM Pond\3 - Technical\02 Hydrology and Hydraulics\SWM\[MOE SWMF Sizing and Calculations_2020-10-XX.xlsx]3 - Volumes

*Note:

The Braneida SWM pond will be in series the with upstream Kylin SWM Facility, the Kylin SWM Report (exp, Sept 2018) dictates that the facility will provide enhanced level quality control and post-to-pre quantity control with the following parameters:

Catchment Area (ha): 74.4
Impervious (%): 91.51

Table 3.2 Water Quality Storage Requirements based on Receiving Waters (MOE Stormwater Management Planning and Design Manual, March 2003)

Protection Level	SWMP Type	Storage Volume (m^3/ha) for Impervious Level			
		35	55	70	85
Enhanced 80% long-term S.S. removal	*Wetlands*	80	105	120	140
	Hybrid Wet Pond/Wetland	110	150	175	195
	Wet Pond	140	190	225	250
Normal 70% long-term S.S. Removal	*Wetlands*	60	70	80	90
	Hybrid Wet Pond/Wetland	75	90	105	120
	Wet Pond	90	110	130	150
Basic 60% long-term S.S. Removal	*Wetlands*	60	60	60	60
	Hybrid Wet Pond/Wetland	60	70	75	80
	Wet Pond	60	75	85	95
	Flow)	90	150	200	240

Step 1: Choose Level of Water Quality Control	Enhanced 80% long-term S.S. removal			
Step 2: Choose Type of Facility	Wet Pond			
Step 3: Catchment characteristics	**Area (ha)**	70.6	**Imperv (%)**	70.0

Interpolated Storage Volume Requirement (m^3/ha) = 225.0

Permanent Pool Required (m^3) = 10,237

Extended Detention Volume Required (m^3) = 5,648 *

*Note:
Typical extended detention volume is 40m^3/ha, but in this case since the SWM pond is designed in series an extra extended detention volume calculation of 80m^3/ha will be used.
Facility catchment area and imperviousness reflective of the portions of the total catchment area which do not drain into the Kylin SWM Pond before draining to the design pond.

Erosion Control Volume Required (m^3) = 11,461 *

*Note: Erosion Control volume is derived using the Visual OTTHYMO Ultimate development condition model to calculate the flow volume entering the facility during the 25mm-4 hour storm

Braneida SWM Facility Retrofit - Facility Volumes

Location: Brantford, Ontario
Project No.:1839
Date: Thursday, October 15, 2020
Designer: JC
File: E:\1839 - Braneida SWM Pond\3 - Technical\02 Hydrology and Hydraulics\SWM\[MOE SWMF Sizing and Calculations_2020-10-XX.xlsx]3 - Volumes

STAGE-STORAGE RELATIONSHIP

Stage	Active Depth	Total Pond Volume	Active Storage Volume	Volume Summary	Ponding Elevation	Comments	Stage
m	*m*	m^3	m^3	m^3	*m*		*m*
211.90		12800		12800		Permanent Pool	211.90
211.90	0.00	12800	0				211.90
212.00	0.10	14339	1539				212.00
212.10	0.20	15878	3078				212.10
212.20	0.30	17418	4618				212.20
212.30	0.40	18957	6157	5648	212.27	MOE Extended Detention	212.30
212.40	0.50	20496	7696				212.40
212.50	0.60	22035	9235				212.50
212.60	0.70	23718	10918				212.60
212.70	0.80	25495	12695	11461	212.64	25mm Event	212.70
212.80	0.90	27366	14566				212.80
212.90	1.00	29237	16437	15388	212.85	1:2 Year Event	212.90
213.00	1.10	31108	18308				213.00
213.10	1.20	32979	20179	19217	213.05	1:5 Year Event	213.10
213.20	1.30	34850	22050				213.20
213.30	1.40	36721	23921	22085	213.21	1:10 Year Event	213.30
213.40	1.50	38592	25792				213.40
213.50	1.60	40463	27663				213.50
213.60	1.70	42334	29534	25344	213.38	1:25 Year Event	213.60
213.70	1.80	44205	31405				213.70
213.80	1.90	46076	33276	27882	213.52	1:50 Year Event	213.80
213.90	2.00	47947	35147	31597	213.72	1:100 Year Event	213.90
214.00	2.10	49818	37018				214.00
214.10	2.20	51689	38889				214.10
214.20	2.30	53560	40760	39497	214.14	Regional Event (Hazel)	214.20
214.30	2.40	55667	42867				214.30
214.40	2.50	57773	44973				214.40
214.50	2.60	59880	47080	47080	214.50	Maximum Ponding	214.50

