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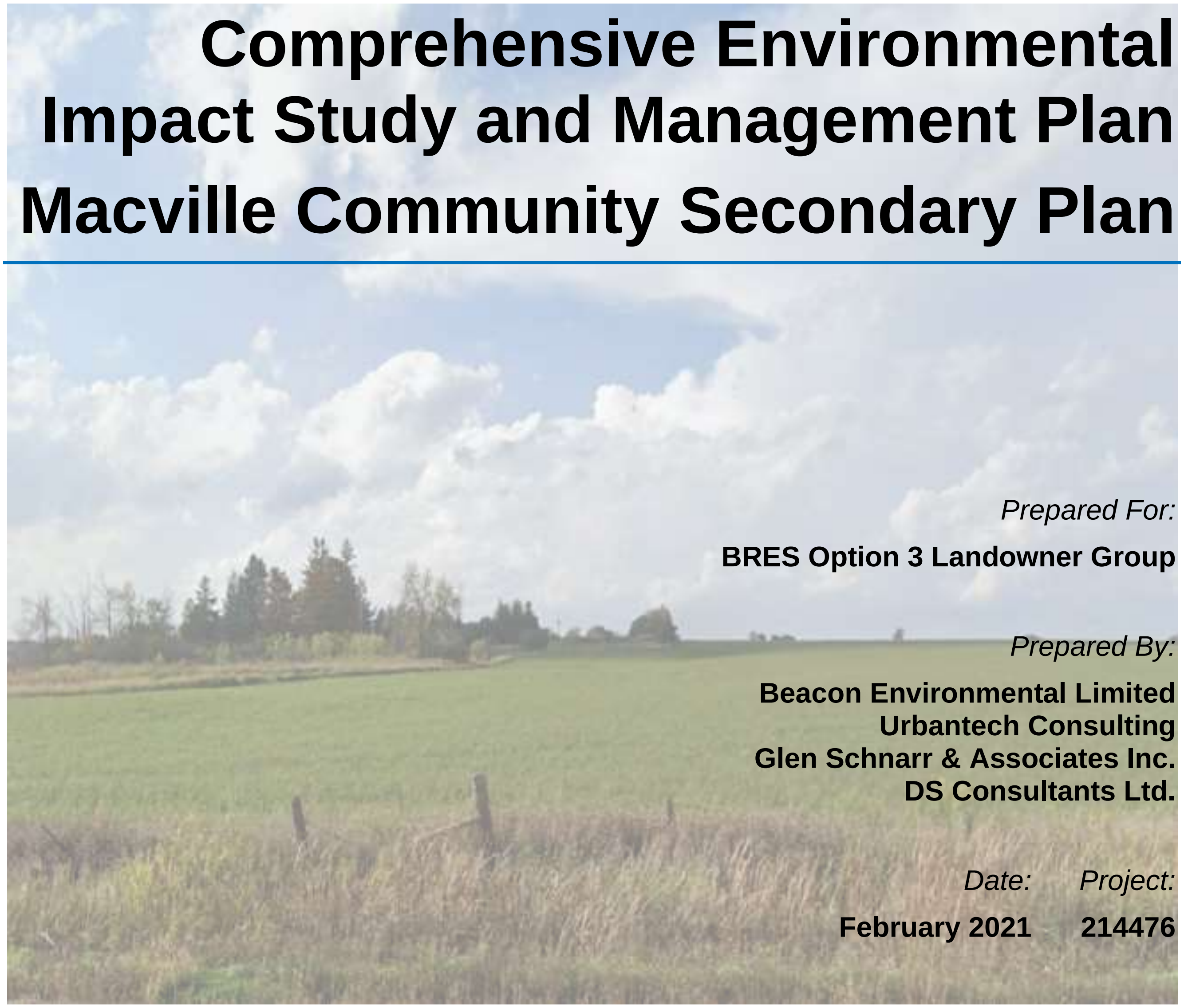

Comprehensive Environmental Impact Study and Management Plan

Macville Community Secondary Plan

Prepared For:

BRES Option 3 Landowner Group

Prepared By:

Beacon Environmental Limited
Urbantech Consulting
Glen Schnarr & Associates Inc.
DS Consultants Ltd.

Date:	*Project:*
February 2021	**214476**

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1. Introduction

Beacon Environmental Limited (Beacon), in collaboration with Glen Schnarr & Associates Inc., Urbantech Consulting and DS Consultants Ltd. were retained by the Bolton Option 3 Landowner Group to prepare a Comprehensive Environmental Impact Study and Management Plan (CEISMP) in support of a proposed Secondary Plan for the Macville Community in Bolton, Ontario.

The Macville Community Secondary Plan lands (herein referred to as the "Subject Lands") include approximately 182 hectares (450 acres) of land generally located north of King Street, east of The Gore Road and west of the CP Railway tracks (**Figure 1**). The Subject Lands are predominantly agricultural with natural heritage features limited to headwater drainage features and wetlands that are concentrated in the southwestern portion of the Subject Lands.

The eastern portion of the Subject Lands, consisting of lands on both sides of Humber Station Road, north of King Street, have been the subject of Regional Official Plan Amendment 30 (ROPA 30) which was recently approved by LPAT and brings these lands into the Bolton Rural Service Centre Settlement Area Boundary. Accordingly, the eastern portion of the Subject Lands are designated "Urban Area" in the Region of Peel Official Plan. The western portion of the Subject Lands, consisting of lands north of King Street and east of The Gore Road are currently designated "Rural Area" within the Region of Peel's Rural System in the Region of Peel Official Plan and "Prime Agricultural Area" in the Town of Caledon's Official Plan. It is recognized that the western portion of the Subject Lands are currently proposed to be brought into the Bolton Rural Service Centre Settlement Area Boundary through the Region's 2051 Municipal Comprehensive Review. It is anticipated that Regional adoption of the new Regional Official Plan will occur before the end of 2021. Notwithstanding the phased approach described above, the Macville Community Secondary Plan and the CEISMP have been prepared to include the entirety of the Subject Lands.

The Macville Community Secondary Plan and associated Land Use Plan, once approved through a Local Official Plan Amendment (LOPA), will serve as a framework for future development of the Subject Lands for the purposes of accommodating residential and mixed-use development with related complimentary uses, such as open spaces, parks, trails, commercial uses, the Bolton GO Station, the Natural Heritage System (NHS), and stormwater management facilities.

This CEISMP summarizes the findings of detailed biophysical investigations and analyses that have been undertaken for the Subject Lands to characterize the environment, identify constraints and opportunities to future development, as well as the environmental management systems that will be required to support future development while enhancing the environment and local natural heritage system. The information presented is this CEISMP was used to guide the development of a Land Use Plan for the Macville Community Secondary Plan as well as a Preliminary Framework Plan.

It should be noted that in 2013/2014, the Town of Caledon had initiated a CEISMP for the Subject Lands as part of the Bolton Residential Expansion Study (BRES). The BRES process identified the Subject Lands as the Option 3 lands (now known as Macville) and advanced them as the preferred future residential expansion area through ROPA 30. Terms of Reference (TOR) for the BRES CEISMP were developed with the Toronto and Region Conservation Authority (TRCA) and the Town initiated some ecological and hydrological studies which generally satisfied Part A of the BRES CEISMP TOR.

The current CEISMP builds upon the previous study and follows the same TOR but has structured the report to integrate Part A – Existing Conditions and Characterization, Part B – Impact Assessment and Detailed Studies, and Part C - Implementation into a single report for greater efficiency.

A copy of the approved BRES CEISMP TOR has been included in **Appendix A**.

1.1 Planning Context

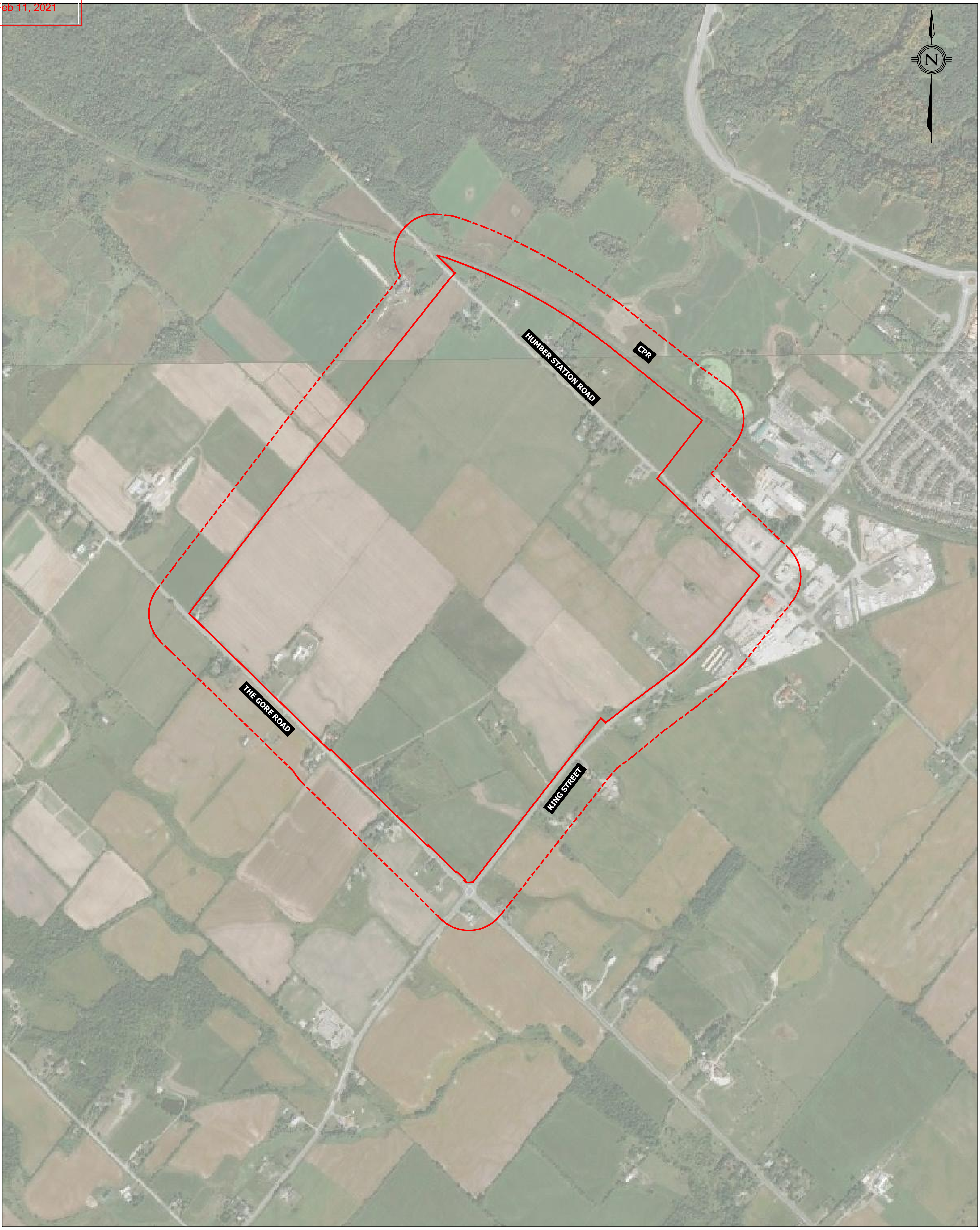
The Growth Plan (2006) set population and employment targets for Peel to achieve to 2031. Regional Official Plan Amendment (ROPA) 24 addressed Growth Plan 2006 conformity for the Region of Peel and OPA 226 was Caledon's response to the Growth Plan and to ROPA 24.

The Town of Caledon adopted Official Plan Amendment 226 (OPA 226) on June 8, 2010 to update population and employment forecasts and allocations for the 2031 planning horizon pursuant to the Growth Plan (2006) and pursuant to the Region of Peel Official Plan. Through OPA 226, it was determined that 190 hectares of additional designated greenfield area in Bolton is required to accommodate 10,348 people and 2,635 jobs (population related) by 2031.

The Town of Caledon undertook the Bolton Residential Expansion Study (BRES) to identify a recommended expansion area to accommodate the allocated growth. In September 2014, Caledon submitted an application to the Region of Peel to amend the Region of Peel Official Plan (ROPA **30**) to expand the Bolton Rural Service Centre including the planning justification and supporting technical studies to address municipal comprehensive review (MCR) requirements in the Provincial Growth Plan and Region of Peel Official Plan.

Through the Region's ROPA 30 process, several technical reports were prepared (or updated from the Caledon process) to re-evaluate the Option Areas as possible settlement area boundary expansion areas. The Town's BRES process coupled with the Region's ROPA 30 process have fulfilled the Provincial Growth Plan MCR requirements. In December 2016, Regional Council approved ROPA 30 for lands known as Option 6 for the Bolton settlement area expansion. The Region's decision on ROPA 30 was appealed by several parties, including the Option 3 Landowners Group.

ROPA 30 was settled and approved at LPAT on November 30, 2020. Through this approval, the eastern portion of the Subject Lands, consisting of lands on both sides of Humber Station Road, north of King Street, are now within the Bolton Rural Service Centre Settlement Area Boundary and are designated "Urban Area" in the Region of Peel Official Plan. The western portion of the Subject Lands, consisting of lands north of King Street and east of The Gore Road, are currently designated "Rural Area" within the Region of Peel's Rural System in the Region of Peel Official Plan and "Prime Agricultural Area" in the Town of Caledon's Official Plan. These lands are contemplated for inclusion into the Bolton Rural Settlement Area Boundary through the Region of Peel's 2041/2051 MCR Official Plan Review. This is expected to be finalized within the next 12 months.



LEGEND:

▭ **SUBJECT LANDS**

⬚ **STUDY AREA (120 m)**

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FIGURE 1

SITE LOCATION

JANUARY 2021

SCALE: 1:12000

1.2 CEISMP Study Process

1.2.1 Study Purpose

The purpose of the CEISMP is to characterize the biophysical environment and identify constraints and opportunities to future development to help guide the design of the development and associated environmental management systems required to support it. The management plan informs planning and decision making so that changes in land use are compatible with natural systems and consistent with the Provincial Policy Statement (PPS) and applicable Region of Peel and Town of Caledon Official Plan policies.

Additionally, the CEISMP provides a sufficient level of detail and direction for implementation of development in accordance with the PPS, the Region of Peel Official Plan and the Town of Caledon Official Plan. It also identifies all necessary components of an implementation strategy which will ensure that all goals, objectives, targets and other related recommendations and management measures are implemented. This includes identifying additional studies that may be required at the site-specific scale to fill in information gaps were necessary.

1.2.2 Study Area

This CEISMP adopts an integrated subwatershed based study approach. As such, the Study Area limits are variable and are defined by disciplines and scale of investigation. For example, when characterizing groundwater and surface water resources, the Study Area boundaries extend to the limits of the catchments, and when characterizing natural heritage resources, the limits are generally based on application of the 120 m adjacent lands standard as depicted on **Figure 1**, although the CIESMP does give consideration to the Subject Lands within the context of the broader landscape and ecological setting.

1.2.3 Study Goals

The goal of the Macville Community Secondary Plan is to develop the Subject Lands into a complete community that is compact, pedestrian and cyclist-friendly, and transit-oriented while also protecting and enhancing significant and sensitive natural heritage features, and providing input on low-impact development design.

As per the CEISMP TOR, the objective of the study is to “conduct an impact assessment and develop a management plan for the natural environment potentially affected by urban development associated with the expansion of the Bolton Rural Service Centre to accommodate future residential growth to 2031.” Also, the goal CEISMP is to provide a sufficient level of detail and clear direction for the development in accordance with the PPS, Regional Official Plan and Municipal Plan.

Additionally, the goals of this CEISMP are in line with Section 3.2.4.15 of the Town of Caledon’s Official Plan, which lists ways in which the Town assist’s in implementing ecosystem principle, goal and objectives, such as identifying groundwater resources and participating in environmental studies.

1.2.4 Study Team

This CEISMP was prepared using an integrated approach with input from a multi-disciplinary project team. The project team is comprised of experts in the fields of land use planning, ecology, hydrology, hydrogeology and fluvial geomorphology.

A list of Study Team members, their qualifications, and role in the project is provided in **Table 1**.

Table 1. Composition of Study Team, Key Roles and Reports Provided

Firm	Individuals	Title - Qualifications	Key Role and Reporting
Beacon Environmental Ltd.	Ken Ursic	M.Sc. / Senior Ecologist	Project Management *CEISMP Report – Primary Author*
	Shelley Gorenc	M.Sc. P.Geo. / Senior Geomorphologist	Geomorphic Assessment *CEISMP Report - Author*
	Grace Coker	B.Sc. CISEC / Ecologist, Surface Water Technician	Headwater Drainage Feature Assessment *CEISMP Report – Author*
	Anna Cunningham	B.Sc. (Hons.) / Ecologist	Amphibian Surveys, Incidental Wildlife *CEISMP Report – Author*
	Dan Westerhof	B.Sc. MES / Terrestrial Ecologist, Certified Arborist	Vegetation Survey *CEISMP Report - Author*
	Ahmed Siddiqui	B.Sc. (Hons.), M.Sc. / River Scientist	Figure Production
	Devin Upper	GIS Analyst / Environmental Scientist	Figure Production
Urbantech Consulting	Paul Chiocchio	Water Resources Coordinator	Functional Servicing Report *CEISMP Report - Author*
	Dragan Zec	P.Eng. / Partner	Functional Servicing Report
	Brad Kargus	P.Eng. / Associate, Water Resources	Functional Servicing Report *CEISMP Report - Author*
DS Consultants Ltd.	Keith Buth	Vice President	Hydrogeological Report
	Scott Watson	B.A.T / Manager	Hydrogeological Report *CEISMP Report - Author*
Gerrard Designs	Ryan Kearns	Designer	Input to Figure Production
Glen Schnarr & Associates Inc. (GSAI)	Glen Schnarr	MCIP, RPP, Partner	Project management of planning process to establish Secondary Plan
	Karen Bennett	MCIP, RPP, Senior Associate	

2. Regulatory Framework for Environmental Protection

To ensure that the proposed Land Use Plan for the Macville Community Secondary Plan and it associated environmental management systems (NHS, Stormwater Management Strategy, etc.) are consistent with requirements outlined in the applicable environmental legislations, regulations and policies related to protection and management of natural resources, the following regulatory framework has been developed to summarize the various legislation, regulations and policies that need to be considered through this land use planning process. Refer to **Figure 2** for the location of existing environmentally designated protection areas that are proximal to the Subject Lands.

The regulatory framework presented below in **Table 2** provides a summary of key statutory requirements and policy tests that need to be satisfied. The purpose of including this framework in this CEISMP is to inform the constraint analysis presented in **Section 4** which was used to guide the design of the Macville Community Secondary Plan Land Use Plan and Preliminary Framework Plan to ensure these plans are consistent with the various regulatory requirements relating to environmental protection and enhancement. Compliance with applicable environmental legislations, regulations and policies regulations is addressed in **Section 10** of the CEISMP.

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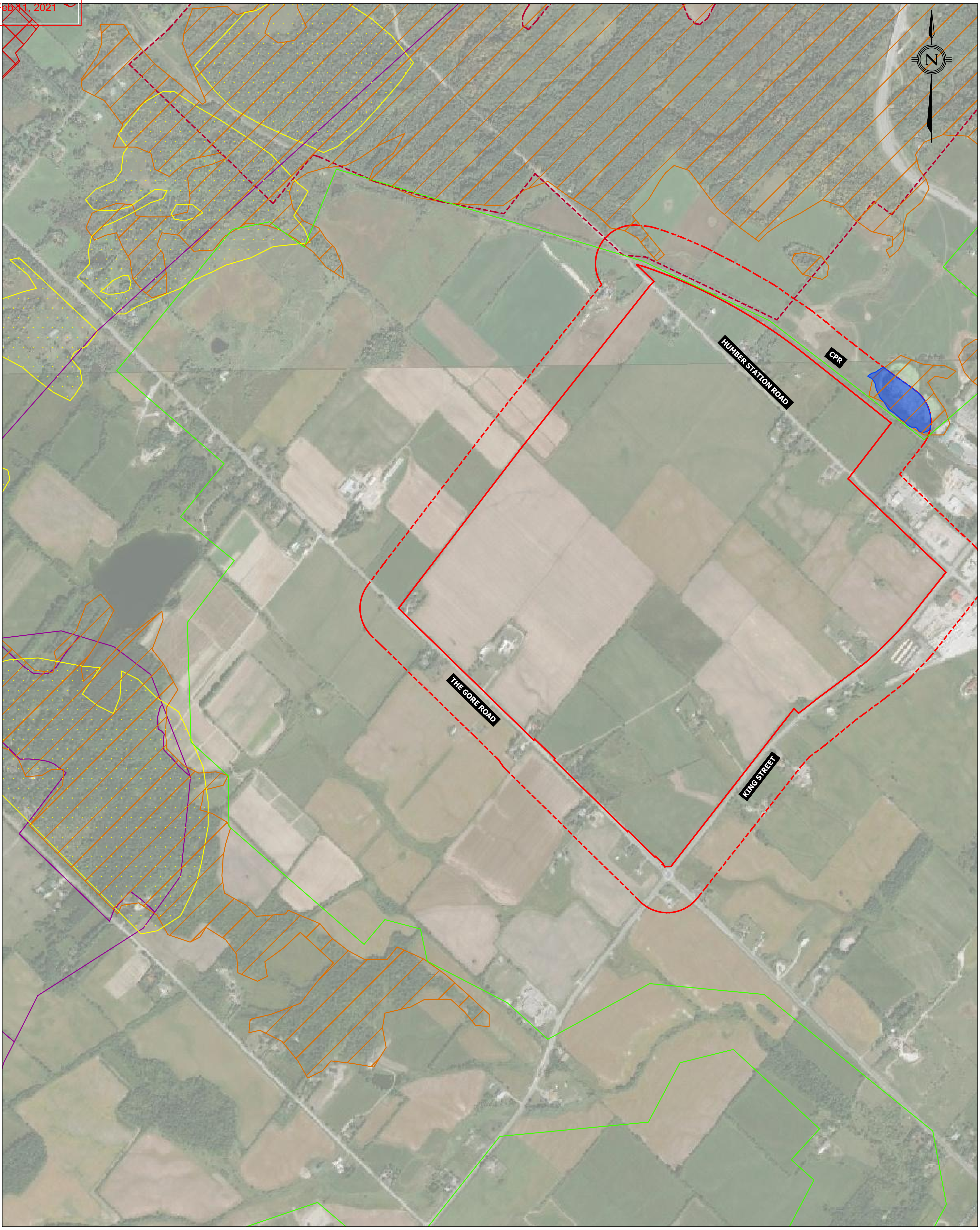