Braneida SWM Facility Retrofit - Facility Hydraulics

Location: Brantford, Ontario
Project No.: 1839
Date: 2020-10-15
Designer: JC
File: E:\1839 - Braneida SWM Pond\3 - Technical\02 Hydrology and Hydraulics\SWM\[MOE SWMF Sizing and Calculations_2020-10-XX.xlsx]3 - Volumes

ecosystem recovery inc. PROFESSIONAL ENGINEERS

Orifice Calculations

$Q_o = C_d * A_o * (2 * g * H_o)^{0.5}$

	Orifice 1	Orifice 2	Orifice 3
C_d	0.63	0.81	0.80
Invert (m)	211.90	500.00	500.00
Width (m)			
Diameter/Height (m)	0.370	2.000	2.000
Type (H/V)	V	V	V

C_d	Description
0.63	Orifice Plate
0.80	Orifice Tube

Weir Calculations (broad crest)

C_d	1.60
Invert (m)	212.64
Length (m)	5.200

Trapazoidal Weir Calculations

$Q_w = 2/3 * C_d * (2g)^{1/2} * L * H_w^{3/2} + 8/15 * C_d * (2g)^{1/2} * \tan\theta * H_w^{5/2}$

C_d	0.50
Invert (m)	214.00
Length (m)	5.200
Side Slope (H:V)	3
Side Slope (rad)	1.249

CSP Riser Calculations

Invert of holes	211.30	m
Diameter of holes	13	mm
# Holes per row	70	
C_d	0.63	
Row Spacing (invert to invert)	0.063	m

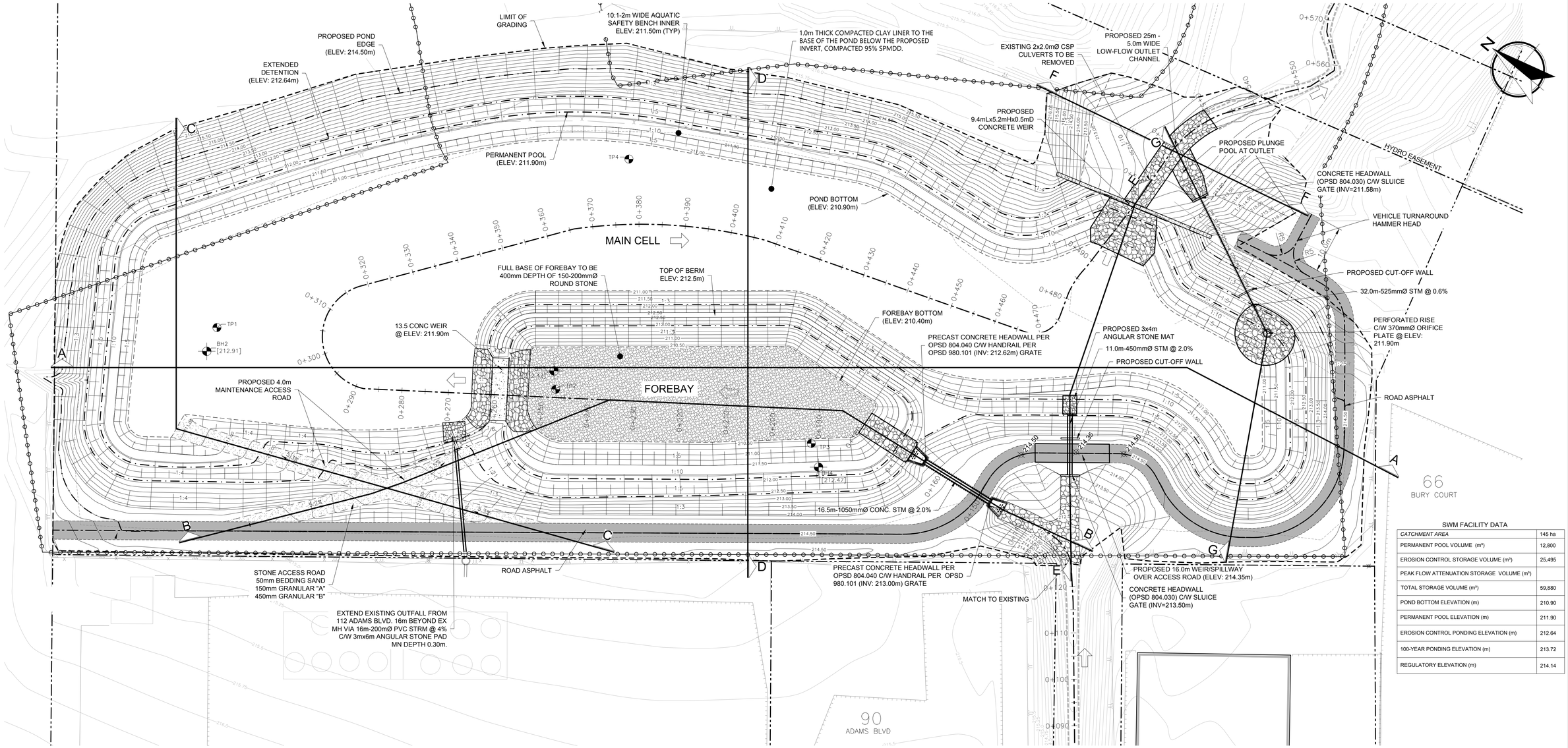
CSP Riser Capacity Check
Applicable for CSP Riser Pipes Only
See attached for row spacing/hole diameter options

STAGE-DISCHARGE RELATIONSHIP

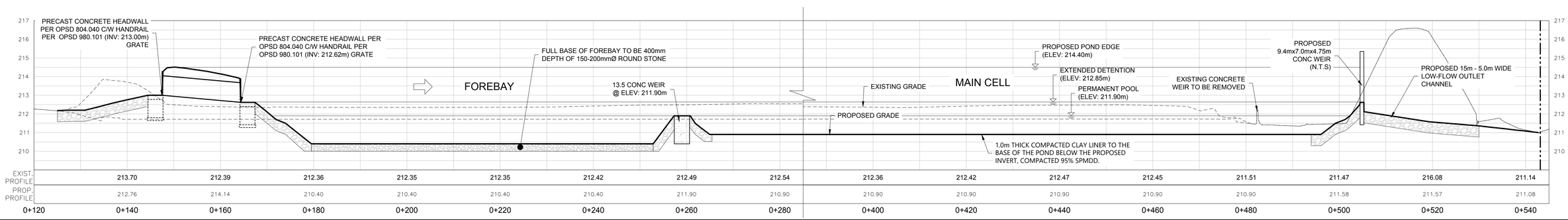
Stage	Active Volume	Orifice 1			Orifice 2			Orifice 3			MH Weir Flow	Weir Flow	Total Flow	Total Orifice Flow	CSP Riser Capacity	Difference
		Area	H_o	Flow	Area	H_o	Flow	Area	H_o	Flow						
m	m^3	m^2	*m*	m^3/s	m^2	*m*	m^3/s	m^2	*m*	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s	m^3/s
211.90	0	0.00	0.00	0.0000	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.1361	0.1361
212.00	1539	0.02	0.05	0.0146	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0146	0.0146	0.1688	0.1541
212.10	3078	0.06	0.10	0.0523	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.0523	0.0523	0.2057	0.1534
212.20	4618	0.09	0.15	0.1009	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.1009	0.1009	0.2445	0.1436
212.30	6157	0.11	0.21	0.1391	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.1391	0.1391	0.2843	0.1452
212.40	7696	0.11	0.31	0.1684	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.1684	0.1684	0.3279	0.1595
212.50	9235	0.11	0.41	0.1933	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.1933	0.1933	0.3710	0.1778
212.60	10918	0.11	0.51	0.2153	0.00	0.00	0.0000	0.00	0.00	0.0000	0.0000	0.0000	0.2153	0.2153	0.4188	0.2034
212.70	12695	0.11	0.61	0.2353	0.00	0.00	0.0000	0.00	0.00	0.0000	0.1223	0.0000	0.3576	0.2353	0.4670	0.2317
212.80	14566	0.11	0.71	0.2537	0.00	0.00	0.0000	0.00	0.00	0.0000	0.5325	0.0000	0.7862	0.2537	0.5165	0.2628
212.90	16437	0.11	0.81	0.2709	0.00	0.00	0.0000	0.00	0.00	0.0000	1.1030	0.0000	1.3739	0.2709	0.5689	0.2981