LEGEND:

- ☐ SUBJECT LANDS
- ⬚ STUDY AREA (120 m)
- 🟩 GREENBELT
- 🟪 OAK RIDGES MORAINE
- ▨ REGION OF PEEL GREENLANDS SYSTEM
- 🟨 CALEDON ENVIRONMENTAL POLICY AREA
- 🟦 PROVINCIALLY SIGNIFICANT WETLANDS
- ☒ ANSI, LIFE SCIENCES
- ┅ BOLTON RESOURCE MANAGEMENT TRACT

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FIGURE 2

DESIGNATED ENVIRONMENTAL AREAS

JANUARY 2021

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Table 2. Regulatory Framework for Environmental Protection

Level of Government	Act/Regulation/ Policy/Guideline	Type	Purpose	Relevance to the Macville Community Secondary Plan Application
Federal	*Fisheries Act* (1985)	Act	To ensure the conservation and protection of fish and fish habitat.	Fish habitat is present on the Subject Lands. Development activities taking place in or near water may affect fisheries by adversely affecting fish or fish habitat. DFO recommends that proponents of these activities should undergo the following: • Understand the types of impacts their projects are likely to cause; • Take measures to avoid and mitigate impacts to the extent possible; and • Request authorization from the Minister and abide by the conditions of any such authorization, when it is not possible to avoid and mitigate impacts of projects that are likely to cause serious harm to fish. While not relevant at this stage of the land use planning process, compliance the Act will need to be demonstrated as a Condition of Draft Plan approval and prior to commencing site preparation, earthworks and construction.
	Migratory Birds Convention Act (1994)	Act	To protect listed migratory bird species and their nests.	Breeding habitat for listed migratory birds is present of on the Subject Lands. To comply with this legislation, activities that can potentially impact breeding birds must be avoided. While not relevant at this stage of the land use planning process, compliance the Act will need to be demonstrated as a Condition of Draft Plan approval and prior to commencing site preparation, earthworks and construction.
	Species at Risk Act (2002)	Act	To protect the habitats of federally listed species at risk.	Habitat for federally listed Species at Risk is present on the Subject Lands. However, the *Species at Risk Act* applies primarily to lands under federal jurisdiction. Outside of federal lands, the *Species at Risk Act* prohibitions apply only to aquatic species and migratory birds that are also listed in the Migratory Birds Convention Act. This is applicable to the Subject Lands as fish habitat and nesting birds are present.
Provincial	*Conservation Authorities Act* (1990)	Act	The Conservation Authorities Act and provides the legislative, operational jurisdictional and regulatory framework for Conservation Authorities.	Under the Act, Conservation Authorities have the authority to regulate activities in areas under their jurisdiction through issuance of permits.
	Fish and Wildlife Conservation Act (1997)	Act	The *Fish and Wildlife Conservation Act* enables the Ministry of Natural Resources (MNR) to provide sound management of the province's fish and wildlife.	The *Fish and Wildlife Conservation Act* protects the nest or eggs of bird not already protected on the *Migratory Birds Convention Act* with some exceptions.
	Endangered Species Act (2007)	Act	This Act provides protection to the habitats of endangered and threatened species in Ontario.	Habitat for provincially listed Species at Risk is present on the Subject Lands. Where habitat exists for threatened or endangered species, such habitats are to be protected in accordance with the provisions of the Act and its regulations (Ontario Regulation 242/08). If a proposed activity has the potential to impact the habitats of threatened or endangered species, then the activity must be authorized by Ministry of Environment, Conservation and Parks (MECP). In some cases, a permit may be required to undertake an activity, while in other cases a Notice of Activity may be registered with the MECP. The Regulation provides exemptions for some species and certain types of activities.
	A Place to Grow: Growth Plan for the Greater Golden Horseshoe 2019 (and Amendment No. 1 2020) (The Growth Plan for the Greater Golden Horseshoe 2019 was prepared and approved under the Places to Grow Act, 2005.)	Provincial Plan	The *Places to Grow Act* was implemented to promote growth plans which reflect the needs, strengths and opportunities of the communities involved, and promotes growth that balances the needs of the economy with the environment. *A Place To Grow: Growth Plan for the Greater Golden Horseshoe* is a long-term plan intended to manage growth through building complete communities, curbing sprawl and protecting the natural environment.	The Growth Plan policies relate to managing growth, housing, designated growth areas, moving people, water/wastewater, natural heritage system and public open space.
	Provincial Policy Statement (2020)	Policy	The Provincial Policy Statement (PPS) provides policy direction to municipalities on matters of provincial interest as they relate to land use planning and development. The PPS provides for appropriate land use planning and development while protecting Ontario's natural heritage and water resources and managing impacts of natural hazards.	All land use planning in Ontario is required to be consistent with the policies of the PPS. These are outlined in • Section 2.1 - Natural Heritage (Policies 2.1.1 - 2.1.9); • Section 2.2 – Water (Policies 2.2.1-2.2.3); and • Section 3.1 - Natural Hazards (Policies 3.1.1-3.1.8).
	Ontario Regulation 166/06 (2013)	Regulation	This Regulation allows TRCA to regulate development activities in and adjacent to wetlands, watercourses and valleylands.	Drainage features and wetlands are found on the Subject Lands. A permit must be obtained from TRCA prior to development or site alteration within these regulated areas.

Level of Government	Act/Regulation/ Policy/Guideline	Type	Purpose	Relevance to the Macville Community Secondary Plan Application
	Living City Policies (TRCA 2014a)	Policy	These policies relate to how TRCA manages its watersheds and regulates activities within areas under its jurisdiction as well as land use planning.	The Study Area supports features and areas that are regulated by TRCA (i.e. drainage features, wetlands and floodplains). The Living City Policies provide direction to land use planning within regulated areas to ensure that land use planning and development are consistent with their regulations.
	Natural Heritage Reference Manual (2010)	Guideline	This manual provides guidance for implementing the natural heritage policies of the Provincial Policy Statement.	Natural heritage features as described under section 2.1 of the PPS are located within the Subject Lands and Study Area. The protection of significant features within an NHS will need to be considered in the land use plan.
	Significant Wildlife Habitat Criteria for Ecoregion 6E (2015)	Guideline	Provides the recommended criteria for identifying Significant Wildlife Habitat (SWH) within Ecoregion 6E.	SWH has been identified as one of the natural heritage feature areas under the Provincial Policy Statement. Tables 1.1 through 1.4 within the Schedules provide guidance for SWH designation for the four categories of SWH outlined in the Significant Wildlife Habitat Technical Guide and its Appendices, while Table 1.5 contains and provides descriptions for exceptions criteria for ecoregional SWH which will be identified at an ecodistrict scale. The CEISMP will assess the Subject Lands for SWH.
	Significant Wildlife Habitat Technical Guide (2000)	Guideline	This guide supports the Natural Heritage Reference Manual. It provides detailed information on the identification, description, and prioritization of significant wildlife habitat.	Planning authorities require proponents to use the guide when completing an ecological site assessment for significant wildlife habitat. This resource will be used to assess SWH on the Subject Lands as part of the CEISMP.
	Redside Dace Development Guidance (2016)	Guideline	The purpose of this document is to provide guidance to persons interested in developing areas in southern Ontario that have Redside Dace (*Clinostomus elongatus*) habitat.	One of the drainage features associated with the Subject Lands demonstrates attributes that may be considered consistent with contributing habitat for Redside Dace. As such, the design of the environmental management systems required to support the land use plan, preliminary framework plan and subsequent draft plans must provide consideration for the protection and enhancement of habitat for this species.
Regional	Region of Peel Official Plan (2018)	Policy	The Peel Region Official Plan contains policies aimed at protecting, maintaining, and restoring a Regional Greenlands System consisting of “Core Areas”, “Natural Areas and Corridors (NACs)”, and “Potential Natural Areas and Corridors (PNACs)”.	The Region of Peel Greenlands System consists of Core Areas, Natural Areas and Corridors (NAC) and Potential Natural Areas and Corridors (PNACs). Currently, Schedule A of the Regional Official Plan does not identify any components of its Greenlands System on the Subject Lands. One of the objectives of the CEISMP is to evaluate features that may qualify are components of the Regional Greenlands System and to identify which of these are to be included within the future NHS and to demonstrate how the land use plan and preliminary framework plans accommodate the NHS.
Municipal	Town of Caledon Official Plan (2018)	Policy	The Town of Caledon Official Plan (2018) provides direction as to the land use within the Town.	Like the Region of Peel Greenlands System, the Town of Caledon has an Ecosystem Framework that consists of four ecosystem components: Natural Core Areas, Natural Corridors, Supportive Natural Systems, and Natural Linkages. Natural Core Areas and Natural Corridors are designated Environmental Policy Area (EPA). Currently, Schedule A of the Town’s Official Plan does not map any EPA on the subject lands. One of the objectives of the CEISMP is to evaluate features that may qualify are components of the Regional Greenlands System and to identify which of these are to be included within the future NHS and to demonstrate how the land use plan and preliminary framework plans accommodate the NHS.
Conservation Authority	Regulation for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (2006)	Policy	This document outlines the procedures and guiding policies of the TRCA in administering Ontario Regulation 166/06, as well as providing legislative background.	Regulated areas occur within the Subject Lands. These relate to floodplain, wetlands and drainage features. Some of these features are considered constraints to development, however others are not and can be eliminated or their functions replicated elsewhere. A permit must be obtained from TRCA prior to development or site alteration within these regulated areas.
	The Living City Policies for Planning and Development in the Watershed (2014a)	Policy	This document contains TRCA’s policies for how to define, protect, enhance, and secure a Natural Heritage System.	The LCP defines the “Natural System” as a combination of 1) water resources, 2) natural features and areas, 3) natural hazards, and 4) any associated potential “natural cover” and/or buffers. Development and site alteration are not permitted in the Natural System, except in accordance with the policies provided in the LCP. Section 7.3 contains TRCA’s policies for how to define, protect, enhance, and secure a Natural Heritage System. The policies described in Section 7.3.1.4 have been identified with the goal of protecting lands that have the potential to be restored in order to enhance existing natural cover and manage natural hazards. The LCP does not permit new development (including lot creation) within hazard lands (i.e., within the floodplain) where no development previously existed. As per Section 7.3.1.4 of the LCP, the TRCA prescribes buffers to natural features and hazards as it may relate to the Subject Lands.
	TRCA’s Humber River Watershed Plan (2008b)	Guideline	Describes current conditions of the Humber River Watershed and provides strategies to protect and enhance it.	The Subject Lands is found within the Humber River Watershed. Chapter 5 of this plan provides management strategies for the environment (including water, air quality and climate change, the aquatic system and the terrestrial system)

3. Existing Conditions

Characterization of existing biophysical conditions in the Study Area is a requirement of the approved CEISMP TOR. Existing biophysical conditions characterized through this CEISMP include:

- Bedrock and Surficial Geology;
- Topography, Slopes and Soils;
- Groundwater Resources;
- Surface Water Resources;
- Terrestrial Resources; and
- Aquatic Resources.

While this CEISMP provide a detailed characterization of biophysical resources in the Study Area, the reader should also consult the Hydrogeological Investigation (DS Consultants Ltd. 2021) included in **Appendix B** and Functional Servicing Report (FSR; Urbantech Consulting 2021).

3.1 Background

To develop an understanding of past and current conditions, all available background information related to the natural heritage resources in the Study Area were obtained and reviewed as required by the CEISMP TOR. This included the following:

- Ministry of Natural Resources' Natural Heritage Information Centre (NHIC) rare species database (accessed August 2020);
- Ontario Breeding Bird Atlas (Cadman *et al*. 2007);
- Ontario Herpetofauna Summary Atlas (Ontario Nature 2020);
- Ontario Butterfly Atlas (MacNaughton *et al.* 2016);
- Fisheries and Oceans Canada Aquatic Species at Risk Distribution Mapping (DFO 2020); and
- Historical and current aerial photography (1956 – 2018).

In addition to the above, the CEISMP has also relied on background information prepared on behalf of the Town of Caledon. This includes, but is not limited to the following:

- Bolton Residential Expansion Study: Background Environmental Study in Support of a Regional Official Plan Amendment, Dougan & Associates, Aquafor Beech Limited, Cam Portt & Associates, BluePlan Engineering Consultants Ltd. and Meridian Planning (October 2014b);
- Bolton Residential Expansion Study – Phase 3: Technical Memorandum- Development of a Preliminary Natural Heritage System, Dougan & Associates, Aquafor Beech Limited, Cam Portt & Associates, BluePlan Engineering Consultants Ltd. and Meridian Planning (Revised June 16, 2014a);
- Headwater Drainage Features Assessment Aquafor Beech Limited (June 16, 2013); and
- Bolton Residential Expansion Study: Phase 2 Technical Memorandum – Natural Heritage, Dougan & Associates (June 19, 2013).

3.2 Physical Resources

This section characterizes the physical resources of the Subject Lands and Study Area. To understand the physical setting, topographic maps, environmental, geotechnical, and hydrogeological reports were used. Additionally, the borehole logs from site specific investigations and Water Well Records (MECP WWRs) from the MECP were used to interpret the geological and hydrogeological conditions.

3.2.1 Bedrock Geology

Available published mapping indicates that bedrock in the area predominantly comprises of shale and minor limestone part of the Queenston Formation (MNDM Map 2544 Bedrock Geology of Ontario). As part of the borehole drilling program within the Macville Community Site area, bedrock was not encountered to 11.3 meters below ground surface (mbgs) (Elev. 250.4 meters above sea level [masl]), which was the maximum depth of investigation. Based on the MECP water well records, there are ten (10) water well records which were reportedly completed into bedrock. The thickness of the overburden generally ranged from 29.9 mbgs to 76.2 mbgs, based on nine (9) well records (MECP WWR No. 4908193, 1908194, 1907399, 1906470, 4905615, 7275497, 4903854, 7267796 and 4904216). There is one (1) well record (MECP WWR No. 4905839) located approximately 490 m northeast of the Subject Lands with a reported depth to bedrock of 11.6 mbgs. This well record is located within the valley lands of the Humber River, and for this reason the ground surface elevation of the well is likely significantly lower than of the Subject Lands.

It is understood that the detailed design of the proposed plans for development have not been finalized at this stage. These specific details include, among other items, the maximum depth of excavation/trenching required in support of the proposed development, servicing and storm water management ponds. At this time, it is assumed that the deepest excavation required during the construction phase will extend into the overburden and will not intersect the bedrock surface. For this reason, bedrock in the area does not present a constraint to the proposed plans for development. It should be noted that this assessment will be revisited at the detailed design stage to confirm the depth of proposed excavations.

3.2.2 Physiography and Surficial Geology

Much of the land surface topography and geology in southern Ontario was formed during the most recent glaciation period, known as the Wisconsin Glaciation, which was accompanied by various meltwater lakes and channels. The Pleistocene deposits present in the Caledon and Brampton area were associated with the advancing and retreating of this ice sheet. This glaciation had begun 27,000 years ago and reached its furthest point of advancement approximately 20,000 years ago. During this time, the entirety of southern Ontario was covered by glacial ice until 14,000 years ago when the glacial ice began to retreat.

The Study Area is located within a physiographic region of southern Ontario known as the South Slope and within a physiographic landform feature known as the Drumlinized Till Plain (Chapman and Putnam, 1984). The South Slope physiographic region lies between the Oak Ridges Moraine in the north and the Peel Plain in the south. The South Slope consists of low-lying till plains, with undulating to gently rolling terrain and incised valleys around larger creeks and rivers. The South Slope has a gently, but steady slope to the southeast towards Lake Ontario, which results in overall good drainage.

Surficial geology mapping made available by the Ontario Geological Survey (2010) indicates that the study area is covered entirely by Halton till. There are some glacial deposits of sand and gravel to the west of the Subject Lands and modern alluvial deposits of silt, sand, and gravel to the east along tributaries to the Humber River. The overburden in the vicinity of the Study Area is clayey silt to sandy silt till deposits (Halton till). An illustration of surficial geology for the Study Area is provided in Figure 3 with the Hydrogeological Investigation (**Appendix B**).

The Halton Till surficial deposits on the Subject Lands consist of tight soils that would have low resulting soil percolation rates. For this reason, it is expected that there will be a higher volume of surface water runoff following precipitation events which needs to be factored into the overall water balance and feature based water balance. This is discussed further in **Section 4.1.3** of this report.

3.2.3 Topography, Slopes & Soils

The CEISMP TOR requires that a geotechnical investigation within the Study Area be completed to identify areas in which potential slope instability exists. Based on field review as part of the geotechnical investigation completed by DS Consultants Ltd. (2021), there are no slopes on the Subject Lands that would require further investigation regarding potential slope instability. The investigation completed includes the following findings:

The Study Area is characterized by gently rolling topography and the ground slopes generally to the south across the Subject Lands. Relief across the Subject Lands ranges from approximately 281 masl at the highest point in the northwest corner, to 262 masl in the southwest corner.

Soil conditions were first investigated in 2014 by SPL Consultants Ltd. (SPL). The consultant completed geotechnical studies on the Cook and Henry properties located on the north half of the study area. These are two of the largest properties within the Subject Lands. The investigations included completion of twenty-one (21) boreholes. Eleven (11) boreholes on the Henry property and ten (10) boreholes on the Cook property. Figure 2 within **Appendix B** illustrates borehole locations from SPL, 2014. A summary of the findings is provided below.

- Based on all twenty-one (21) boreholes, SPL (2014) encountered a topsoil/organic layer with a thickness ranging from 200 to 300mm throughout the site. The topsoil is underlain with a shallow layer of disturbed/reworked till extending 0.7 to 1.4 mbgs. Localised fill was encountered in BH14-07 on the Henry property, extending 2.1 mbgs.

- SPL (2014) encountered a surficial layer of clayey silt till to silty clay till in all but one borehole throughout the two investigations. This layer extended to depths ranging from 1.1 to 4.0 mbgs on the Henry property and 7.1 to 11.1 below ground surface (bgs) on the Cook property. The consistency of this material was stiff to hard with N values ranging from 11 to 60 and moisture contents ranging from 9% to 19%.

- Sandy silt till was encountered in boreholes BH14-03, BH14-05, BH14-09, and BH14-11 on the Henry property and BH14-03, BH14-09, and BH14-11 on the Cook property. This layer extended 4.0 to 9.1 mbgs throughout and reached the limit of exploration at some locations. N values ranged from 23 to greater than 100 blows per 300mm penetration and moisture contents ranged from 6% to 11%.

- Native cohesionless sandy silt to silty sand was encountered in all boreholes but BH14-05 and BH14-11 on the Henry property and extended to the depth of termination in all locations. On the Cook property, only BH14-04 and BH14-10 contained this material and it extended to depth of termination in BH14-04 but only to 2.1 mbgs in BH14-10. N values ranged from 3 to greater than 100 blows per 300mm penetration indicating a very loose to very dense state. Natural water contents ranged from 14% to 25%.

As part of current investigations, on-site subsurface soils were interpreted from the boreholes/monitoring wells (BHs/MWs) drilled by DS. The locations of the BHs/MWs are shown in Figure 2 within **Appendix B** and detailed subsurface conditions are presented on the borehole Logs in **Appendix B**.

In summary, the Subject Lands are underlain by a surficial layer of topsoil / fill / disturbed native material, which in turn was underlain by native soil deposits extending to the full depth of investigation. The native soil deposits on the Subject Lands comprised of clayey silt till to silty clay till (Halton Till), which in turn was underlain by silt to sandy silt/sandy silt deposits. Sand and gravel alluvium deposits were encountered in the southeast corner of the Subject Lands (BH20-16). Bedrock was not encountered during the subsurface investigation.

Geological Cross-Sections A-A’ to F-F’, which depict the stratigraphic setting at the Subject Lands are provided in Figure 6A to 6F within **Appendix B**.

The stratigraphic conditions encountered in the boreholes are further summarized below.

Topsoil/Fill/Disturbed Native

At all borehole locations but BH20-04, topsoil was encountered at the surface. Topsoil depths vary from 200mm to 550mm with an average thickness of 340mm. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative of the Study Area and should not be relied on to calculate the amount of topsoil at the site.

Fill/disturbed native material was encountered at all boreholes to a maximum depth of 0.8m below ground surface. The fill/disturbed material consisted of sandy silt to clayey silt, trace gravel, trace topsoil/organics throughout.

Halton Till Deposits (Clayey Silt Till to Silty Clay Till)

Glacial till deposit of clayey silt till to silty clay till with traces of sand and gravel was the predominant surficial material encountered in all boreholes except BH20-4. The till deposits contained occasional wet silt or sand seams/layers. This layer extended to depths of 1.5 to 11.3mbgs and to the depth of investigation at BHs 20-6, 20-7, 20-10, 20-14, and 20-15. “N” values ranged from 8 to 72 blows for 300mm penetration.

Newmarket Till (Silt / Sandy Silt / Silty Sand)

Silt/sandy silt/silty sand was encountered in all BHs but BH20-6, 20-7, 20-10, 20-14, and 20-15 extending to the limits of excavation wherever it is present. A massive layer of silty sand to sandy silt Newmarket till likely underlies the Halton till and modern alluvial deposits throughout the site, even where clayey silt is found to the extent of boreholes. “N” values ranged from 7 to greater than 100 blows for 300mm penetration.

Modern Alluvium (Sand and Gravel)

Sand and gravel deposits are not common throughout the Study Area however they are present at the southeast corner near at BH 20-16 where a sand and gravel layer exist between 1.5 and 6.2 mbgs and is intersected by a sandy silt layer from 3.3 to 4.5 mbgs.

3.2.4 Groundwater Resources

The CEISMP TOR requires that a hydrogeological investigation within the Study Area be completed to identify and responsibly manage groundwater resources as it relates to private groundwater users, wetlands, watercourses, fishery resources and other features that are potentially sensitive to changes in groundwater availability. The following sections provide an overview of the general hydrogeological characteristics of the Subject Lands. The hydrogeological conditions were evaluated using the data collected from the MECP water well records, on-site monitoring wells installed as part of this investigation, and existing reports for the area.