213.00	18308	0.11	0.91	0.2870	0.00	0.00	0.0000	0.00	0.00	0.0000	1.7971	0.0000	2.0841	0.2870	0.6208	0.3338
213.10	20179	0.11	1.01	0.3023	0.00	0.00	0.0000	0.00	0.00	0.0000	2.5957	0.0000	2.8980	0.3023	0.6769	0.3746
213.20	22050	0.11	1.11	0.3168	0.00	0.00	0.0000	0.00	0.00	0.0000	3.4866	0.0000	3.8035	0.3168	0.7311	0.4143
213.30	23921	0.11	1.21	0.3307	0.00	0.00	0.0000	0.00	0.00	0.0000	4.4611	0.0000	4.7918	0.3307	0.7771	0.4464
213.40	25792	0.11	1.31	0.3441	0.00	0.00	0.0000	0.00	0.00	0.0000	5.5124	0.0000	5.8565	0.3441	0.8187	0.4746
213.50	27663	0.11	1.41	0.3569	0.00	0.00	0.0000	0.00	0.00	0.0000	6.6355	0.0000	6.9924	0.3569	0.8574	0.5005
213.60	29534	0.11	1.51	0.3693	0.00	0.00	0.0000	0.00	0.00	0.0000	7.8258	0.0000	8.1951	0.3693	0.8940	0.5247
213.70	31405	0.11	1.61	0.3813	0.00	0.00	0.0000	0.00	0.00	0.0000	9.0799	0.0000	9.4612	0.3813	0.9288	0.5475
213.80	33276	0.11	1.71	0.3929	0.00	0.00	0.0000	0.00	0.00	0.0000	10.3947	0.0000	10.7876	0.3929	0.9620	0.5691
213.90	35147	0.11	1.81	0.4042	0.00	0.00	0.0000	0.00	0.00	0.0000	11.7674	0.0000	12.1716	0.4042	0.9940	0.5898
214.00	37018	0.11	1.91	0.4152	0.00	0.00	0.0000	0.00	0.00	0.0000	13.1957	0.0000	13.6109	0.4152	1.0249	0.6097
214.10	38889	0.11	2.01	0.4259	0.00	0.00	0.0000	0.00	0.00	0.0000	14.6775	0.0112	15.1146	0.4259	1.0547	0.6288
214.20	40760	0.11	2.11	0.4364	0.00	0.00	0.0000	0.00	0.00	0.0000	16.2110	0.0634	16.7108	0.4364	1.0836	0.6473
214.30	42867	0.11	2.21	0.4466	0.00	0.00	0.0000	0.00	0.00	0.0000	17.7945	0.1747	18.4157	0.4466	1.1118	0.6652
214.40	44973	0.11	2.31	0.4565	0.00	0.00	0.0000	0.00	0.00	0.0000	19.4264	0.3586	20.2415	0.4565		