As part of the hydrogeological study, DS Consultants Ltd. completed a search of the MECP WWR database. Based on the MECP water well records search, there are seventy-three (73) water wells within 500 meters of the Subject Lands. Forty-seven (47) water wells are noted as domestic supply wells and six (6) wells are noted as commercial or industrial supply wells. Eight (8) wells are noted as test holes or monitoring wells. The remaining twenty-three (12) wells are either abandoned or unknown use. Private domestic and commercial water supply wells are drilled into sandy aquifers confined under clay till. The depths of these wells range from 5.5 to 65.2 mbgs. Domestic water supply records exist for wells drilled between the dates of January 15th, 1957 to June 13th, 2016. The water well record summary is included in **Appendix B**. Figure 1 within the Hydrogeological Investigation (**Appendix B**) shows the MECP water well location plan.

There are no records of permits to take water (PTTW) within 500 m of the Subject Lands.

3.2.4.1 Hydrostratigraphy

The major regionally extensive hydrostratigraphic units in the general area are comprised of the following, from shallowest to deepest (TRCA 2007):

(i) Surficial Aquifer (incl. weathered Halton Till);
(ii) Halton Till (Aquitard);
(iii) Oak Ridges Aquifer / Mackinaw Interstadial (ORAC);
(iv) Newmarket Till (Aquitard);

(v) Thorncliffe Aquifer (incl. tunnel channels);
(vi) Sunnybrook Aquitard;
(vii) Scarborough Aquifer; and
(viii) Weathered Bedrock.

The regionally extensive surficial aquifer consists of a sequence of glaciolacustrine deposits which cover the underlying tills (Halton and Newmarket). These deposits generally consist of near shore sands and gravel beach deposit within the shoreline of the ancient glacial Lake Iroquois in the southern portion of the watershed and glaciolacustrine fine sands, silt and clay deposits north of the ancestral lake footprint. These also include the upper weathered portion of the underlying Halton Till deposits. Generally, these deposits form a thin veneer over the underlying deposits, however, may be several meters thick locally.

The Halton Till underlies the surficial aquifer and is predominantly comprised of sandy silt to clayey silt till interbedded with silt, clay, sand and gravel. The Halton Till becomes rich in clay content in areas where the glacial ice has overridden glaciolacustrine deposits. This unit is considered a regionally extensive aquitard layer, which generally confines the underlying Oak Ridges Aquifer.

The Oak Ridges Aquifer is a stratified sediment complex that is related to the Oak Ridges Moraine physiographic feature. This stratigraphic unit is 160 km long and varies from 5 km to 20 km in width. The Oak Ridges Aquifer overlies the Newmarket Till and older sediments. The Oak Ridges Aquifer deposits are understood to have been deposited in a glacial lake that formed between the two retreating glacial ice lobes (Lake Ontario and Simcoe) and the Niagara Escarpment in the west approximately 12,000 to 13,000 years ago. The aquifer generally comprises of glaciofluvial, transitional to glaciolacustrine subaqueous fan and delta sediments.

The Newmarket Till was deposited 18,000 to 20,000 years ago by the Laurentide ice sheet. The till predominantly comprises of calcite-cemented sandy silt to silty sand with limestone clasts and represents a dividing aquitard between the overlying shallow aquifer system (Oak Ridges) and the underlying deep aquifer systems (Thorncliffe Aquifer and the Scarborough Aquifer). Breaches in the till have been formed through meltwater erosion activity and is referred to as Tunnel Channels. The Tunnel channels are associated with subglacial floods and predominantly consist of sandy sediments under confined conditions within the Newmarket Till. These tunnel channels also breach into underlying deeper aquifer systems and can yield high volumes of groundwater.

The Thorncliffe Aquifer underlies the Newmarket Till and was deposited approximately 45,000 years ago. This aquifer comprises of glaciofluvial deposits consisting of sand and silty sand in the lower lying areas of the underlying deposits. In the southern portion, the formation consists of silt, sand and pebbly silt and clay deposits originating from glacial meltwater entering into ancient Lake Iroquois. Breaches of the tunnel channels also reach into the Thorncliffe Aquifer and are a strong source of groundwater yield.

The Sunnybrook Drift Aquitard was deposited approximately 45,000 years ago and are comprised of silt and clay material. The Sunnybrook Drift aquitard formed were deposited at the base of a glacially dammed lake, which was reportedly 100 m deeper than modern day Lake Ontario (TRCA 2009). The Sunnybrook Drift acts as an aquitard divide between the upper Thorncliffe Aquifer and the underlying Scarborough Aquifer.

The Scarborough Aquifer is the deepest overburden hydrostratigraphic unit in the Humber River watershed and marks the commencement of the Wisconsin glaciation approximately 70,000 to 90,000 years ago. The aquifer deposits comprise organic rich sand deposits overlying silts and clays. The deposits originated from a fluvial-deltaic system, which was fed by braided meltwater rivers draining from an ice sheet. Weathered bedrock underlies the Scarborough Aquifer system.

The direction of groundwater flow in the shallow and deep flow systems generally follows the regional topography from the Oak Ridges Moraine in the north towards Lake Ontario in the south. The influence of the surface topography on the direction of groundwater flow is greatest in the shallower flow systems with wanning influence towards the deeper flow systems. There are deviations in the regional groundwater flow patterns towards local streams and/or watercourses in the watershed. The predicts there are inter-watershed flows into the Humber River in the East Caledon area from the Credit River into the Oak Ridges Aquifer and the Thorncliffe Aquifer.

Based on the borehole drilling investigation carried out by DS Consultants Ltd. within the Macville Community boundary, the subsurface conditions on the Subject Lands comprised of native deposits inferred to be part of the Halton Till (silty clay) overlying the Newmarket Tills (silty sand / silt). Recent sand and gravel alluvium deposits associated with the tributaries of the Humber River were noted in the southeast corner of the Subject Lands.

It is understood that the detailed design of the proposed plans for development have not been finalized at this stage. These specific details include, among other items, the maximum depth of excavation/trenching required in support of the proposed development, servicing and storm water management ponds. At this stage, it is assumed that the deepest excavation required during the construction phase will be limited to 4 m below the existing ground surface. For this reason, the depth of excavation in support of the proposed plans for construction will likely be advanced into the inferred Newmarket Till, which does not provide any significant constraints to the construction works. It should be noted that if at the detailed design stage, the above assumptions do not hold true, then this assessment will need to be revisited based on the correct design details.

3.2.4.2 Groundwater Levels

To assess groundwater levels across the Study Area, DS Consultants Ltd. (2021) implemented a manual groundwater monitoring program starting in August 2020 and continuing on a monthly basis to assess long-term groundwater fluctuations. Within the Hydrogeological Investigation (**Appendix B**), Figure 2 shows the monitoring well locations and Table 1 presents a summary of the measured groundwater level elevations in all monitoring wells and piezometers for August through October 2020. The highest water levels were encountered on August 6, 2020, and ranged from 0.97-7.63 mbgs, corresponding to elevations ranging from 261.73-275.72 masl. Based on measured water levels, the localized groundwater flow in the vicinity of the Study Area is interpreted to be in a general southeasterly direction. More specifically, there is a groundwater divide in northwest sections of the Subject Lands corresponding to changes in topography. Groundwater is observed as moving east and south from high to low areas of the Subject Lands.

Continuous water level monitoring was conducted on four monitoring wells at BH20-5, BH20-7, BH20-12, and BH20-16. Continuous monitoring was completed using a fixed interval pressure and temperature data recording device which was corrected for atmospheric pressure from a central location on the site. The data is displayed in hydrographs which can be found in Appendix F of the

Hydrogeological Investigation (**Appendix B**). The water levels show limited variation in the first three months of monitoring. In BH20-5, water levels are shown to have fallen from 270.2 - 269.7 masl from August to October. In BH20-7 the water level has steadily increased from 254.1 to 258.3 over August to October, a result of low permeability within the screened clay soils limiting the rate of recharge in the well. In BH20-12 the water level has remained unchanged at approximately 264.8 masl. In BH20-16, water levels have fluctuated between 262.9 to 263.4 masl. With exception to BH 20-7 which had not reached stabilization, the water levels have slightly declined throughout the Subject Lands from late summer to fall.

3.2.4.3 Horizontal and Vertical Gradients

As determined through the groundwater monitoring program, groundwater is observed as moving east and south from high to low areas of the site. The average horizontal gradient is about 0.009 metre/metre from west to east across the north half of the site. From north to south the average horizontal groundwater gradient is around 0.001 m/m in the north half to 0.008 in the south half of the Site. The vertical hydraulic gradient on the Subject Lands is generally downward, except for an upward gradient observed in the nested piezometers (W8-PZS and W8-PZD) at the location of Wetland 8. The vertical hydraulic gradient at Wetland 8 is estimated during the current monitoring period to be 0.036 m/m. Groundwater discharges to surface streams at the southwest and southeast limits of the site. A groundwater flow direction map is provided in Figure 4 within the Hydrogeological Investigation (**Appendix B**).

3.2.4.4 Recharge/Discharge Areas

Presence of any groundwater recharge/discharge areas on the Subject Lands under the pre-development conditions is currently being characterized as part of the current ongoing study in support of the Macville Community Secondary Plan. Any groundwater recharge/discharge that is currently present on the Subject Lands will need to be assessed to determine whether it provides for contributions to natural wetland features at the Site.

A 1-year pre-construction surface water and groundwater monitoring program of the Subject Lands is currently underway, and this report includes the findings from the data collected to-date during the August to October of 2020 monitoring period. The pre-construction monitoring period will at a minimum continue until August 2021. All staff gauges installed within the wetlands and monitoring wells BH20-5, BH20-7, BH20-12 and BH20-16 on the Subject Lands have been instrumented with a Levelogger^{TM} to allow for continuous monitoring at every 15-minute intervals. The monitoring program includes a site visit on an every 1-month basis to retrieve the water level data from the Levelogger^{TM} and to collect manual readings within all surface stations and monitoring wells. Observations for any evidence of groundwater seepage and/or springs throughout the Study Area is obtained during the bimonthly monitoring events.

Based on the monitoring of groundwater levels in the nested piezometers screened within the shallow soils, vertical hydraulic gradients on the Subject Lands are generally observed to be downward during the August to October 2020 monitoring period. The groundwater elevations in the monitoring wells are noted to be lower than the levels measured in the piezometers, and further reinforce this observed trend of downward groundwater gradients. On this basis, based on the minimum outflow from most wetlands and the water levels at the Site, surface water has generally been a likely source of shallow groundwater recharge in the majority of the Study Area during the current monitoring period. Groundwater seepage on the Subject Lands is expected to occur at areas where the shallow groundwater in the upper permeable soils discharge/exit along slopes and/or wetland/stream banks. During the current monitoring period, upward groundwater gradients on the Subject Lands were noted at the location of Wetland 8. Groundwater levels in Monitoring Wells BH20-6 and BH20-12 indicate near surface potentiometric levels and have the potential to provide for groundwater seepage at the ground surface during periods of higher groundwater tables. The groundwater elevation at these monitoring wells and surface water monitoring stations are currently below the existing ground surface, however it is likely that during the spring period, the elevations may rise and provide for groundwater discharge to the wetlands or seepage along the ground surface.

Further monitoring of surface water and groundwater will be required to confirm seasonal baseline fluctuations and areas of groundwater discharge/recharge. Once the 1-year monitoring program has been completed, an update to the recharge/discharge assessment will be provided.

3.2.4.5 Hydraulic Conductivity

Single Well Response Tests (SWRTs) were completed in nine (9) select monitoring wells on August 6th and 7th, 2020 to estimate hydraulic conductivity (K) for the representative geological units in which the wells are screened. SWRTs were completed by performing a rising head test (slug test) using a bailer to extract a known volume of water from the well. A Levelogger™ was placed at the bottom of the wells to monitor recovery. Hydraulic conductivity values were calculated using the Bouwer and Rice method. A summary of the hydraulic conductivity testing results is provided in **Table 3** below.

Table 3. Summary of Hydraulic Conductivity (K) Test Results

Well ID	Screen Interval (masl)	Screened Formation	K- Value(m/s)
BH20-1	272.2 m to 273.7 m	Silt	7.3×10^{-7}
BH20-5	264.0 m to 275.5 m	Silty sand	5.3×10^{-7}
BH20-6	262.5 m to 264.0 m	Clayey silt till, sand seams	1.4×10^{-7}
BH20-9	266.5 m to 268.0 m	Silty clay till, some sand	3.2×10^{-6}
BH20-11	261.0 m to 262.5 m	Silt, some sand	5.2×10^{-8}
BH20-12	257.3 m to 258.8 m	Silt	7.3×10^{-7}
BH20-14	257.1 m to 258.6 m	Silty clay till, some sand	6.0×10^{-7}
BH20-15	255.0 m to 256.5 m	Clayey silt till, some sand	7.4×10^{-9}
BH20-16	251.8 m to 259.4 m	Silty sand, some clay	1.5×10^{-8}

Based on the results of the single well response testing, the hydraulic conductivity values of the screened clayey silt till and sandy silt till units underlying the Subject Lands ranged from 7.4×10^{-9} m/sec to 3.2×10^{-6} m/sec. The hydraulic conductivity testing results are provided in **Appendix B**.

3.2.4.6 Groundwater Chemistry

The Provincial Groundwater Quality Monitoring Network (PGMN) was approved in April 2000 by the Ontario Cabinet in response to the observed low water conditions noted during 1999 in many parts of southern Ontario. The PGMN is a partnership program that comprise of all 36 conservation authorities and 10 municipalities in the province of Ontario. The mandate of the PGMN is to collect and manage ambient/baseline groundwater levels and quality data from major aquifers in the province to ensure the groundwater resources are not being impacted from activities and development on land and/or from exploitation of water resources. The PGMN consists over 400 groundwater monitoring wells across Ontario, of which there are currently twenty-one (21) wells in the Humber River Watershed (TRCA 2013).

The initial round of groundwater sampling in the PGMN wells was undertaken by the MECP and the samples were analyzed against the Provincial Water Quality Objectives (PWQO) for a wide variety of parameters including anions, cations, heavy metals, nutrients, bacteria, chlorinated solvents, volatile organic compounds (VOCs), herbicides and pesticides (TRCA 2008a). The results of the analytical testing completed by the MECP indicated that the groundwater quality met the permissible limit of all analyzed parameters against their respective PWQO criteria.

The subsequent round of groundwater sampling was conducted by the TRCA in 2004 and 2005 and the monitoring program included a reduction in the original list of analyzed parameters by the MECP. The sampling of the PGMN monitoring wells by the TRCA included analysis of groundwater quality for anions, cations and heavy metals. The results of the sampling by the TRCA were compared against the Ontario Drinking Water Quality Objectives (ODWQS) and the PWQO, where applicable. The PGMN monitoring wells located in the Bolton and Caledon East area which were sampled as part of this monitoring program are reportedly screened within the Thorncliffe (Intermediate) Aquifer. The results of the analytical testing completed by the TRCA in the watershed indicated that the groundwater quality generally met the permissible limit of all analyzed parameters against the most stringent criteria between the ODWQS and PWQO. The TRCA (2008a) reported exceedance of some analyzed parameters against the ODWQS in the Bolton and Caledon East PGMN wells during the Fall 2004 sampling period, as per the following:

- There was an exceedance in the Bolton PGMN well (W327) for total manganese;
- There was an exceedance in the Caledon East PGMN well (W330) for total dissolved solids (TDS); and
- There was an exceedance in both the Bolton (W327) and Caledon East (W330) PGMN wells for iron and total hardness.

The exceedance for iron, total manganese, and total hardness are reportedly not unusual in groundwater and are generally naturally occurring.

As per the TRCA (2013), the overall quality of groundwater in the watersheds of the TRCA is classified as “Good” with the optimal quality of groundwater to be found in the Thorncliffe (Intermediate) Aquifer on the Oak Ridges Moraine. Most wells in the watershed indicate concentrations for nitrates and nitrites are within acceptable levels and display minimal impacts from agricultural practices or leaky septic systems. There are exceedances in the chloride levels above the Canadian drinking water standards in several monitoring wells located in the urbanized areas of the watershed. These exceedances are likely as a result of road salt application for de-icing purposes during the winter period and/or background concentrations in the deep aquifers overlying the shale bedrock which contain naturally elevated concentrations of chloride (TRCA 2013).

Non-filtered groundwater samples were collected from select monitoring well location (BH 20-4) on the Subject Lands on September 4th, 2020 to assess the groundwater quality. The collected samples were submitted to SGS Laboratory in Lakefield, Ontario. SGS Laboratory is a Canadian Association of Laboratory Accreditation Inc. (CALA) and Canadian Standard Association (CSA) certified. Groundwater quality results were compared to parameters listed in the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to nearby surface water features. **Table 4** below presents a summary of exceeded parameters, and the certificate of analysis is provided in Appendix D within the Hydrogeological Investigation (**Appendix B)**.

Table 4. Parameters in Groundwater Exceeding MECP Guidelines

Parameter Exceeded	Guideline	Unit	Borehole #	Guideline limit	Concentration
Cobalt	MECP O.Reg. 153/04	µg/L	20-4	**3.8**	**5.16**

Based on the results of the analytical testing, the quality of groundwater from the monitoring wells at on the Subject Lands met the permissible limit of all analyzed parameters with the exception of Total Cobalt, which exceeded its respective PWQO criteria.

3.2.5 Surface Water Resources

3.2.5.1 Subwatershed Catchment Areas

The drainage features on the Subject Lands are within the West Humber River and Main Humber River watershed.

The Subject Lands are situated at the approximate drainage divide between the West Humber River and Main Humber River watersheds. Within the FSR (Urbantech Consulting 2021), Drawing 201 illustrates existing drainage patterns and subcatchments within the Subject Lands and immediate surrounding area. It is noted that the pre-development conditions provided by TRCA, including the subcatchment drainage boundaries within the West Humber and Main Humber watersheds intersected by the Subject Lands, have been refined on Drawing 201 (Urbantech Consulting 2021) from recent topographic surveys carried out locally to clarify flow paths, drainage boundaries and outlets.

The majority of the Subject Lands consisting of the west, central and southeast portions is within the West Humber River watershed. These portions consist mainly of some minor headwater features that convey runoff from various West Humber subcatchments that intersect the study area toward culverts along King Street and Humber Station Road. A group of unevaluated wetlands is located just northeast of the intersection of King Street West and The Gore Road.

The northeast portion of the Subject Lands is located within the Main Humber River watershed. This portion consists mainly of some minor headwater features that convey runoff from the intersected Main Humber headwater subcatchments toward the CPR line.

CEISMP **Figures 3.2.5.2a/b** illustrate the drainage features and CEISMP **Figure 4.2** illustrates the constraints and opportunities, within the study area.

The land use with the Subject Lands limits is predominantly agricultural, which has led to modification of the headwater features by farming activities.- In general, the headwater features are poorly defined with ephemeral or intermittent flow.

Table 5 identifies the existing drainage outlets for the Study Area represented on Drawing 201 within the FSR (Urbantech Consulting 2021) and the respective contributing drainage areas.

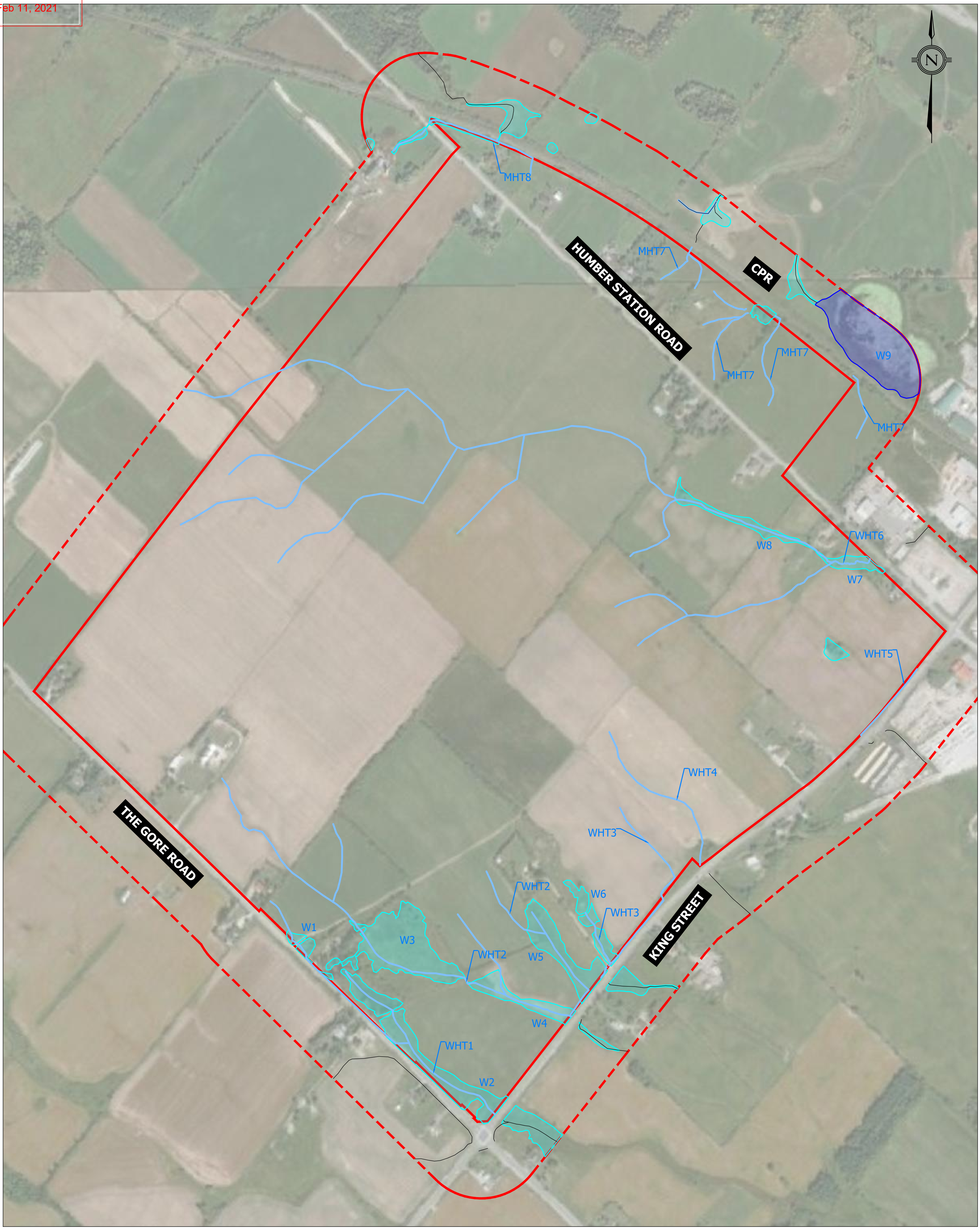
Table 5. Existing Study Area Drainage Outlets

Outlet	Existing Drainage Area [ha]
West Humber River Outlet / Flow Node	
Node E3, 3.50m Wide Concrete Box Culvert at The Gore Road	562.34
Total West Humber River Drainage Area at The Gore Road Crossing	**562.34**
Main Humber River Outlets	
Node 6, 800mm Concrete Box Culvert Across CPR	18.80
Node 7, Culvert Across CPR	2.78
Node 8, 700mm Concrete Box Culvert Across CPR	19.00
Total Main Humber Drainage Area Within MVSP	**40.58**

Under proposed conditions, southeasterly drainage within the Subject Lands, west of Humber Station Road, will be consolidated to a single outlet at the existing Humber Station Road crossing at Node 5. The consolidation to Node 5 includes drainage that contributes to Node 4 under existing conditions, from private property within the Subject Lands. Consolidation is not proposed for three (3) King Street crossings at the southwest of the Subject Lands (i.e. Nodes 1, 2 and 3), in order to maintain drainage conditions for the unevaluated wetland features.