Appendix J

Preferred Alternative Concept Design



SWM FACILITY DATA	
CATCHMENT AREA	145 ha
PERMANENT POOL VOLUME (m³)	12,800
EROSION CONTROL STORAGE VOLUME (m³)	25,495
PEAK FLOW ATTENUATION STORAGE VOLUME (m³)	
TOTAL STORAGE VOLUME (m³)	59,880
POND BOTTOM ELEVATION (m)	210.90
PERMANENT POOL ELEVATION (m)	211.90
EROSION CONTROL PONDING ELEVATION (m)	212.64
100-YEAR PONDING ELEVATION (m)	213.72
REGULATORY ELEVATION (m)	214.14



	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+400	0+420	0+440	0+460	0+480	0+500	0+520	0+540
EXIST. PROFILE	213.70	212.39	212.36	212.35	212.35	212.42	212.49	212.54	212.36	212.42	212.47	212.45	211.51	211.47	216.08	211.14	
PROP. PROFILE	212.76	214.14	210.40	210.40	210.40	210.40	211.90	210.90	210.90	210.90	210.90	210.90	210.90	211.58	211.57	211.08	

NO.	DATE	DESCRIPTION	APP'D.	NO.	DATE	DESCRIPTION	APP'D.
-	-	-					

REVISIONS

LEGEND

EXISTING
- GRCA REGULATORY FLOOD LIMIT
- CONTOURS
- FENCE LINE
- PROPERTY LIMIT
- HYDRO EASEMENT
- OVERHEAD HYDRO LINES
- EDGE OF PAVEMENT

PROPOSED
- WATERLEVEL
- CONTOURS
- BOTTOM OF BANK
- TOP OF BANK/SLOPE
- LIMIT OF GRADING
- ROCK
- FOREBAY LINING
- ASPHALT ACCESS ROUTE
- STONE ACCESS ROUTE

SITE BENCHMARK:
MH10A AND MH11A AS DEFINED ON THE ADAMS BOULEVARD PLAN AND PROFILE DRAWING (AS CONSTRUCTED, PHILLIPS 1990). BENCHMARKS WERE SURVEYED WITH A TRIMBLE GPS AND ELEVATIONS WERE RECORDED AS:
MH10A T/G: 216.34
MH11A T/G: 215.70

STAMP

STAMP

ecosystem recovery Inc. PROFESSIONAL ENGINEERS

BRANEIDA SWMF RETROFIT AND DOWNSTREAM CHANNEL REHABILITATION

SWM POND PROPOSED PLAN AND PROFILE

DATE: 2020/05/20	CHK/APP: CM	DRAWING NUMBER C201
SCALE: H1:400 V1:100	DSN: JC	
PRO. No: 1839	DRN: KV	

EXISTING TRAIL

EXISTING FOOTBRIDGE

LIMIT OF CREEK CONSTRUCTION

RED: APPROXIMATE LOCATION OF FEATURES TO PROTECT KICKPOINTS FROM FURTHER REGRESSION BY PROTECTING THE TILL BED AND MANAGING CHANGE IN ELEVATION THROUGH A NATURALIZED CASCADE OR STEP POOL CONFIGURATION, REFER TO TYPICAL DETAIL.

YELLOW: APPROXIMATE LOCATION OF PROTECTION TO PREVENT EXPOSED TILL BED FROM EROSION AND INTEGRATION OF HABITAT ELEMENTS SUCH AS LARGE WOODY DEBRIS, REFER TO TYPICAL DETAIL

GRCA REGULATORY FLOOD LIMIT

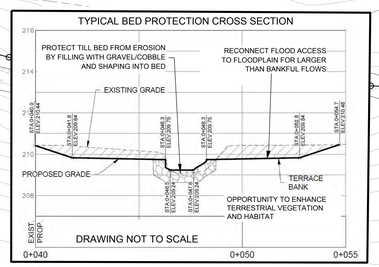
EXISTING CHANNEL CENTRELINE

GARDEN AVE TRIBUTARY

LIMIT OF CREEK CONSTRUCTION

0+720 0+730 0+740 0+750 0+760 0+770 0+780 0+790 0+800 0+810 0+820 0+830 0+840 0+860 0+870 0+880 0+890 0+900 0+910 0+920 0+940 0+950 0+960 0+970 0+980 0+990 1+000 1+010 1+020 1+030