There are three (3) minor headwater reaches within the Main Humber River consisting of three (3) culverts across the Canadian Pacific Railway (CPR) line. The existing and proposed conditions to each culvert have been evaluated in Section 6 of the FSR (Urbantech Consulting 2021).

Refer to Section 5 of the FSR (Urbantech Consulting 2021) for the discussion regarding existing versus proposed drainage outlets.



LEGEND:

- 🟥 SUBJECT LANDS
- ⬚ STUDY AREA (120 m)
- 🟦 PROVINCIALLY SIGNIFICANT WETLANDS
- 🟦 UNEVALUATED WETLANDS
- — DRAINAGE FEATURES
- — UNASSESSED DRAINAGE FEATURES
- W1 WETLAND NUMBER
- WHT1/MHT1 TRIBUTARY NAME AND NUMBER (i.e. WEST HUMBER TRIBUTARY; MAIN HUMBER TRIBUTARY)

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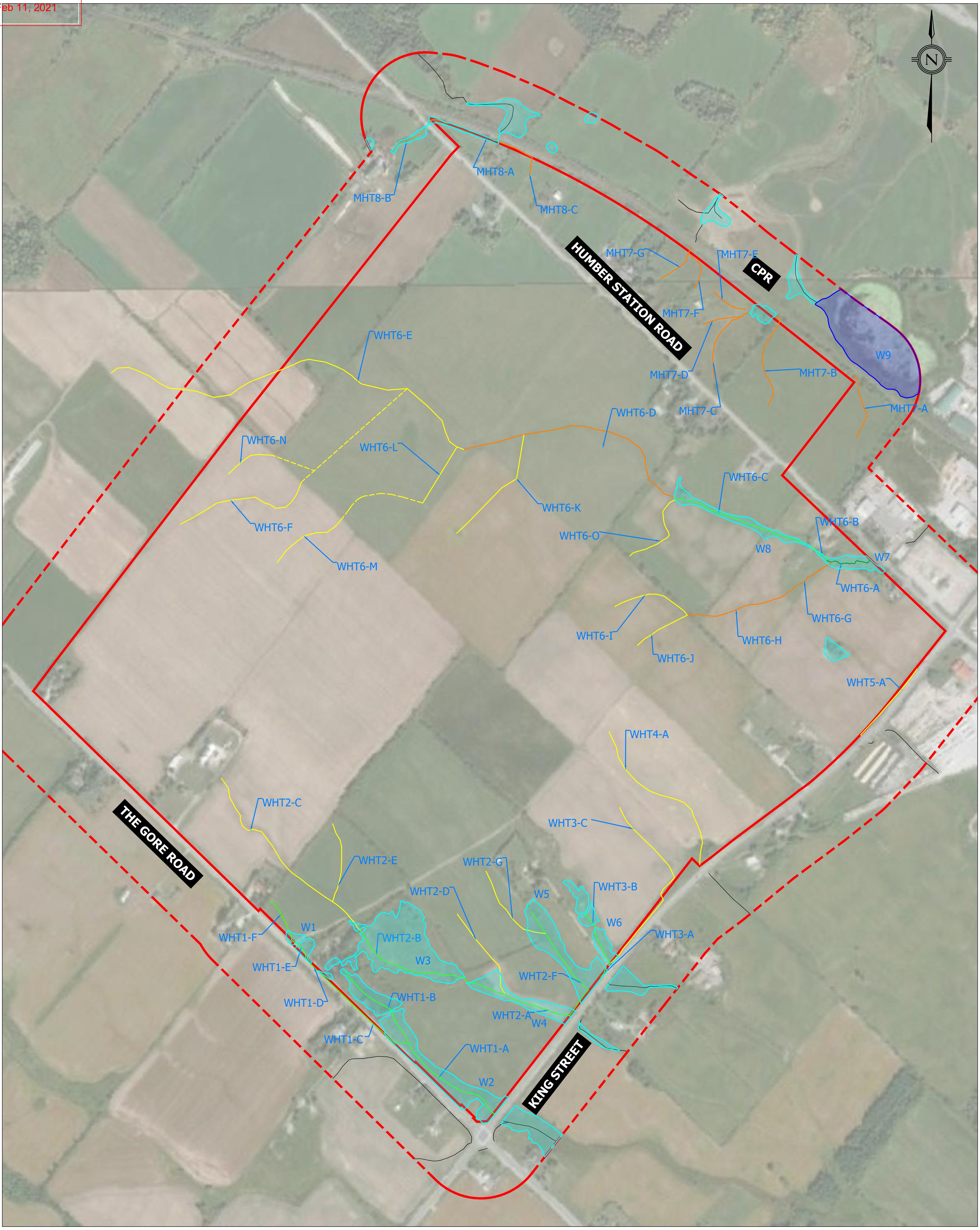
FIGURE 3.2.5.2a

HEADWATER FEATURES

JANUARY 2021

SCALE: 1:7500



LEGEND:

🟥	SUBJECT LANDS
⬚	STUDY AREA (120 m)
🟦	PROVINCIALLY SIGNIFICANT WETLANDS
🟦	UNEVALUATED WETLANDS
W1	WETLAND NUMBER
WHT1/MHT1	TRIBUTARY NAME AND NUMBER (i.e. WEST HUMBER TRIBUTARY; MAIN HUMBER TRIBUTARY)

HEADWATER FEATURE MANAGEMENT RECOMMENDATIONS

—	PROTECTION	—	NO MANAGEMENT REQUIRED
—	CONSERVATION	- - -	NO MANAGEMENT REQUIRED (ENCLOSED)
—	MITIGATION	—	UNASSESSED

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FIGURE 3.2.5.2b

HEADWATER FEATURE MANAGEMENT RECOMMENDATIONS

JANUARY 2021

SCALE: 1:7500

External Drainage

In terms of external drainage, a 79 ha area within the West Humber River watershed north of the Subject Lands drains from northwest to southeast via an ephemeral swale into the Subject Lands as shown on Drawing 201 within the FSR (Urbantech Consulting 2021). This external area is represented by Catchments 37.12A, 37.12B, 37.12C and 37.12D draining to Node 9. This includes drainage beginning from west of The Gore Road.

3.2.5.2 Headwater Drainage Features

The Study Area is situated in the headwaters of the West Humber River and the Main Humber River and supports a number of surface drainage features **(Figure 3.2.5.2a)**.

TRCA policies require that headwater drainage features (HDFs) be identified and managed in accordance with their *Evaluation, Classification, and Management of Headwater Drainage Features Guideline (*TRCA 2014b*)*. The TRCA guideline defines headwaters as follows:

> *Non-permanently flowing drainage features that may not have defined bed or banks; they are first-order and zero-order intermittent and ephemeral channels, swales and connected headwater wetlands*, but do not include rills or furrows*. **wetlands that are connected downstream through surface flow are considered to be headwater drainage features for the purposes of this guideline.*

Consideration of HDFs through the land use planning process is relevant because alteration or removal of these features through land development can affect ecohydrological functions that are important for sustaining natural features and ecosystems.

HDFs in the Study Area were previously assessed by Aquafor Beech Limited in 2013 in support of the Town of Caledon's Bolton Residential Expansion Study to evaluate their relative importance and to determine how each HDF is to be managed in the future. The Aquafor Beech Limited (2013) Headwater Drainage Feature Assessment (HDFA) was completed in accordance with TRCA's 2009 Interim Guidelines. While the Aquafor Beech Limited HDFA was comprehensive, it was completed more than five years ago, and it is possible that site conditions may have changed. Furthermore, TRCA has subsequently adopted new guidelines for undertaking HDFA's which could affect the assessment findings. For these reasons, it was determined that the HDFA should be reviewed and updated as part of this CEISMP.

In 2020, Beacon completed a field review all HDFs on the Subject Lands for the purposes of validating the mapping of HDFs and findings of the original HDFA prepared by Aquafor Beech Limited in 2013. As part of the validation exercise, the following task were completed:

1. The original HDFA was reviewed;
2. Tile drainage mapping was reviewed to identify HDFs affected;
3. All HDFs on the Subject Lands were walked on June 8, 2020;
4. Mapping of HDFs was updated to reflect the 2020 field conditions;
5. Photographs of select HDF were taken to supplement the original HDFA (**Appendix C**);
6. HDF Classifications were reviewed to confirm consistency with 2020 field observations and adjusted where necessary;

7. HDF Management Recommendations were reviewed and adjusted where necessary; and
8. Findings were summarized.

The validation exercise resulted in several refinements to the HDF mapping. The changes are based on the field review and confirmation of existing tile drain networks and culvert locations. All HDFs and reaches were also assigned new names/number to be consistent with the tributary nomenclature utilized in the CEISMP.

In reviewing the HDF classifications, Beacon relied upon field observations as well as biophysical information collected in 2020 as part of the CEISMP, including updated ecological community classifications, wildlife data, hydrological data, and hydrogeological.

A summary of functional classifications and management recommendations for all HDF reaches is provided in **Table 6** below.

In general, findings of the 2020 validation exercise are relatively consistent with the Aquafor Beech Limited (2013) HDFA, with the following exceptions:

- Field observations resulted in the addition of a number of additional HDF reaches, particularly in the portion of the Study Area east of Humber Station Road;
- HDF reach mapping along Tributary WHT6 was updated to reflect portions of the drainage feature that are enclosed within tile drains;
- Results of the culvert assessment provided by Urbantech Consulting resulted in the delineation of WHT4 (previously mapped as part of WHT3); and
- Management classifications associated with the downstream reaches of WHT1, WHT2, and WHT3 were revised to ‘Conservation’ based on the presence of wetland riparian vegetation.

Table 6. Headwater Drainage Feature Assessment Summary

HDF Reach	HDF Reach (Aquafor Beech Limited 2013)	Step 1		Step 2	Step 3	Step 4	Management Recommendation[i]	Governing Factor
		Hydrology[ii]	Modifiers	Riparian[iii]	Fish Habitat[iv]	Terrestrial Habitat[v]		
WHT6-A	1a	Important Functions	Historically channelized	Important Functions	Important Functions	Important Functions	Protection	Management recommendation governed by hydrology, riparian vegetation and presence of breeding amphibians
WHT6-B	1b	Valued Functions	Historically channelized	Important Functions	Valued Functions	Valued Functions	Conservation	Management recommendation governed by riparian vegetation
WHT6-C	1c	Valued Functions	Historically channelized	Important Functions	Valued Functions	Valued Functions	Conservation	Management recommendation governed by riparian vegetation
WHT6-D	1d	Valued Functions	Agriculture, Tile Drain	Limited Functions	Contributing Functions	Limited Functions	Mitigation	Management recommendation governed by hydrology.
WHT6-E	1e	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT6-F	1f	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT6-G	1g	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	Mitigation	Management recommendation based on Aquafor Beech Limited (2013) report and potential for tile drainage.
WHT6-H	1h	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	Mitigation	Management recommendation based on Aquafor Beech Limited (2013) report and potential for tile drainage.
WHT6-I	1i	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT6-J	1j	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT6-K	1k	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT6-L	1l	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT6-M	1m	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT6-N	1n	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT6-O	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by reference reach WHT6-I.
WHT5-A	1o	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
MHT7-A	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by reference reach MHT7-C.
MHT7-B	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by reference reach MHT7-C.
MHT7-C	2a	Limited Functions	Anthropogenic	Contributing Functions	Contributing Functions	Limited Functions	Mitigation	n/a
MHT7-D	N/A	Limited Functions	Anthropogenic	Contributing Functions	Contributing Functions	Limited Functions	Mitigation	n/a
MHT7-E	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by reference reach MHT7-C.
MHT7-F	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by reference reach MHT7-C.
MHT7-G	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by reference reach MHT7-C.

HDF Reach	HDF Reach (Aquafor Beech Limited 2013)	Step 1		Step 2	Step 3	Step 4	Management Recommendation[i]	Governing Factor
		Hydrology[ii]	Modifiers	Riparian[iii]	Fish Habitat[iv]	Terrestrial Habitat[v]		
MHT8-A	2b	Limited Functions	Anthropogenic	Contributing Functions	Contributing Functions	*Valued Functions	Mitigation	Heavily modified ditch along existing rail line.
MHT8-B	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by reference reach MHT8-A.
MHT8-C	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by reference reach MHT8-A.
WHT2-A	3a	Valued Functions	Wetland	Important Functions	Contributing Functions	Important Functions	Conservation	Management recommendation is governed by riparian vegetation (meadow marsh) and the presence of breeding amphibians
WHT2-B	3b	Valued Functions	Wetland	Important Functions	Contributing Functions	**Valued Functions	Conservation	Management recommendation governed by riparian vegetation
WHT2-C	3c	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT2-D	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by riparian vegetation.
WHT2-E	3e	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT2-F	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by wetland unit.
WHT2-G	3d	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT3-A	3g	Valued Functions	Wetland	Important Functions	Contributing Functions	**Valued Functions	Conservation	n/a
WHT3-B	3f	Valued Functions	Wetland	Important Functions	Contributing Functions	**Valued Functions	Conservation	n/a
WHT3-C	3h	Limited Functions	Agriculture	Limited Functions	Contributing Functions	Limited Functions	No Management Required	n/a
WHT1-A	4a	Valued Functions	Wetland	Important Functions	Contributing Functions	**Valued Functions	Conservation	Management recommendation governed by riparian vegetation
WHT1-B	4b	Valued Functions	On-line pond	On-line pond	On-line pond	On-line pond	Conservation	Amphibians calling
WHT1-C	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by riparian vegetation.
WHT1-D	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by riparian vegetation.
WHT1-E	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by riparian vegetation.
WHT1-F	N/A	Not Assessed						Feature was not identified in HDFA ArcHydro mapping. Management recommendation is governed by riparian vegetation.

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[i] **Protection – Important Functions:**
Protect and/or enhance the existing feature and its riparian zone corridor, and groundwater discharge or wetland in-situ;
Maintain hydroperiod;
Incorporate shallow groundwater and base flow protection techniques such as infiltration treatment;
Use natural channel design techniques or wetland design to restore and enhance existing habitat features, if necessary; realignment not generally permitted;
Design and locate the stormwater management system (e.g. extended detention outfalls) are to be designed and located to avoid impacts (i.e. sediment, temperature) to the feature.

Conservation – Valued Functions:
Maintain, relocate, and/or enhance drainage feature and its riparian zone corridor;
If catchment drainage has been previously removed or will be removed due to diversion of stormwater flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage), as feasible;
Maintain or replace on-site flows using mitigation measures and/or wetland creation, if necessary;
Maintain or replace external flows,
Use natural channel design techniques to maintain or enhance overall productivity of the reach;
Drainage feature must connect to downstream.

Mitigation – Contributing Functions:
Replicate or enhance functions through enhanced lot level conveyance measures, such as well-vegetated swales (herbaceous, shrub and tree material) to mimic online wet vegetation pockets, or replicate through constructed wetland features connected to downstream;
Replicate on-site flow and outlet flows at the top end of system to maintain feature functions with vegetated swales, bioswales, etc. If catchment drainage has been previously removed due to diversion of stormwater flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage);
Replicate functions by lot level conveyance measures (e.g. vegetated swales) connected to the natural heritage system, as feasible and/or Low Impact Development (LID) stormwater options (refer to Conservation Authority Water Management Guidelines for details);

Recharge Protection – Recharge Functions:
Maintain overall water balance by providing mitigation measures to infiltrate clean stormwater, unless the area qualifies as an Area of High Aquifer Vulnerability under the Oak Ridges Moraine Conservation Plan (ORMCP) or Significant Recharge Areas under the Source Water Protection Act. These areas will be subject to specific policies under their respective legislation.
Terrestrial features may need to be assessed separately through an Environmental Impact Study to determine whether there are other terrestrial functions associated with them.

Maintain or Replicate Terrestrial Linkage – Terrestrial Functions:
Maintain the corridor between the other features through in-situ protection or if the other features require protection, replicate and enhance the corridor elsewhere
If the feature is wider than 20 m, it may need to be assessed separately through an Environmental Impact Study to determine whether there are other terrestrial functions associated with it.

No Management Required – Limited Functions:
The feature that was identified during desktop pre-screening has been field verified to confirm that no feature and/or functions associated with headwater drainage features are present on the ground and/or there is no connection downstream. These features are generally characterized by lack of flow, evidence of cultivation, furrowing, presence of a seasonal crop, and lack of natural vegetation. No management recommendations required.

[ii] **Hydrology**
Important Functions: Perennial, standing surface water in wetlands
Valued Functions: Intermittent; water is present in the spring as a result of seasonally high groundwater discharge or seasonally extended contributions from wetlands or other areas that support intermittent flow or water storage conditions
Limited Functions: Dry or Standing Water; characterized by no definition or flow, no groundwater seepage or wetland functions, evidence of cultivation, furrowing, presence of a seasonal crop, lack of natural vegetation, fine textured soils

[iii] **Riparian**
Important Functions: Feature type is wetland and/or any of the riparian corridor categories on either side of the feature is dominated by forest or thicket/scrubland communities or wetland
Limited Functions: Riparian corridor is dominated by cropped land or no vegetation, and there are no important, valued or contributing riparian functions
Contributing Functions: the riparian corridor is dominated by lawn

[iv] **Fish Habitat**
Important Functions: Any fish species present in spring and mid-summer; suitable spawning habitat for any fish species; species-at-risk present at any time; or feature provides critical habit to downstream species-at -risk
Valued Functions: Fish present in spring only or suitable habitat identified for feeding, cover, refuge, migration; or contributing habitat for species at risk
Contributing Functions: Allochthonous transport through feature to downstream habitat

[v] **Terrestrial Habitat**
Important Functions: Wetlands with breeding amphibians
Valued Functions: Wetland; considering wetland pockets associated with the HDF that are within 400 m of other wetlands upstream and downstream is recommended for assessing stepping stone habitat function; no breeding amphibians present
*Valued Functions: no wetland vegetation present but amphibian calls recorded
**Valued Functions Wetland habitat occurs within the corridor but no breeding amphibians present
Limited Functions: No terrestrial habitat present

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The following sections summarize the CEISMP HDF reaches by management classification. **Figure 3.2.5.2b** illustrates HDFA reaches and associated management recommendations.

No Management Required

The majority of the HDF reaches assessed within the Subject Lands were characterized as actively farmed, poorly defined features. These reaches provide limited hydrologic functions and do not provide aquatic or terrestrial habitat. In accordance with the TRCA (2014b) Guidelines, these reaches have been identified as 'No Management Required'.

Mitigation

All of the HDF reaches assessed east of Humber Station Road (draining to the main Humber River) were classified as mitigation. These features were characterized as providing surface drainage to downstream fish habitat, with meadow vegetation within riparian communities. While amphibian calls were documented for Reach MHT8-A, this feature was characterized as a heavily modified (channelized) ditch along the rail line embankment. As the vegetation community was classified as Anthropogenic (no wetland present), terrestrial habitat for this reach was classified as 'Valued' (i.e., potential stepping stone habitat), refer to **Appendix C** (**Photo 17**).

HDFA results for Reach WHT6-D determined that, given the enclosed (historical tile drainage) nature of this feature, it currently functions to provide surface drainage (valued hydrology) to downstream reaches. Similarly, WHT6-G and WHT6-H were presumed to have been subject to historical tile drainage. In accordance with the TRCA (2014b) Guidelines, these reaches have been identified as 'Mitigation".

Conservation

Reaches WHT1-A through WHT1-F, WHT2-A, WHT2-B and WHT2-F, WHT3-A and WHT3-B, WHT6-B and WHT6-C all had valued or contributing hydrology with wetland riparian vegetation. Breeding amphibians were recorded in the WHT2-A meadow marsh. A management classification of "Conservation" is recommended for these reaches (marshes with amphibian breeding habitat).

Protection

Reach WHT6-A was identified as "Protection" based on the presence of flow during the June 8, 2020 sample event (important hydrology), presence of breeding amphibian habitat and wetland riparian vegetation (**Appendix C - Photo 1**).

3.2.5.3 Fluvial Geomorphology

Fluvial geomorphology is the study of the physical form and function of surface water features. Typically, it is a consideration when undertaking subwatershed studies and land use planning studies because it informs how the watercourses are managed.

Geomorphic Assessment

The CEISMP TOR recommend that a fluvial geomorphic assessment of watercourses be undertaken to:

- Characterize hydrologic features within the Study Area including sensitive reaches, areas of erosion and aggradation, channel migration, etc.;
- Determine the relationship between hydrology of the stream and geomorphology, aquatic resources and water quality, using a continuous simulation modeling approach;
- Meander belt width analysis and delineation of the 100-year erosion limit; and
- Assessment of stream bank erosion and the potential for such erosion within the 100-year timeframe, with consideration for potential impacts on the morphology of the valley or stream corridor.

As was discussed in **Section 3.2.5.2**, Beacon has confirmed that all the hydrologic features within the Study Area are HDFs and generally lack a defined channel. The few HDFs that do exhibit evidence of channel form lack consistent flow conditions that could result in lateral channel migration. Consequently, it is our opinion that a fluvial geomorphic assessment of stream bank erosion, aggradation and channel migration is not warranted and that the HDFA validation exercises effectively characterized the relationship between hydrology, geomorphology and aquatic resources for the purposes of this study.

Meander Belt Analysis

The meander belt of a watercourse is generally defined as the lateral extent that a meandering channel has historically occupied and will likely occupy in the future. In general, watercourses with drainage areas less than one square kilometer (100 hectares) and do not generate sufficient hydraulic energy to initiate migration and the associated risk of potential erosion for property and infrastructure (TRCA 2015). Typically, these watercourses are vegetation controlled. Due to the poorly defined, vegetated nature of the HDFs within the Study Area, and overall lack of evidence of active geomorphic processes (i.e., erosion, aggradation or migration), it is our opinion that the regulatory floodline represents a more appropriate tool for delineating the watercourse hazard limit for applicable hydrologic features within the Study Area.

Stormwater Erosion Control Analysis

The Urbantech Consulting (2021) FSR identifies that stormwater erosion control requirements for SWMF 1 and 2 will be met by providing a minimum 48-hour (maximum 72-hour) drawdown time for the 25mm storm event. Target release rates for both SWMFs were determined based on unit flow rates as identified by TRCA (2018) for the West Humber River watershed and the associated contributing drainage area to each SWMF. A preliminary extended detention orifice dimension of 100 mm was determined by Urbantech Consulting (2021) for SWMF 1 and 2 referencing the required drawdown time (i.e., minimum 48 hours) and target extended detention release rates of 0.060 m^3/s and 0.030 m^3/s, respectively, to mitigate potential impacts to downstream receiving reaches due to post-development stormwater release. SWMF outlets have also been designed to ensure that post-development peak flow rates for the 2-year to 100-year storm events do not exceed the pre-development conditions at each of the modelled Flow Node locations.

3.2.5.4 Surface Water Quality

As the drainage features on the Subject Lands are primarily ephemeral and intermittent, there is no water quality data available. According to the TRCA's Watershed Report Card (2018), the West Humber received a surface water quality grading as "poor" whereas the Main Humber was graded as "fair". This grade is based off of phosphorous and *Escherichia coli* (*E.coli*) concentrations.

3.2.5.5 Hydraulics

The existing HEC-RAS model geometry for the West Humber and Main Humber Rivers was established in the Humber River Hydrology Update prepared by TRCA and Civica Infrastructure (April 2018). The model geometry for the existing conditions was updated with detailed LIDAR / site survey information in several locations, with a focus on the more significant crossings of Humber Station Road, the CPR line and King Street. The HEC-RAS model was also refined using the updated flows from the existing hydrologic model created based on the pre-development drainage plan. Refer to FSR Drawing 202 for the existing Regional flood mapping drawing and FSR Appendix 2 for the hydraulic and hydrologic model results (Urbantech Consulting 2021).

The majority of drainage features within the Subject Lands are considered to be headwater features and do not require flood mapping due to their small corresponding drainage areas (less than 50 hectares), with the exception of West Humber River Tributary (WHT) 6, which is proposed to be realigned, all headwater features will be removed during development.

3.2.6 Existing Water Balance

3.2.6.1 Existing Site Water Balance

To understand and compare existing hydrologic conditions over the Study Area, a Thornthwaite site water balance was completed. The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. Inputs to the model are monthly temperature, site latitude, precipitation, and stormwater run-on. Outputs include monthly potential and actual evapotranspiration, evaporation, water surplus, total infiltration, and total runoff. For ease of calculation, a spreadsheet model was used for the computation.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table, or evaporate/evapotranspiration (ET) from the earth's surface and vegetation. The sum of R and I is termed as the water surplus (S). When long-term averages of P, R, I and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for small changes in ST. The annual water budget can be stated as:

$$P = ET + R + I + ST$$

As provided below,

Precipitation (P)

Based on the 30-year average for the Toronto Lester B. Pearson Climate Station in Ontario, the average precipitation for the area is about 786 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in Table 1, Appendix G within the Hydrogeological Investigation (**Appendix B**).

Storage (St)

Groundwater storage (ST) of native soils for the existing Subject Lands was estimated using values of Water Holding Capacity (mm) of respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning & Design Manual (MOE March 2003). The land uses, soil types and respective water holding capacities chosen to represent existing conditions on the Subject Lands include combinations of pasture/shrub, moderately rooted crop and urban lawn with a silty clay soil. Respective water holding capacities (200 mm, 150 mm and 75 mm) were applied to March for monthly calculations. Using the procedures outlined in the SWM Planning & Design Manual for the above land use and soil type, the annual change in storage is zero (0).

Evapotranspiration (Et)

Monthly Potential Evapotranspiration (PET) is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite,1948; Mather, 1978). In the Thornthwaite water balance model, PET is calculated using the Hamon equation (Hamon, 1061);

PET Hamon = 13.97 * d * D2 * Wt
Where:
d = the number of days in the month
D = the mean monthly hours of daylight in units of 12 hours
Wt = a saturated water vapour density term = 4.95 * e0.627/100
T = the monthly mean temperature in degrees Celsius

The calculated Actual Evapotranspiration (AET) is based on PET and changes in ST (∆ ST). Where there is not enough P to satisfy PET, a reduction in ST occurs. As a result, volumes of AET are less than PET. Also, it is assumed that evaporation will occur and will amount to approximately 15% of the total precipitation for an impervious cover.

Precipitation Surplus (S)

Precipitation surplus is calculated as P–ET. For pervious areas, ET is considered AET and for impervious areas, ET is evaporation.

Infiltration (I) and Runoff (R)

For pervious areas, precipitation surplus has two components in the Thornthwaite model: a runoff component (overland flow that occurs when soil moisture capacity is exceeded) and an infiltration component. The accumulation of infiltration factors for topography, soil types and cover as prescribed in Table 3.1 of the SWM Planning & Design Manual (CVC and TRCA 2010) give infiltration factors for existing conditions on the Subject Lands as shown below in **Table 7**. The runoff component calculated in the pre-development model is the remaining volume of precipitation surplus following AET, ET, and infiltration.

Table 7. Existing Conditions – Infiltration Factor

LAND USES / SOIL TYPES	TOPOGRAPHY	SOIL	COVER	TOTAL INFILTRATION FACTOR
Urban Lawn - Pervious Development	0.10	0.15	0.05	0.30
Moderately rooted crops/ Clay Loam	0.10	0.15	0.10	0.35
Pasture and Shrub/ Clay Loam	0.10	0.15	0.15	0.40

The Subject Lands have a total area of about 181.60 ha and is primarily agricultural (147.9 ha) with some natural areas consisting of NHS lands, hedgerows and swales (20.8 ha). There are also some existing rural development consisting of pervious landscaped areas (9.8 ha) and impervious buildings and asphalt/paved area (3.1 ha). Figure 7 within the Hydrogeological Investigation (**Appendix B**) shows the pre-development conceptual model considered for establishing current hydrologic conditions. To predict outputs of the pre-development site water balance, various inputs were entered into the Thornthwaite model including monthly precipitation and temperature, site latitude, water holding capacity values for native soils and factors of infiltration.

Based on the above analysis, the resulting annual evapotranspiration, infiltration and runoff volumes for each hydrological land use of the Subject Lands during the pre-development period is summarized in **Table 8** below.

Table 8. Summary of Pre-Development Water Balance

LAND USES / SOIL TYPES	ET Volume (m^3/year)	AET Volume (m^3/year)	Infiltration Volume (m^3/year)	Runoff Volume (m^3/year)
Urban Lawn - Pervious Development	0	49,398	8,394	19,585
Moderately rooted crops/ Clay Loam	0	789,624	130,527	242,407
Pasture and Shrub/ Clay Loam	0.10	115,750	19,505	29,257
Impervious Areas	3,708	0	0	21,010
Total	**3,708**	**953,773**	**158,426**	**312,260**

Within the Hydrogeological Investigation (**Appendix B**), the detailed calculations are presented in Table 1 and 2 of Appendix G, while various outputs of the model are summarised in Section 6 of this report.

3.2.6.2 Existing Feature Based Water Balance

A feature-based water balance is currently being completed to evaluate hydrologic inputs to retained wetlands W1 through W6 within the Subject Lands. Surface water and shallow groundwater level monitoring in select areas of the wetlands began in August 2020 and will continue for a minimum of 1 year. The monitoring data will be used to define wetland hydroperiods and assess groundwater and surface water interaction. The data will be used to calibrate a continuous model representative of existing conditions. Once the model adequately represents existing conditions; it will be reparametrized to represent proposed post-development conditions. The model will be used to assess the effect of the hydrologic changes on each of the wetland hydroperiods to help determine the magnitude of hydrologic changes as a result of proposed conditions. The results of the model will be used to define a LID plan which ensures that the retained features maintain form and function.

3.3 Natural Heritage Resources

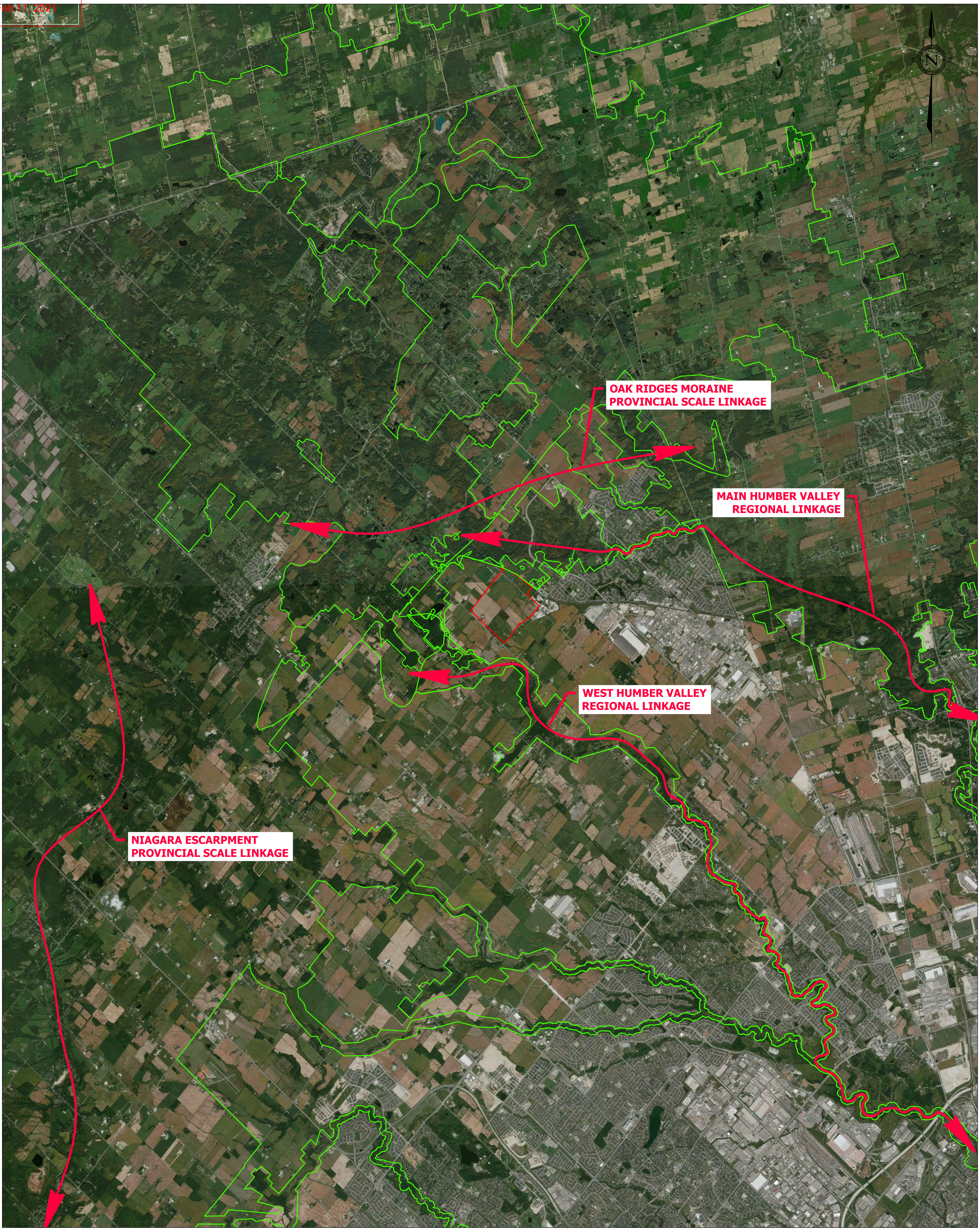
The CEISMP TOR requires that natural heritage features in the Study Area be characterized and that their functional relationships in the broader natural heritage system be described. This section of the report characterizes natural heritage resources using available background information and supplementary data gathered through recent field investigations completed by Beacon in 2020.

Natural heritage resources in the Study Area were previously characterized during the BRES process and are documented in the various studies prepared for the Town of Caledon by Dougan & Associates, Cam Portt & Associates, Aquafor Beech Ltd., BluePlan Engineering Consultants Ltd., and Meridian Planning (2014a and 2014b). Information from these background studies was reviewed and the findings have been integrated within the supplemental work completed by Beacon in 2020. The subsections below provide a comprehensive characterization of the natural heritage resources in the Study Area.

3.3.1 Landscape Scale Natural Heritage Systems

The Study Area is located on the farmed till plains of the South Slope physiographic region several kilometres south of where the Oak Ridges Moraine converges with the Niagara Escarpment. The Niagara Escarpment which is located 4 km to the west and the Oak Ridges Moraine, which is located 2 km to the west and north, form part of the provincial Greenbelt which supports protected natural areas and linkages. Along with the Humber River valleylands, which are located 0.5 km to the northeast of the Study Area, these natural features and areas form part of a broader provincial and regional Natural Heritage System (NHS) identified in the Growth Plan NHS and Region of Peel Greenlands System (refer to **Figure 3.3.1**).

The Oak Ridges Moraine is an irregular ridge approximately 3-12 km wide and 170 km in length that extends from the Niagara Escarpment in the west to the Trent River in the east. The Niagara Escarpment is a bedrock escarpment and cuesta that extends 1,200 km from Rochester, NY to Green Bay, WI., and traverses southern Ontario from Niagara Falls to Manitoulin Island. The Humber River valleylands connects its headwaters in Caledon to Lake Ontario, some 40 km downstream and



LEGEND:

▭	SUBJECT LANDS
—	PROVINCIAL AND REGIONAL SCALE NATURAL HERITAGE SYSTEM
→	LINKAGES

BEACON ENVIRONMENTAL
DS CONSULTANTS LTD.
GSAI Glen Schnarr & Associates Inc.
URBANTECH

Bolton-Macville Community-Comprehensive Environmental Impact Study and Management Plan

PROJECT No.

FIGURE 3.3.1

LANDSCAPE LEVEL NATURAL HERITAGE SYSTEM

JANUARY 2021

SCALE: 1:12000

represents a significant landscape north-south linkage corridor. The Humber River valleylands to the east of the Study Area are contained within the Bolton Resource Management Tract (BRMT). The BRMT is a 973-hectare area comprised of a mix of valleylands, forests, and wetlands owned by TRCA that connects the Humber Rover to the Oak Ridges Moraine.

The lands in the Study Area are primarily agricultural. Natural features are limited to drainage features that represent the headwaters of the west and main branches of the Humber River. Associated with some of these drainage features are some small unevaluated wetland features. These drainage features and wetlands connect to similar features immediately downstream of the Study Area and function to provide some local scale connectivity, however connections to the broader regional and provincial NHS described above is limited due to lack of natural features and barriers to connectivity such as the CP rail line which effectively separates the Study Area from the Humber River valleylands.

Treed features on the Subject Lands are generally limited to hedgerows, most of which are short and fragmented and offer little connectivity due to poor cover.

At the present time, there are no designated natural heritage areas or systems identified on the Subject Lands. The Region Official Plan (ROP) does not identify any components of its Regional Greenlands System on the Subject Lands. Similarly, the Town of Caledon Official Plan does not map any of the features on the Subject Lands as Environmental Policy Area. There are however several wetland features located east of the CP rail line that are identified as part of the Provincially Significant Bolton Wetland Complex.

As natural features are limited on the Subject Lands, it is not unusual that the features present have not yet been mapped on the Region and Town’s environmental schedules. One of the objectives of the CEISMP is to determine whether the natural heritage features associated with the Subject Lands satisfy the various evaluation criteria for inclusion within the Regional Greenlands System and Environmental Policy Area and if so to develop an NHS to protect and enhance their functions.

Natural heritage features associated with the Subject Lands are concentrated near the southern boundary. From a natural heritage system perspective, the drainage features and wetlands on the Subject Lands are most functionally connected to downstream areas and the tributaries of the west branch of the Humber River directly to the south. Due to the locations of these features and barriers in the landscape (rail lines and roads), their functional relationship with the broader provincial and regional scale NHS to the west, north and east is limited.

3.3.2 Ecological Land Classification

Ecological communities within the Study Area were classified and mapped in accordance with the Ecological Land Classification (ELC) System for southern Ontario (Lee *et al*. 1998). The ELC System classifies ecological communities based on their vegetation composition and structure, site history, substrate type, moisture regime, drainage class, and other attributes. Under the ELC System, ecological communities are classified to the ecosite or ecoelement level depending on scale and specific application. Ecological communities within the Study Area were mapped and described to the ecosite level, and where possible to the ecoelement level, using ELC protocols.

Ecological communities within the Study Area were initially mapped in 2013 and 2014 by Dougan & Associates *et al.* (2014b) as part of the BRES process. In 2020, Beacon conducted field investigations to confirm the previous findings. Through this work, feature classifications and feature boundaries were confirmed and refined where necessary to reflect current conditions. The boundaries of wetland communities were also adjusted to align the wetland limits that were staked by MNRF staff on May 2, 2016.

The ELC classification are based on vegetation and soils information gathered from representative communities. Floristic surveys were conducted to document vegetation composition and structure for each representative community, including recording species relative abundance and ranking dominant species according to vegetation strata (canopy, subcanopy, understory, and ground layers).

A total of 18 ecological community types were identified in the Study Area, including communities corresponding with anthropogenic and agricultural lands. A description of the various ecological communities observed in the Study Area is provided below in **Table 9**. The locations of the communities and their corresponding polygon or unit identifiers are mapped in **Figure 3.3.2**.

Table 9. Ecological Community Descriptions

Unit	Type	Description
1	Anthropogenic	Existing rural residential properties containing residential and commercial development.
2	Agriculture - Annual Row crops	Corn, wheat, and soybean fields.
3	Agriculture - Hay	Alfalfa fields.
4	Hedgerow (H)	Hedgerows in the Study Area are largely dominated by Common Buckthorn, hawthorns (*Crataegus* sp.), Domestic Apple (*Malus pumila*), and Manitoba Maple (*Acer negundo*), with occasional White Elm (*Ulmus americana*) and Basswood (*Tilia americana*), and Ash (*Fraxinus* spp.).
5	Cultural Woodland (CUW1)	Small treed area surrounding a dug pond comprised of Crack Willow (Salix fragilis), Siberian Elm (*Ulmus pumila*), Trembling Aspen (*Populus tremuloides*).
6	Cultural Thicket (CUT1)	This community is dominated by Common Buckthorn with lesser amounts of hawthorn (*Crataegus* sp.). Ground covers include Thicket Creeper (*Parthenocissus vitacea*), Enchanter's Nightshade (*Circaea lutetiana*), grasses, Tall Goldenrod, Wild Strawberry (*Fragaria virginiana*), and Zig Zag Goldenrod (*Solidago flexicaulis*).
7	Reed Canary Grass Mineral Meadow Marsh (MAM2-2)	Meadow marsh communities dominated by Reed Canary Grass in association with other wetland forbs and graminoids such as Panicled Aster (*Symphyotrichum lanceolatum*), Purple-stemmed Aster (*Symphyotrichum puniceum*), Field Horsetail (*Equisetum arvense*), Purple Loosestrife (*Lythrum salicaria*), Fowl Bluegrass (*Poa palustris*), and sedges (*Carex* spp.).
8	Cattail Mineral Shallow Marsh (MAS2-1)	Marsh communities on mineral soil dominated by Narrow-leaved Cattail (*Typha angustifolia*) with lesser amounts of Broad-leaved Cattail (*Typha latifolia*) and other wetland forbs and graminoids such as Panicled Aster, Spotted Jewelweed (*Impatiens capensis*), Purple-stemmed Aster, bulrushes (*Scirpus atrovirens, S. microcarpus*), sedges, and Joe-Pye Weed (*Eutrochium maculatum*).
9	Cattail Organic Shallow Marsh (MAS3-1)	Marsh communities on organic soil dominated by Narrow-leaved Cattail (*Typha angustifolia*) with lesser amounts of Broad-leaved Cattail (*Typha latifolia*) and other wetland forbs and graminoids such as Reed Canary Grass, Panicled Aster, Spotted Jewelweel, Purple-stemmed Aster, bulrushes (*Scirpus atrovirens, S. microcarpus*), sedges, and Joe-Pye Weed (*Eutrochium maculatum*).