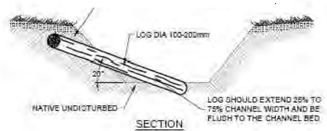
TYPICAL BED PROTECTION CROSS SECTION



DRAWING NOT TO SCALE

0+040 0+050 0+055

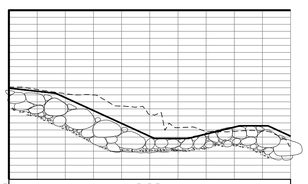
EXAMPLE OF LARGE WOODY DEBRIS



SECTION

DRAWING NOT TO SCALE

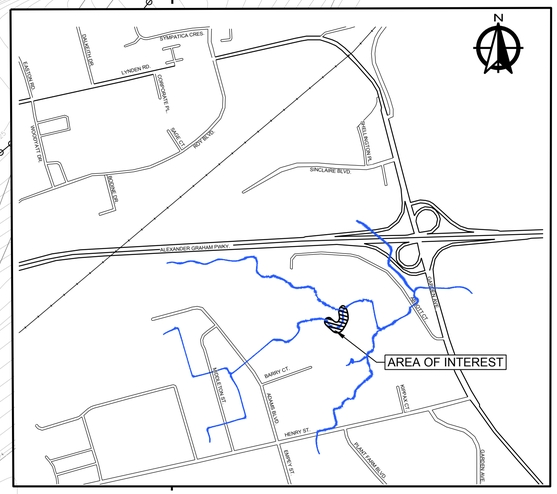
TYPICAL CASCADE STEP POOL CONFIGURATION

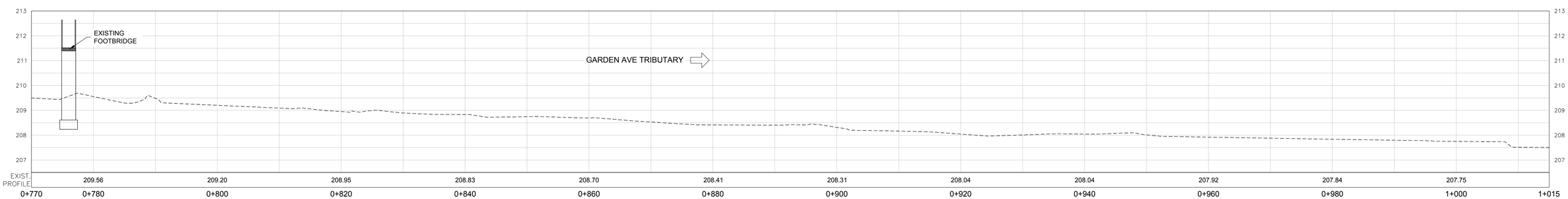


PROFILE 345.31
PROFILE 344.53
0+070

DRAWING NOT TO SCALE

47 BURY COURT





NO.	DATE	DESCRIPTION	APP'D.	NO.	DATE	DESCRIPTION	APP'D.

REVISIONS

LEGEND

EXISTING

- GRCA REGULATORY FLOOD LIMIT
- EXISTING CONTOURS
- EXISTING FENCE LINE
- PROPERTY LIMIT
- HYDRO EASEMENT
- OVERHEAD HYDRO LINES
- EDGE OF PAVEMENT

SITE BENCHMARK:
MH10A AND MH11A AS DEFINED ON THE ADAMS BOULEVARD PLAN AND PROFILE DRAWING (AS CONSTRUCTED, PHILLIPS 1990). BENCHMARKS WERE SURVEYED WITH A TRIMBLE GPS AND ELEVATIONS WERE RECORDED AS:
MH10A T/G: 216.34
MH11A T/G: 215.70

STAMP

STAMP

ecosystem recovery Inc. PROFESSIONAL ENGINEERS

BRANEIDA SWMF RETROFIT AND DOWNSTREAM CHANNEL REHABILITATION

GARDEN AVE TRIBUTARY PROPOSED PLAN AND PROFILE

DATE: 2020/05/20	CHK/APP: CM	DRAWING NUMBER
SCALE: H1:300 V1:75	DSN: JC	C202
PRO. No: 1839	DRN: KV	