Unit	Type	Description
10	Stonewort Submerged Shallow Aquatic (SAS1-3)	Dug ponds with thick layer of Stonewort (*Chara* spp.) and sparse amounts of Lesser Duckweed (*Lemna minor*).
11	Forb Mineral Meadow Marsh (MAM2-10)	Meadow marsh dominated by Panicled Aster, Reed Canary Grass, sedges, and willowherbs *(Epilobium* spp.)
12	Organic Deciduous Swamp (SWD3)	Small swamp on organic soils with a canopy of dead hardwood (ash), White Elm (*Ulmus ameriana*), Yellow Birch (*Betula allegheniensis*), and White Birch (*Betula papyrifera*). The understory consists of Red-osier Dogwood, Black Current (*Ribes americana*), and White Cedar. Dominant ground covers are Spotted Jewelweed, Marsh Marigold (Caltha palustris), horestails (*E. arvensis, E. sylvaticum*), and ferns (*Onoclea sensibilis, Matteucia struthiopteris*).
13	Pondweed Submerged Shallow Aquatic (SAS1-1)	Small shallow aquatic feature dominated by pondweeds (*Potomogeton* spp.), with a small amount of Lesser Duckweed and Reed Canary Grass
14	Open Aquatic (OAO)	Small, dug pond.
15	Dry-Moist Old Field Meadow (CUM1-1)	Meadows dominated by old field forbs and graminoids including Smooth Brome Grass (*Bromus inermis*), Reed Canary Grass (*Phalaris arundinacea*), Orchard Grass (*Dactylis glomerata*), Tall Goldenrod (*Solidago altissima*), Tufted Vetch (*Vicia cracca*). Woody regeneration is generally sparse but includes Common Buckthorn (*Rhamnus cathartica*) and Manitoba Maple (Acer negundo), Tatarian Honeysuckle (*Lonicera tatarica*), hawthorns, and Red-osier Dogwood (*Cornus sericea*). Through restoration efforts, some of the old fields (3d, 3e) have been planted with various trees and shrubs including White Cedar (*Thuja occidentalis*), White Spruce (*Picea glauca*), Freeman's Maple (*Acer x freemanii*), Nannyberry (*Viburnum lentago*), and Basswood (*Tilia americana*).
16	Willow Mineral Thicket Swamp (SWT2-2)	Small thicket swamp dominated by Pussy Willow (*Salix discolor*), Reed Canary Grass, Purple Loosestrife, Panicled Aster, and Tall Goldenrod.
17	Mineral Meadow Marsh (MAM2)	Wetland disturbed by agricultural activity dominated by Barnyard Grass (*Echinocloa crus-galli*), Creeping Bent Grass (*Agrosits stolonifera*), Foxtail grasses (*Setaria* spp.), and smartweeds (*Persicaria* sp.)
18	Cultural Plantation (CUP)	Former meadows with well-established planted native trees and shrubs including Eastern Cottonwood (*Populus deltoides*), White Cedar, White Spruces, Freeman's Maple, Gray dogwood, Red-osier Dogwood, Nannyberry, and Speckled Alder. Ground covers include grasses, Tall Goldenrod, Wild Carrot, and Creeping Thistle.

3.3.3 Wetland Boundary Delineation

Except for several very small wetland features (ELC Units 7e, 7f, 7l, 13 and 14a), all wetland communities on the Subject Lands were staked with the Ministry of Natural and Forestry (MNRF) on May 2, 2016. The staked limits were surveyed by an OLS and geodetic data provided to MNRF and used to prepare the ELC mapping (refer to **Figure 3.3.2**).

3.3.4 Floristics

A total 163 vascular plant species were recorded on the Study Area during surveys conducted in 2020. A plant list is included in **Appendix D.** Of these, 78 (48%) are non-native to Ontario, which is reflective of the agricultural land use history of the Study Area. Most of the species (155) are considered regionally and provincially common and secure (ranked S5 or S4 provincially by NHIC, or L5 and L4 regionally by TRCA). Eight (8) of the species recorded are of regional conservation concern (ranked L3 by TRCA). These species are listed in **Table 10**. Of these eight species, three (3) species, Tamarack (*Larix larcina*), White Spruce (*Picea glauca*), and Speckled Alder (*Alnus incana* ssp. *rugosa*) have been introduced through plantings.

Table 10. Vegetation Species of Regional Conservation Concern

Species	Common Name	S-Rank[1]	L-Rank[2]	Location
*Alnus incana ssp. rugosa**	Speckled Alder	S5	L3	ELC units 18a, 18b
Carex laevivaginata	Smooth-sheathed Sedge	S4	L3	ELC unit 12
Epilobium leptophyllum	Narrow-leaved Willowherb	S5	L3	ELC unit 8a
Equisetum sylvaticum	Woodland Horsetail	S5	L3	ELC unit 12
*Larix laricina**	Tamarack	S5	L3	ELC unit 11, 16, 18a, 18b
*Picea glauca**	White Spruce	S5	L3	ELC unit 11, 16
Triosteum aurantiacum	Orange-fruit Horse-gentian	S4S5	L3	ELC unit 6a

*planted

[1] Provincial Rank (NHIC): S4=Apparently Secure, S5=Secure

[2] Local Rank (TRCA): L3=Regional conservation concern

3.3.5 Tree Resources

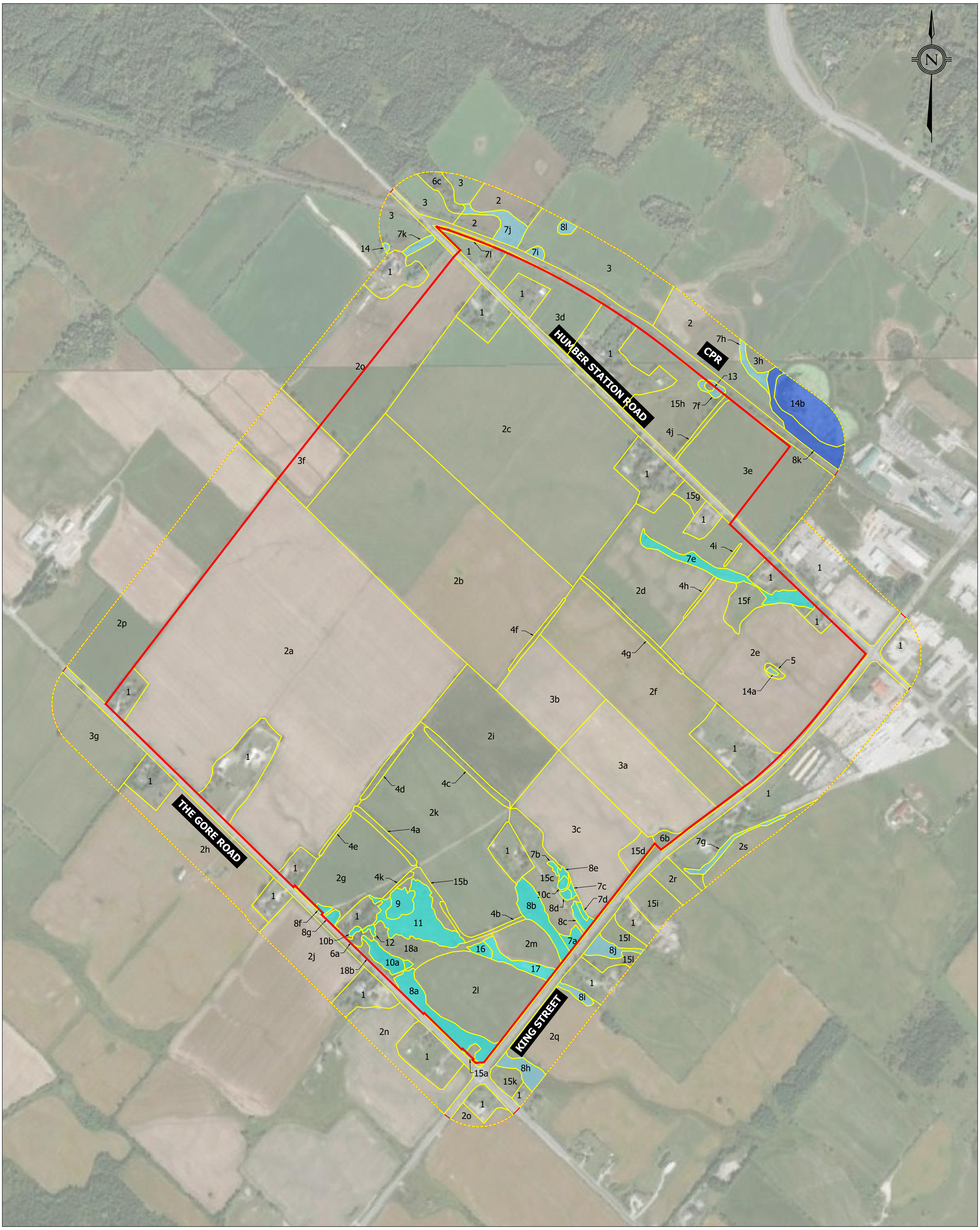
Beacon has characterized the treed resources in the Study Area. An inventory and evaluation of the existing individual trees and tree groupings in the Study Area was conducted on June 12, June 18, and August 20, 2020 by an Arborist certified by the International Society of Arboriculture.

Individual trees ≥10 cm DBH (diameter at breast height, measured 1.4 m above grade) were tagged with numbered with aluminum forestry tags and their locations were recorded with GPS. For each tree, the following information was recorded:

- Species;
- Trunk DBH (diameter at breast height, measured 1.4 m above grade);
- Health condition; and
- Structural condition rating.

Where trees occur in groupings such as hedgerows, rather than tag and assess all trees individually, the number, species, size, and condition of the trees in each group were recorded.

Most of the property is agricultural and trees are limited to hedgerows and ornamental trees associated with farm properties and some tree communities (as described in **Section 3.3.2**). The trees that were



LEGEND:

🟥	SUBJECT LANDS
⬚	STUDY AREA (120 m)
🟦	PROVINCIALLY SIGNIFICANT WETLANDS (NOT STAKED)
▭	UNEVALUATED WETLANDS (NOT STAKED)
▭	UNEVALUATED WETLANDS (STAKED)
2n	ELC COMMUNITIES

UNIT	COMMUNITY TYPE
1	Anthropogenic
2	Agriculture - Row Crops
3	Agriculture - Hay
4	Hedgerow (H)
5	Cultural Woodland (CUW1)
6	Cultural Thicket (CUT1)
7	Reed Canary Grass Mineral Meadow Marsh (MAM2-2)
8	Cattail Mineral Shallow Marsh (MAS2-1)
9	Cattail Organic Shallow Marsh (MAS3-1)
10	Stonewort Submerged Shallow Aquatic (SAS1-3)
11	Forb Mineral Meadow Marsh (MAM2-10)
12	Organic Deciduous Swamp (SWD3)
13	Pondweed Submerged Shallow Aquatic (SAS1-1)
14	Open Aquatic (OAO)
15	Dry-Moist Old Field Meadow (CUM1-1)
16	Willow Mineral Thicket Swamp (SWT2-2)
17	Mineral Meadow Marsh (MAM2)
18	Cultural Plantation (CUP)

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FIGURE 3.3.2

ECOLOGICAL COMMUNITIES

JANUARY 2021

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inventoried individually or as group are illustrated on **Figure 3.3.5**. These results are detailed in **Appendix E**.

There are a number of landowners in the Study Area that are not participating in the current study. Trees located on non-participating landowner properties were not included in the tree inventory. An inventory of these trees will be completed at the Draft Plan stage.

Further consideration will be given to preservation trees and tree groupings at the Draft Plan stage in accordance with the Town of Caledon guidelines. However, future Arborist Reports and Tree Preservation Plans can rely on the inventory created through this CEISMP.

3.3.6 Avifauna

A total of 48 bird species were recorded in the Study Area during the 2013 and 2014 surveys completed by Dougan & Associates *et al*. (2014a and 2014b). Most species observed were noted as common and widespread in Ontario and representative of open habitats. A species list was not included in the report; however, it was noted that the following avian SAR were recorded from the Study Area in 2013 and 2014:

- Barn Swallow (*Hirundo rustica*) - 14 individuals were seen in six locations on the Subject Lands;
- Bank Swallow (*Riparia riparia*) - one individual was seen flying over Humber Station Road on July 13, 2013, although given the habitat in this location and the surrounding areas, Dougan & Associates *et al.* (2014b) assumed it was not likely breeding locally;
- Bobolink (*Dolichonyx oryzivorus*) - at least 42 individuals were seen in six general locations on the Subject Lands; and
- Eastern Meadowlark (*Sturnella magna*) - six individuals (which were all single birds singing) were seen in six locations on the Subject Lands.

In 2020, Beacon completed breeding bird surveys in the Study Area as shown on **Figure 3.3.6**. Surveys took place in the early morning on days with low winds (3 or less on the Beaufort scale), temperatures within 5°C of normal and minimal precipitation. The Study Area was walked such that all singing birds could be heard or observed and recorded on an aerial photograph of the Study Area as shown in the field notes (**Appendix F**). Survey details are presented in **Table 11**.

Table 11. Breeding Bird Survey Details 2020

Details	Survey 1	Survey 2	Survey 3
Date:	May 28, 2020	June 19, 2020	July 4, 2020
Start Time:	4:45	6:20	4:45
End Time:	8:15	9:10	8:30
Temperature (˚C):	16-18	19-20	18-21
Wind speed (km/h):	0	0	0
Cloud cover (%):	100	20-75	0
Precipitation:	None	None	None

A total of 47 species were documented (**Appendix G**). Of the 47 species documented, 42 exhibited evidence of breeding and are considered to be breeding on the Subject Lands. Species that were observed only flying or foraging over the Study Area included: Great Blue Heron (*Ardea Herodias*), Peregrine Falcon (*Falco peregrinus*), Ring-billed Gull (*Larus delawarensis*), Northern Rough-winged Swallow (*Stelgidopteryx serripennis*), and Tree Swallow (*Tachycineta bicolor*).

Species observed were generally associated with the following three habitat types: agriculture/hedgerow, house/garden and wetland/early successional habitats. Field notes from the breeding bird surveys in 2020 indicated where each species has been recorded, and has been included as **Appendix F**.

The avian community is comprised of species that are indicative of agricultural and rural settings. This is consistent with the habitats present. Most of the Subject Lands are farmed and there are also residential and industrial areas nearby. Three of the most abundant species recorded included Red-winged Blackbird (*Agelaius phoeniceus*), Song Sparrow (*Melospiza melodia*) and Savannah Sparrow (*Passerculus sandwichensis*).

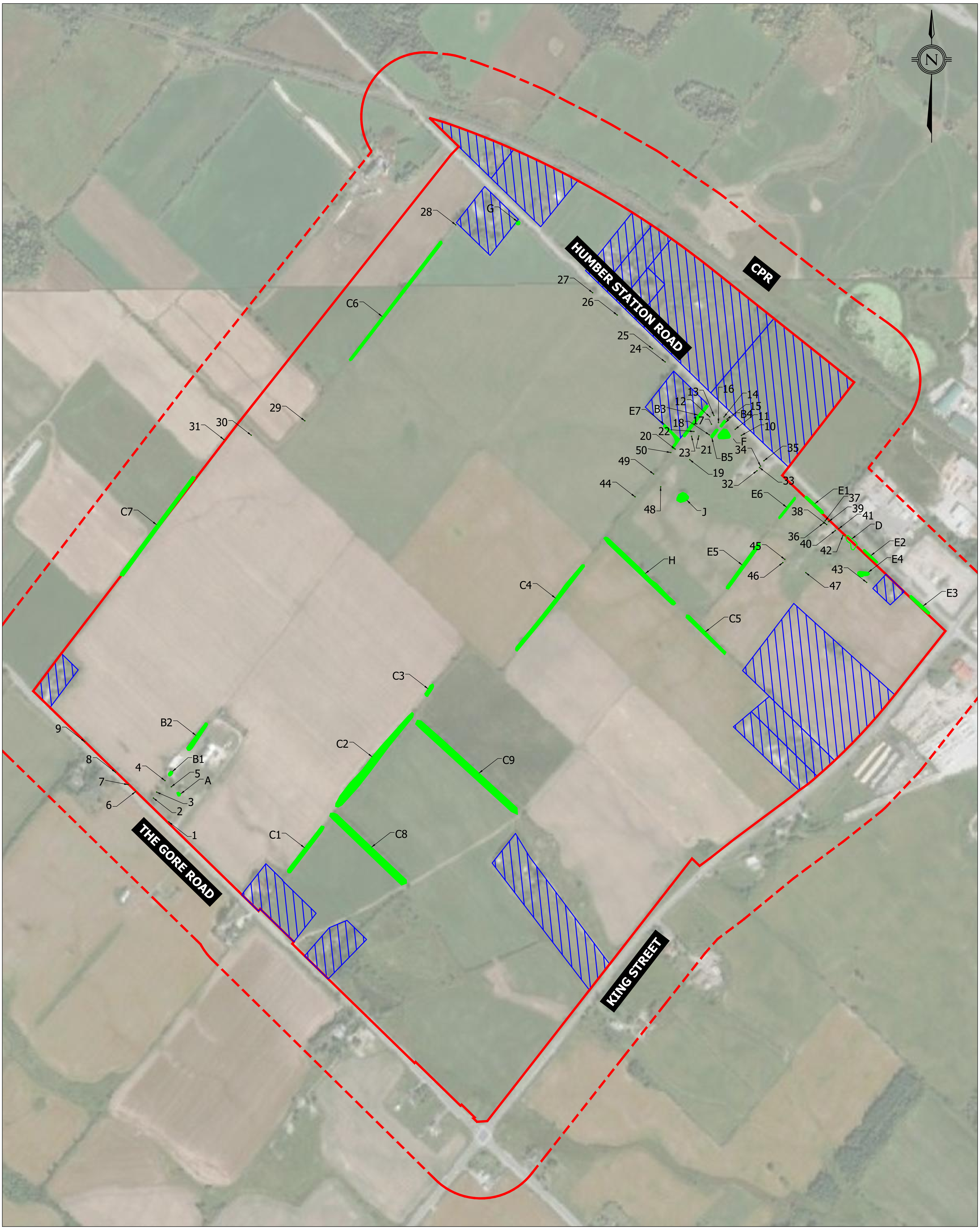
Other species observed that are also tolerant of anthropogenically modified habitats include : America Robin (*Turdus migratorius*), House Wren (*Troglodytes aedon*), European Starling (*Sturnus vulgaris*), Northern Cardinal (*Cardinalis cardinalis*), Indigo Bunting (*Passerina cyanea*), Brown-headed Cowbird (*Molothrus ater*) and American Goldfinch (*Spinus tristis*).

Other than the Red-winged Blackbird, which as discussed is an anthropogenic tolerant bird, a small number of species generally considered to be wetland associates were observed. A single Swamp Sparrow (*Melospiza georgiana*) and a few Common Yellowthroat (*Geothlyphis trichas*) were observed in the wetland habitats in the southern corner of the Subject Lands.

Of the 42 species that exhibited breeding evidence, all have a conservation rank of S5 (Secure) or S4 (Apparently Secure) (NHIC 2020). However, three avian species breeding in the Study Area are listed as Threatened under the *Endangered Species Act* (2007), including: Barn Swallow, Bobolink and Eastern Meadowlark.

Barn Swallow is an open country aerial insectivore that nests primarily in barns and similar structures and forages over fields, meadows and bodies of water. This species has been listed as threatened because it “has experienced very large declines that began somewhat inexplicably in the mid to late 1980s in Canada” (COSEWIC 2011a). Barn Swallow were observed foraging over ELC Unit 3c (Agriculture – Hay) on May 28, 2020 and over (ELC Unit 2e) Agriculture - Row Crops on June 19, 2020. Nesting Barn Swallow were also observed on a house (7675 Peel Regional Road 9) located south east of the Subject Lands but within the Study Area.

Bobolink is an area sensitive open country grassland species that requires large blocks of open habitat such as pasturelands and older hay fields. It is estimated that there are 700,000 Bobolink that breed in southern Ontario (Cadman *et al*. 2007). The preferred breeding habitat of Bobolink in eastern North America is confined to open grasslands, particularly hayfields and pastures (McCracken *et al.* 2013, COSEWIC 2010). The species has an affinity for hayfields older than eight years (McCracken *et al*. 2013). It generally avoids habitats that are subject to flooding as well as early successional habitats with tree and shrub growth. However, throughout its range it can also be found in wet prairie, graminoid peatlands, abandoned fields with tall grass, native tall grass prairie, no-till cropland, and reed beds (COSEWIC 2010). On the Subject Lands, Bobolink were observed in Agriculture - Hay (ELC Unit 3c)



LEGEND:

☐ SUBJECT LANDS

☐ STUDY AREA (120 m)

▨ PARCELS NOT SURVEYED

🟩 TREE GROUPINGS

· INDIVIDUAL TREES (APPROXIMATE LOCATION)

1 TREE TAG NUMBER

C1 TREE GROUP NUMBER

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FIGURE 3.3.5

TREED RESOURCES

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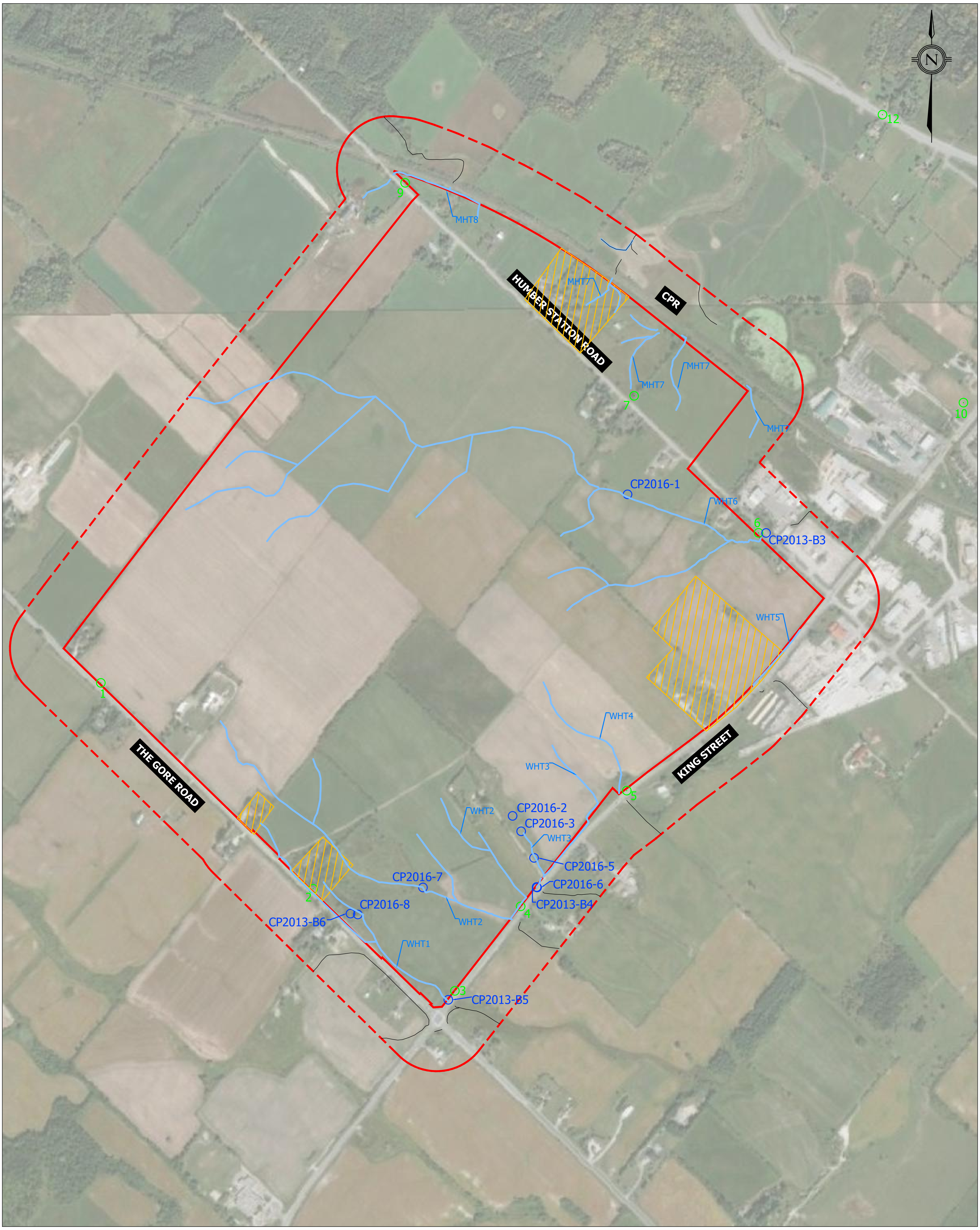

LEGEND:

▭ SUBJECT LANDS

⬚ STUDY AREA (120 m)

▨ PORTIONS OF STUDY AREA NOT ACCESSED DURING BREEDING BIRD SURVEYS

○ CP20XX-XX FISH COMMUNITY SAMPLING SITES (C. PORTT & ASSOCIATES [YEAR-SAMPLING REACH NUMBER])

○ AMPHIBIAN CALL STATION

— DRAINAGE FEATURES

— UNASSESSED DRAINAGE FEATURES

WHT1/MHT1 TRIBUTARY NAME AND NUMBER (i.e. WEST HUMBER TRIBUTARY; MAIN HUMBER TRIBUTARY)

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FIGURE 3.3.6

BIOLOGICAL SAMPLING

JANUARY 2021

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and Agriculture - Row Crop (ELC Units 2b and 2i) on May 28, 2020 and in Agriculture - Hay (ELC Unit 3c) on June 19, 2020. No Bobolink were observed on the Subject Lands during the third breeding bird survey on July 4, 2020 as suitable habitat was no longer present due to cropping. The Subject Lands are regularly farmed, and crops rotated annually or more frequently. As there are no fields that support consistent cover for prolonged periods utilization of the fields by this species is highly variable and ephemeral. The area continues to be farmed and does not provide suitable habitat for these species.

Eastern Meadowlark is also considered an area sensitive species that breeds in large hay fields, pastures and old field meadows (COSEWIC 2011b). While this species has similar habitat preference to Bobolink, it can also be found in more successional habitats that contain sparse tree and shrub cover as well as a higher proportion of forbs. Eastern Meadowlark were observed on the Subject Lands in Agriculture - Row Crops (ELC Units 2c and 2d) on May 28, 2020 and in Agriculture - Hay (ELC Unit 3d) on July 4, 2020. Eastern Meadowlark was also observed west of the Subject Lands within the Study Area on June 19, 2020.

Historically, in eastern North America, open country species such as Bobolink and Eastern Meadowlark have benefited from human alteration of the landscape for agriculture. However, like many other open country species, their populations in Ontario and other jurisdictions are thought to have declined.

Further discussion for Barn Swallow, Bobolink and Eastern Meadowlark is provided in **Section 3.3.9.6.**

As previously mentioned, Bobolink and Eastern Meadowlark are area-sensitive, which are species that either require a larger block of suitable habitat in which to breed or which are more productive in large habitat blocks. The Savannah Sparrow is also considered a grassland area-sensitive species. It is very common and widespread and breeds in a variety of open field situations from agricultural fields to large cultural meadows.

TRCA ranks species of regional conservation concern and ranks them from L1 (highest concern) to L5 (least concern) (TRCA 2016). Seven species of the species observed from the Subject Lands are of regional concern and have rank of L1 to L3. Species include: Bobolink, Eastern Meadowlark, Wild Turkey (*Meleagris gallopavo*), Black-billed Cuckoo (*Coccyzus erythropthalmus*), Horned Lark (*Eremophila alpestris*), Brown Thrasher (*Toxostoma rufum*) and Vesper Sparrow (*Pooecetes gramineus*) which are ranked L1. Eastern Meadowlark are ranked as L2, meaning they typically occur in high-quality habitats and are of regional concern. The remaining five species are ranked L3, meaning they can withstand minor disturbance, are generally secure in the natural matrix but are of regional concern.

3.3.7 Herpetofauna

Anurans

Dougan & Associates *et al.* (2014a and 2014b) conducted nocturnal amphibian breeding surveys on April 25, May 27, and June 24, 2014. Five species of amphibians were recorded from the Study Area during these surveys, including Spring Peeper (*Pseudacris crucifer*), Wood Frog (*Lithobates sylvaticus*), Gray Tree Frog (*Hyla versicolor*), Green Frog (*Rana clamitans*), and American Toad (*Anaxyrus americanus*). All observations were associated with the wetlands and ponds within the Study Area; however, the precise locations of amphibian observations were not included in their reporting.

In 2020, Beacon completed additional amphibian surveys in the Study Area by establishing monitoring stations in locations similar to those used by Dougan & Associates *et al.* (2014a and 2014b). Call surveys are the primary method for identifying breeding habitats for anurans (frogs and toads) as this is when they are vocalizing and most detectable as different species breed at different times in the spring three surveys were completed in order to detect the full range of anuran species present on a site. Surveys focussed on potential anuran breeding habitat such as wetlands and ponds. The locations of the call survey stations are illustrated in **Figure 3.3.6**.

The surveys were conducted after dusk during suitable weather conditions between April and June, a minimum of 15 days apart. Weather details (i.e., air temperature, precipitation, wind speed, and cloud cover) at the time of survey were recorded (see **Table 12**). Surveys were conducted using the point count method whereby the surveyor stands at a set point for a specific period and record all species that can be heard calling over that time from within a 100 m radius sample area. Each survey station was surveyed for a minimum of three minutes. The approximate locations of calling anurans were noted on a standard MMP data sheet and chorus activity for each species was assigned a call code as follows:

- Code 0 - no calls;
- Code 1: individual calls do not overlap and calling individuals can be discretely counted;
- Code 2: calls of individuals sometimes overlap, but numbers of individuals can still be estimated;
- Code 3: overlap among calls seems continuous (full chorus), and a count estimate is impossible.

Table 12. Anuran Survey Details 2020

Details	Round 1	Round 2	Round 3
Date:	April 27, 2020	May 27, 2020	June 22, 2020
Start time:	20:49	21:36	22:13
Temp (°C):	10	26	23-25
Wind (km/h):	1-11	0	0
Cloud cover (%):	<10	15	90-100
Precipitation	None	None	None/Fog

Four frog species and one toad species were recorded from ten stations in the Study Area during the 2020 nocturnal amphibian call surveys. Species recorded included American Toad, Green Frog, Gray Tree Frog, Spring Peeper and Wood Frog. These findings are consistent with the previous surveys completed by Dougan & Associates *et al.* (2014a and 2014b). The findings are summarized below in **Table 13**. It should be noted that Station 8 was not accessed in 2020, and that there is no Station 11.

Table 13. Anuran Survey Results 2020

Station	Round 1	Round 2	Round 3
1	-	GRTR 2(4)*	-
2	-	-	**GRFR 1(1)** **GRTR 2(5)** GRTR 2(4)*
3	-	-	-
4	-	-	GRTR 1(2)*
5	-	GRTR 1(2)*	-
6	-	-	-
7	**SPPE 3** SPPE *	**SPPE 2(10)** GRTR 3 SPPE 3	**AMTO 1(2)** **GRFR 1(1)** GRTR 2(3)
9	SPPE 3 WOFR 1(1) SPPE 3*	GRTR 3 SPPE 2(12) GRTR 3*	GRFR 1(1) GRTR 2(7) AMTO 1(1)* GRTR 2(5)*
10	SPPE 3 SPPE 3*	GRTR 2(8) SPPE 2(10) GRTR * SPPE 3*	GRTR 2*
12	SPPE 3	GRTR 2(10) SPPE 3 GRTR 2* SPPE 2*	AMTO 1(1) GRFR 1(2) GRTR 2(5)*

*= Call recorded from outside of station area
Results in **bold** are recorded within the Subject Lands
AMTO = American Toad, GRFR = Green Frog, GRTR = Gray Tree Frog, SPPE = Spring Peeper, WOFR = Wood Frog
Code 0 - No calling
Code 1 - Individuals can be counted; calls not simultaneous. Estimated number of individuals indicated in brackets
Code 2 - Calls distinguishable, some simultaneous calling. Estimated number of individuals indicated in brackets
Code 3 - Full chorus; calls continuous and overlapping.

As shown on **Figure 3.3.6**, the amphibian monitoring stations cover the Study Area. The results of the surveys completed to date indicate that most of the breeding is associated with the PSW east of the Subject Lands. On the Subject Lands, there was only one station (Station 7)) were a call level code of three (3) was recorded on one occasion. This observation corresponds with Spring Peeper during the first round (April 27, 2020). Station 7 includes a Reed Canary Grass Mineral Meadow Marsh (ELC Unit 7f) and Pondweed Submerged Shallow Aquatic (ELC Unit 13).

Reptiles

Dougan & Associates *et al.* (2014b) completed incidental surveys for reptiles in 2013 and 2014. During these surveys, they recorded observations of Midland Painted Turtle (*Chrysemys picta marginata*) and Snapping Turtle (*Chelydra serpentine*). Both species were observed in a small, unevaluated wetland outside of the Study Area, but in close proximity to the Bolton PSW Complex, which is within the Study Area.

Midland Painted Turtle is not considered significant in Ontario; although, in April 2018 it was designated Special Concern in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) due to loss of wetlands in Ontario; the *Species at Risk Act* has not created a schedule yet for Midland Painted Turtle. However, Snapping Turtle was assigned “Special Concern” status in Canada in 2008 and Ontario in 2009.

No formal surveys for reptiles were undertaken in 2020, however, on October 5, 2020, a juvenile Snapping Turtle was noted incidentally within the Study Area on the east side of the railroad tracks adjacent to the PSW pond unit.

As Snapping Turtle is a Special Concern, it is also discussed in the Significant Wildlife Habitat section of this report (**Section 3.3.9.4**).

3.3.8 Aquatic Habitat & Fish Communities

The CEISMP TOR require that detailed studies be undertaken to confirm which fish communities and aquatic habitats are present in the Study Area.

Based on the background review, MNRF and TRCA fish collection records are not available for the Study Area and Subject Lands. The MNRF Aquatic Resource Area (ARA) database does however note the following fishes as being associated with the broader Humber River system:

- American Brook Lamprey;
- Blacknose Dace;
- Bluntnose Minnow;
- Brook Trout;
- Brown Trout;
- Common Shiner;
- Creek Chub;
- Fantail Darter;
- Fathead Minnow;
- Johnny Darter x Tessellated Darter;
- Longnose Dace;
- Northern Hog Sucker;
- Rainbow Darter;
- Redside Dace;
- Rock Bass;
- Stonecat; and
- White Sucker.

The ARA database classifies all the drainage features within the Study Area as supporting a warmwater fishery.

A review of the DFO’s Aquatic Species at Risk online mapping tool, indicates that the are no aquatic species at risk or critical habitat identified within the Study Area. Habitat for endangered Redside Dace is however mapped approximately 1.5 km downstream of the Subject Lands along Lindsay Creek (West Humber) immediately west of The Gore Road. Redside Dace is listed both federally and provincially as endangered and is regulated by DFO under the *Species at Risk Act* and by MECP under the *Endangered Species Act*. Through reviewing MNRF comments on the Background Environmental Study (Dougan & Associates *et al.* 2014b) provided in a letter from Jackie Burkart to Town of Caledon on March 11, 2016, it was suggested that “the watercourses within these lands [Option 3 lands] are considered “contributing” habitat for Redside Dace”.

Aquatic assessments of drainage features on the Subject Lands were completed in 2013 and 2016 by C. Portt & Associates. The purpose of these assessments was to characterize the fish communities under spring and early summer conditions and to search for migratory spawning fish species in these headwater areas.

An assessment of all drainage features entering or exiting the Subject Lands was completed on August 23, 2013 by C. Portt & Associates. The assessment recorded the amount of water, flow and instream habitat conditions during this typically dry season. Similar to the surface water assessment discussed in **Section 3.2.5**, the results of the aquatic assessment found that the drainage features on the Subject Lands were considered HDFs with intermittent flows and did not have the same complex function or aquatic communities that occur downstream of the Study Area where flows are seasonal or permanent (Dougan & Associates *et al*. 2014b).

C. Portt & Associates noted that the lower reaches of WHT1 and WHT6 support standing water with intermittent flows and considered these reaches to provide seasonal habitat. To characterize the fish community, C. Portt & Associates completed electrofishing along drainage features at seven stations on the Subject Lands in 2013 and 2016. These sampling locations are identified on **Figure 3.3.6**

Fish were captured at only two of the stations corresponding with HDF reaches WHT6-A and WHT1-B (**Figure 3.2.5.2b**). Brook Stickleback (*Culaea inconstans*) was observed at both reaches (stations CP2013-B3, CP2013-B6 and CP2016-1), and Fathead Minnow (*Pimephales promelas*) was observed only at WHT1-B (station CP2016-8).

Brook Stickleback is a coolwater species commonly associated with HDFs throughout southern Ontario (OFFLHD 2020). This species is regularly found in warmwater habitats including man-made drainage ditches, stormwater management ponds and other habitats that go dry in the summer (Stewart and Watkinson 2004).

Fathead Minnow is a warmwater species that prefers still waters of ponds, lakes, creeks and small rivers with muddy substrate (OFFLHD 2020). This species is common in Southern Ontario and is tolerant to anthropogenic activities.

As described in **Section 3.2.5.2**, Beacon reviewed the drainage features in the Study Area in 2020 and confirmed that the characterization of aquatic habitats is generally consistent with observations made by C. Portt and Associates and the HDFA prepared by Aquafor Beech Limited (2013). For this reason, additional fish community sampling was not undertaken by Beacon in 2020. It is Beacon's opinion that HDF reaches WHT1-A, WHT1-B and WHT6-A provide fish habitat while the other HDF's are dry outside the spring freshet indirectly support fish habitat.

Through additional surface water monitoring work completed by DS Consultants Ltd. in 2020, it appears that HDF reaches WHT1-A and WHT1-B do receive some baseflow inputs. Additionally, Beacon has observed iron staining and watercress within HDF reach WHT1-B which suggests a more permanent flow regime and possibly a coolwater thermal regime. All other HDFs in the Study Area exhibit and intermittent flow regime and warmwater thermal regime.

3.3.9 Evaluation of Significant Natural Heritage Resources

The protection, maintenance, enhancement and restoration of ecosystems and their function in the landscape is necessary to maintain ecosystem integrity. This goal has been adopted in the Town's ecosystem principles and ecosystem planning strategy and is to be achieved through implementation of the policies outlined in Ecosystem Planning and Management section of the Town of Caledon Official Plan. All development within the Town of Caledon is required to satisfy the Environmental Performance Measure policies.

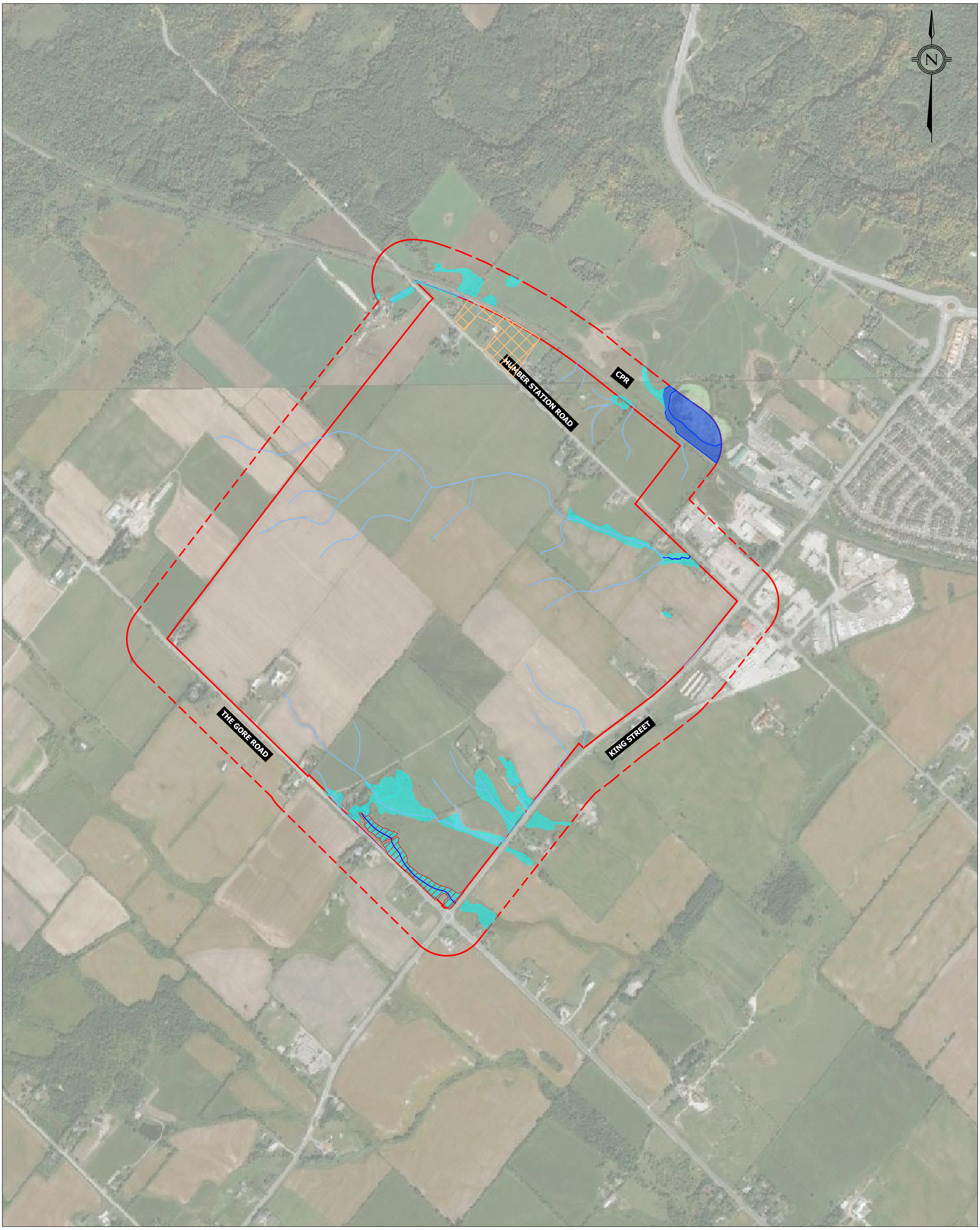
To determine which biophysical resources and ecological functions in the Study Area are considered significant we relied upon the significance criteria outlined in the PPS (2020) and associated Natural Heritage Reference Manual (2010), Region of Peel's Greenlands System policies and Town of Caledon's Environmental Performance Measures policies.

It should be noted that the Study Area only supports seven of the seventeen Environmental Performance Measures outlined in the Town of Caledon Official Plan. Environmental Performance Measures applicable to the Study Area are listed in **Table 14** below.

Table 14. Town of Caledon Environmental Performance Measures Applicable to the Study Area

Environmental Performance Measure	In Study Area
Woodlands	✗
Wetlands	✓
Areas of Natural and Scientific Interest (ANSIs)	✗
Environmentally Significant Areas (ESAs)	✗
Niagara Escarpment Natural Areas	✗
Niagara Escarpment Protection Areas	✗
Habitat of Threatened and Endangered Species	✓
Fisheries	✓
Wildlife Habitat	✓
Valley and Stream Corridors	✓
Groundwater	✓
Wellhead Protection Areas	✗
Soils	✓
Natural Slopes	✗
Oak Ridges Moraine Key Natural Heritage Features	✗
Oak Ridges Moraine Hydrologically Sensitive Features	✗
Greenbelt Key Natural Heritage and Key Hydrologic Features	✗

The following subsections describe how the significance of the various Environmental Performance Measures has been evaluated and what criteria have been applied. Significant natural heritage resources area illustrated on **Figure 3.3.9**.



LEGEND:

▭ SUBJECT LANDS

⬚ STUDY AREA (120 m)

🟦 WETLAND CORE AREAS (i.e., PROVINCIALLY SIGNIFICANT WETLANDS)

🟦 OTHER WETLANDS (i.e., UNEVALUATED WETLANDS AND NON-PSW)

— DRAINAGE FEATURES

— FISH HABITAT

HABITAT OF ENDANGERED AND THREATENED SPECIES

☒ EASTERN MEADOWLARK HABITAT

▨ REDSIDE DACE CONTRIBUTING HABITAT

NOTE: SIGNIFICANT WILDLIFE HABITAT HAS NOT BEEN MAPPED. REFER TO REPORT SECTION 3.3.9.4
POTENTIAL HABITAT OF SAR BATS HAS NOT BEEN MAPPED. REFER TO REPORT SECTION 3.3.9.6
REFER TO FIGURES 3.2.5.2a AND 3.2.5.2b FOR WETLAND AND TRIBUTARY/REACH LABELLING

BEACON ENVIRONMENTAL

DS CONSULTANTS LTD.

GSAI Glen Schnarr & Associates Inc.

URBANTECH

Bolton-Macville Community-Comprehensive Environmental Impact Study and Management Plan

PROJECT No.

FIGURE 3.3.9

SUMMARY OF SIGNIFICANT NATURAL HERITAGE RESOURCES

JANUARY 2021

SCALE: 1:12000

3.3.9.1 Wetlands

Through background review and field investigations, it has been confirmed that the Study Area supports a number of wetland communities. The locations of these wetlands are illustrated on **Figure 3.3.2**.

None of the wetlands on the Subject Lands have been evaluated, however their boundaries were previously staked by MNRF on May 2, 2016 during the BRES planning process. There are additional wetlands within the Study Area outside the Subject Lands. Most of these wetlands are small and unevaluated, however there is one larger wetland feature to the east of the CPR line that has been evaluated and is part of the provincially significant Bolton Wetland Complex.

In terms of establishing the significance of these wetland features, we relied upon the criteria and definitions included in the PPS (2020) and Region of Peel and Town of Caledon official plans.

Both the PPS and ROP describe Significant Wetlands as follows:

> *…an area identified as provincially significant by the Ontario Ministry of Natural Resources using evaluation procedures established by the Province, as amended from time to time.*

Based on the application of the provincial and regional significance criteria, only the one provincially significant wetland unit W9 (ELC Units 8k & 14b) located to the east of the Subject Lands would be considered significant.

While unevaluated wetlands are not considered significant under the ROP, they are recognized as Potential Natural Areas and Corridors (PNACs) and form part of the Regional Greenlands System. The ROP defers to local municipal plans regarding protection and management of PNACs.

The Town of Caledon Official Plan does not include a specific definition or criteria for identification of Significant Wetlands. Wetlands are however in the Town's Ecosystem Framework as Wetland Core Areas and Other Wetlands. Wetland Core Area includes wetlands that have been determined to be significant and approved by MNRF (i.e. provincially significant wetlands). Other Wetlands are defined as wetlands that have not identified as Wetland Core Areas (i.e., unevaluated wetlands and evaluated wetlands that are not provincially significant). Under the Town's Environmental Ecosystem Framework, Wetland Core Area as included within Natural Core Areas and Other Wetlands are included under Supportive Natural Systems. Irrespective of these categorizations, the Town's Environmental Performance Measures policies require all wetlands and their functions to be maintained so as not to compromise ecosystem integrity. While the Town's policies prohibit any development within Wetland Core Areas (i.e. provincially significant wetlands), they do permit development within Other Wetlands, provided it can be demonstrated to the satisfaction of the Town and applicable review agencies that such development will not compromise ecosystem integrity.

Based on the evaluation of the provincial, regional and local significance criteria pertaining to wetlands, the only significant wetland within the Study Area is the provincially significant wetland unit located to the east of the Subject Lands. All other wetlands in the Study Area are not considered significant. Irrespective of their significance status, all wetlands are subject to Town's Environmental Performance Measures policies.

3.3.9.2 Woodlands

The PPS (2020) defines Significant Woodlands as follows:

> *… an area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history. These are to be identified using criteria established by the Ontario Ministry of Natural Resources…*

The Regional Official Plan defines Significant Woodlands as follows:

> *…an area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or …the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history.*

Prior to application of the significant woodland criteria, it is necessary to first identify which of the treed features in the Study Area meet the definition of a "woodland" as per the Town of Caledon Official Plan.

Town of Caledon Official Plan Glossary of Terms (Section 6.7) defines "woodlands" as follows:

> *Woodlands, shall mean ecosystems comprised of treed areas and the immediate biotic and abiotic environmental conditions on which they depend. Woodlands provide environmental and economic benefits to both the private landowner and the general public, such as erosion prevention, hydrological and nutrient cycling, the provision of clean air and the long-term storage of carbon, the provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products. Woodlands include woodlots, cultural woodlands, cultural savannahs, plantations and forested areas and may also contain remnants of old growth forests.*
>
> *Woodlands are further defined as any area greater than 0.5 hectares that has:*
> - *a) A tree crown cover of over 60% of the ground, determinable from aerial photography, or*
> - *b) A tree crown cover of over 25% of the ground, determinable from aerial photography, together with on-ground stem estimates of at least:*
>   - *i) 1,000 trees of any size per hectare, or*
>   - *ii) 750 trees measuring over five centimetres in diameter at breast height (1.37m), per hectare, or*
>   - *iii) 500 trees measuring over 12 centimetres in diameter at breast height (1.37m), per hectare, or*
>   - *iv) 250 trees measuring over 20 centimetres in diameter at breast height (1.37m), per hectare (densities based on the Forestry Act of Ontario, 1998),*
>
> *and, which have a minimum average width of 40 metres or more measured to crown edges.*

> *Treed portions with less than the required stocking level will be considered part of the woodland as long as the combination of all treed units in the overall connected treed area meets the required stocking level. Woodlands experiencing changes such as harvesting, blowdown or other tree mortality are still considered woodlands. Such changes are considered temporary whereby the forest still retains its long-term ecological value.*
>
> *Woodlands do not include plantations that are:*
>
> a) *Managed for production of fruits, nuts, Christmas trees or nursery stock;*
> b) *Managed for tree products with an average rotation of less than twenty (20) years (e.g. hybrid willow or poplar); or,*
> c) *Established and continuously managed for the sole purpose of complete removal at rotation, as demonstrated with documentation acceptable to the Region or area municipality, without a woodland restoration objective.*
>
> *Additional exclusions may be considered for treed communities which are dominated by invasive non-native tree species such as buckthorn (Rhamnus species) and Norway maple (Acer plantanoides), or others deemed to be highly invasive, that threaten the ecological functions or biodiversity of native communities. Such exceptions should be supported by site-specific studies that consider 1) the degree of threat posed; 2) any potential positive and/or negative impact on the ecological functions or biodiversity of nearby or adjacent native communities; and 3) the projected natural succession of the community. Communities where native tree species comprise approximately 10 percent or less of the tree crown cover and approximately 100 or fewer stems of native tree species of any size per hectare would be candidates for exclusion*.

There are only four (4) treed communities within the Study Area. These are listed below.

- Cultural Woodland (ELC Unit 5) – 0.08 ha.;
- Organic Deciduous Swamp (ELC Unit 12) – 0.04 ha.;
- Cultural Plantation (ELC Unit 18a) – 0.96 ha.; and
- Cultural Plantation (ELC Unit 18b) – 0.21 ha.

It should be noted that the ELC system for classifying treed features differs from the woodland definitions provided in the official plans.

ELC units 5,12 and 18b are less than 0.5 ha and too small to qualify as woodlands.

ELC unit 18a is larger than 0.5 ha but does not meet the minimum density requirements to qualify as a woodland under the ROP and Town of Caledon Official Plan definitions.

In summary, none of the treed features in the Study Area meet the definitions of a woodland.

3.3.9.3 Valley and Stream Corridors

The PPS (2020) does not include a natural heritage category for Valley and Stream Corridors. It does however have include a category for Significant Valleylands, however determination of significance is the responsibility of the municipality or partner agencies.

The PPS defines valleylands as follows:

> *Means a natural area that occurs in a valley or other landform depression that has water flowing through or standing for some period of the year*

Significance as it relates to valleylands is interpreted as follows:

> *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;*

The Region of Peel recognizes Valley and Stream Corridors as part of the Regional Greenlands System and defines them as follows:

> *Valley and stream corridors are the natural resources associated with river systems and are characterized by their landform, features and functions, and include associated ravines. Valley corridors and their associated ravines are distinguished from stream corridors by the presence of a distinct landform. Due to the inherent hazards of valley lands they have remained mainly undeveloped and vegetated. Valley and stream corridors are natural linkages in the landscape having important ecological functions, providing habitat for fish and wildlife and acting as corridors for movement.*

While the Regional Official Plan does not define valley and Stream Corridors as significant, it includes criteria and thresholds by which they are to be evaluated for inclusion as Core Areas of the Regional Greenlands System. However, the criteria exclude portions of tributaries contained within designated Rural Service Centres and rural settlements of the Rural System, so would not apply to the Subject Lands.

The Town of Caledon considers Valleylands and Stream Corridors to be a component of their Ecosystem Framework where they are recognized as Natural Corridors. The Town of Caledon defines Valley and Stream Corridors as follows:

> *Valley and Stream Corridor, shall mean continuous water-based ecosystems which are centred on watercourses, their associated floodplains, valley systems, vegetative communities and functionally-related tableland features.*

While the Study Area supports headwater drainage features, these features are not associated with any distinctive valley landforms. Therefore, by using the definitions listed above, Stream Corridors on the Subject Lands include HDF reach WHT6 as it has an associated floodplain and is considered fish habitat, as well as HDF reaches WHT1-A and WHT1-B has they contain fish habitat and have a permanent flow regime.

3.3.9.4 Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) includes those natural areas, features, attributes and functions that represent the best examples of wildlife habitat within a municipality. The PPS (2020) defines SWH as follows:

> *Significant means: in regard to other features and areas, 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…*

The responsibility for confirming SWH is assigned to the local or regional planning authority; however, municipalities often also rely upon proponents to identify “candidate SWH” through studies such as this CEISMP. Ultimately, it is the responsibility of the municipality to confirm SWH.

According to the *Significant Wildlife Habitat Technical Guidelines* (MNR 2000), there are four broad categories of SWH:

1. Seasonal Concentration Areas of Animals;
2. Rare Vegetation Communities or Specialized Habitat for Wildlife;
3. Habitat for Species of Conservation Concern; and
4. Animal Movement Corridors.

Within each of these categories, there are multiple subcategories of SWH, each of which is intended to capture a specialized type of habitat that may or may not be captured by other existing feature-based categories (e.g., significant wetlands, significant woodlands).

To determine whether the Study Area supports any wildlife habitat features, attributes or functions that could potentially qualify as candidate SWH, Beacon relied upon the provincial evaluation criteria provided in the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E* (MNRF 2015). A summary of this evaluation is presented in **Appendix H**.

In addition to applying the provincial criteria, Beacon also considered the evaluation criteria contained in the *Peel-Caledon Significant Woodlands and Significant Wildlife Habitat Study* (NSEI *et al*. 2009). An evaluation using the regional criteria is presented below in **Table 15**. It should however be noted that because these evaluation criteria predate the provincial criteria and have not been formally adopted in the Region of Peel’s policies, greater weight has been placed on the provincial criteria as they more current and comprehensive.

Table 15. List of Regional Significant Wildlife Habitat Criteria

Significant Wildlife Habitats Criteria*	Subject Lands	Study Area	Not Present	Not Applicable
A1. Deer Wintering Area			✓	
A2. Colonial Bird Nesting Sites (e.g., heronry, gull colony)			✓	
A3. Waterfowl Nesting Habitat			✓	
A4i. Migratory Landbird Stopover Areas				✓
A4ii. Migratory Bat Stopover Areas			✓	
A4iii. Migratory Butterfly Stopover Areas				✓
A4iv. Migratory Waterfowl Stopover and/or Staging (Terrestrial)			✓	
A4v. Migratory Waterfowl Stopover and/or Staging (Aquatic)			✓	
A4vi. Migratory Shorebirds Stopover Areas			✓	
A5. Raptor Wintering Areas (i.e., used for feeding and/or roosting)			✓	

Significant Wildlife Habitats Criteria*	Subject Lands	Study Area	Not Present	Not Applicable
A6. Snake Hibernacula	✓	✓		
A7. Bat Maternal Roosts and Hibernacula			✓	
A8. Bullfrog Concentration Areas			✓	
A9. Wild Turkey Winter Range				✓
A10. Turkey Vulture Summer Roosting Areas			✓	
B1. Rare Vegetation Communities			✓	
B2. Forests Providing a High Diversity of Habitats (captured by Significant Woodlands)			✓	
B3. Old-growth or Mature Forest Stands (captured by Significant Woodlands)			✓	
B4. Foraging Areas with Abundant Mast (i.e., nut bearing trees)			✓	
B5. Highly Diverse Areas			✓	
B6. Cliffs and Caves			✓	
B7. Seeps and Springs			✓	
B8i. Amphibian Breeding Habitat - Forested Sites (e.g., vernal pools)			✓	
B8ii. Amphibian Breeding Habitats - Non-forested Sites (e.g., marshes)			✓	
B9. Turtle Nesting Habitat and Turtle Overwintering Areas	✓	✓		
B10. Habitat for Area-Sensitive Forest Interior Breeding Bird Species			✓	
B11. Habitat for Open Country and Early Successional Breeding Bird Species			✓	
B12. Habitat for Wetland Breeding Bird Species			✓	
B13i. Raptor Nesting Habitat - Wetlands, Pond and Rivers			✓	
B13ii. Raptor Nesting Habitat - Woodland Habitats			✓	
B14. Mink, River Otter, Marten and Fisher Denning Sites			✓	
B15. Mineral Licks				✓
C1. Species identified as Nationally Endangered or Threatened by COSEWIC which are not listed as Endangered or Threatened under Ontario's *Endangered Species Act*			✓	
C2. Species identified as Special Concern based on Species at Risk in Ontario List that is periodically updated by the MNRF/MECP	✓	✓		
C3. Species that are listed as rare (S1-S3) or historical in Ontario based on Records kept by the Natural Heritage Information Centre in Peterborough	✓	✓		
C4. Species whose populations appear to be experiencing substantial declines in Ontario	✓	✓		
C5. Species that have a high percentage of their global population in Ontario and are rare to uncommon in the Regional Municipality of Peel			✓	
C6. Species that are rare to uncommon in the Regional Municipality of Peel, even though they may not be provincially rare	✓	✓		
C7. Species that are subject of recovery programs			✓	

Significant Wildlife Habitats Criteria*	Subject Lands	Study Area	Not Present	Not Applicable
C8. Species considered important to the Regional Municipality of Peel, based on recommendation from a local Conservation Advisory Committee				✓
D1. Animal Movement Corridors	✓	✓		

*Criteria provided in the *Peel-Caledon Significant Woodlands and Significant Wildlife Habitat Study* (North-South Environmental Inc., Dougan & Associates, and Sorensen Gravely Lowes 2009).

Based on the application of the evaluation criteria contained in the *Peel-Caledon Significant Woodlands and Significant Wildlife Habitat Study* (NSEI *et al*. 2009; **Table 15**), it was determined the Subject Lands and Study Area could support seasonal wildlife concentration areas, specialized habitats for wildlife, habitat for species of conservation concern and animal movement corridors. Most of the areas identified as supporting potential candidate SWH are associated with natural features that will be protected.

The findings of the SWH evaluation based on the application of provincial and regional criteria are summarized below.

Seasonal Concentration Areas of Animals

Based on a review of evaluation criteria related to Seasonal Concentration Areas of Animals, it was determined that the Study Area could potentially Snake Hibernacula. While no snake observations have been reported from the Study Area to date, given the size of the Study Area and types of habitats present (ponds, wetlands, fields), it is highly likely that snakes hibernation sites are present. Common snake species known to occur in the area can utilize building foundations, railway beds, barns and rodent holes and dens, all of which are present. Locating snake hibernacula is extremely difficult and resource intensive. No surveys for hibernacula were proposed or undertaken for this CEISMP. It is however recommended that such surveys be conducted at the site-specific level in support of future draft plan applications.

Rare Vegetation Communities or Specialized Habitats for Wildlife

Based on a review of evaluation criteria related to Rare Vegetation Communities or Specialized Habitats for Wildlife, it was determined that the Study Area does not support any rare vegetation communities. In terms of specialized habitat for wildlife, the Study Area does support candidate SWH for overwintering and nesting turtles. As was discussed in **Section 3.3.7**, Dougan & Associates *et al*. (2014b) noted Midland Painted Turtle and Snapping Turtle in the ponds and wetlands to the east of the CPR rail line outside the Subject Lands. Given the size and depth of these ponds, it is likely that they support overwintering and nesting habitat for these species and would therefore qualify as candidate SWH for this category. While no turtles have been documented from the Subject Lands, it is also likely that this local population could also utilize the large pond beside The Gore Road (ELC Unit 10a) for overwintering and nesting. For this reason, ELC Unit 10a should also be considered SWH until more detailed surveys can be completed to confirm presence.

No basking or nesting surveys were proposed or undertaken for this CEISMP. It is recommended that such surveys be conducted at the site-specific level in support of any future draft plan applications in proximity to ELC Unit 10a.

Habitat for Species of Conservation Concern

Based on a review of evaluation criteria related to Habitat for Species of Conservation Concern, it was determined that the Study Area supports potential habitat the following listed Special Concern species:

- Snapping Turtle (*Chelydra serpentine)*: Potentially suitable habitat is present within the Bolton PSW to the east as well in the pond on the Subject Lands identified as ELC Unit 10a.
- Monarch (*Danaus plexippus*): Potentially suitable habitat may be present within the meadow habitats on the Subject Lands and within the Study Area.

No turtle basking or nesting surveys were proposed or undertaken for this CEISMP. It is recommended that such surveys be conducted at the site-specific level in support of any future draft plan applications that are in proximity to ELC Unit 10a or the PSW ponds to the east of the CPR line. Likewise, no specific surveys of common milkweed, the food source for Monarch, were proposed or completed for this CEISMP. It is recommended that such surveys be conducted at the site-specific level in support of any future draft plan applications to identify potential candidate SWH.

Animal Movement Corridor

Animal movement corridors in the Study Area are limited to the wetland communities associated with the HDFs. These linear features likely support local scale animal movements, however their function as linkage corridors is impaired by the presence of barriers such as roads and rail lines. Nevertheless, they have been identified as potential candidate SWH. While the Study Area supports several hedgerow features, these features are generally too narrow and discontinuous to provide any significant linkage functions for wildlife. Further study is not recommended as the existing features that comprise animal movement corridors have been identified for retention in the future NHS.

Summary of Significant Wildlife Habitat

In summary, the Candidate SWH that has been identified through this CEISMP is limited to features that will ultimately form part of the future NHS. Habitat for Monarch as well as snake hibernacula could exist outside the NHS and for this reason it is recommended that this be confirmed through further study at the draft plan stage, in addition to the recommend turtle basking and nesting surveys.

3.3.9.5 Fish Habitat

The PPS (2020) defines Fish Habitat as follows:

> *Fish habitat: as defined in the Fisheries Act, means spawning grounds and any other areas, including nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes.*

Based on the aquatic habitat characterization, fish community sampling results and HDFA work completed on the drainage features within the Study Area, it is Beacon's opinion that HDF reaches WHT1-A, WHT1-B and WHT6-A provide fish habitat while the other HDF's are dry outside the spring freshet indirectly support fish habitat.

3.3.9.6 Habitats of Endangered and Threatened Species

Significance, as it relates to the habitat of endangered species and threatened species is defined by the PPS (2020) as:

> *…the habitat, as approved by the Ontario Ministry of Natural Resources, that is necessary for the maintenance, survival, and/or the recovery of naturally occurring or reintroduced populations of endangered species or threatened species, and where those areas of occurrence are occupied or habitually occupied by the species during all or any part(s) of its life cycle…*

In the *Bolton Residential Expansion Study Phase 3 Technical Memorandum* prepared by Dougan & Associates *et al*. (2014a), it is noted that a SAR screening letter was received from the MNRF on January 2, 2014 that included records of the following SAR within the BRES Study Area (Options 1 and 3 lands):

- Bobolink (*Dolichonyx oryzivorus*) - Threatened;
- Butternut (*Juglans cinerea*) - Endangered;
- Eastern Meadowlark (*Sturnella magna*) - Threatened; and
- Redside Dace (*Clinostomus elongatus*) - Endangered.

In undertaking the review for this CEISMP, Beacon also reviewed all available background information pertaining to SAR in the Study Area (ref. **Section 3.1**). This review revealed records for several additional endangered and threatened species to those previously noted. It was determined that there are records for nine (9) endangered and threatened species in the vicinity of the Study Area.

A complete summary is presented below **Table 16** and in **Appendix I**.

Table 16. Potential for Habitats of Threatened and Endangered Species

Species	ESA Status	Subject Lands	Study Area
Barn Swallow (*Hirundo rustica*)	Threatened	Foraging habitat confirmed. Nesting habitat not present.	Nesting habitat confirmed in Study Area on property south of King Road.
Bobolink (*Dolichonyx oryzivorus*)	Threatened	No suitable breeding habitat. While Bobolink have been observed in some of the fallow fields, these same fields were planted with row crops which do not provide suitable habitat.	Same
Eastern Meadowlark (*Sturnella magna*)	Threatened	Breeding habitat confirmed in one field in 2020.	Same

Species	ESA Status	Subject Lands	Study Area
Redside Dace (*Clinostomus elongatus*)	Endangered	Tributary reaches WHT1-A and WHT1-B are the only HDFs exhibit evidence of baseflow and stream permanence and could be considered contributing habitat for this species as populations are known to be present downstream of the Study Area.	Same
Eastern Small-footed Myotis (*Myotis leibii*)	Endangered	Presence/Absence of listed bats to be confirmed. Snag surveys of ELC unit 12 – Organic Deciduous Swamp to be completed. All buildings and structures to be screened for potential habitat and exit surveys completed where applicable. These surveys are to be completed at the at draft plan stage	Same
Little Brown Myotis (*Myotis lucifugus*)	Endangered	Same as above	Same as above
Northern Myotis (*Myotis septentrionalis*)	Endangered	Same as above	Same as above
Tricoloured Bat (*Perimyotis subflavus*)	Endangered	Same as above	Same as above

*Habitat as defined under the *Endangered Species Act* or MECP's Species Specific Guidelines

Discussion of how the habitats of these species have been considered though the land use planning for the study area is provided in **Section 4.1.4.3**.

4. Constraints and Opportunity Analysis

The purpose of this constraint and opportunity analysis is to a) identify significant and sensitive biophysical features and functions that could potentially constrain how the Subject Lands are developed in the future, and b) to identify potential opportunities for enhancement of the natural environment and ecological functions in association with the future development.

The identification of potential biophysical constraints to future development is based on the findings of the background review, characterization of existing conditions, and evaluation of significance. Where conditions have been revealed that make land unsuitable for future development under the current environmental regulatory framework described in **Section 2**, these have been identified as potential constraints to development.

It is important to note that while an area or feature may be identified as a potential constraint, this does not necessarily mean the area is not developable. Constraints are treated variably according to their significance and sensitivity as well as the regulatory requirements applicable to them. For example, the Study Area supports numerous small drainage features or HDFs, and depending on the form and function of each, may or may not require protection. Similarly, areas that are currently subject to flooding and represent a constraint can also be modified and designed to reduce the extent of area being constrained.

4.1 Physical Resources

4.1.1 Groundwater Resources

Based on the findings of the subsurface drilling investigation, there is potential for grading or construction activities within the Subject Lands to intersect with the existing groundwater table. As a result, construction dewatering may be required. Groundwater level monitoring to-date indicates that groundwater levels range from 0.1 m (Elev. 275.7 masl) to 6.8 m (Elev. 255.2 masl) below the existing ground surface (bgs). The highest measured groundwater level of 0.1 mgs is considered to be localized in the south-central portion of the Subject Lands adjacent to King Rd. Seasonal variations of water levels are expected to range from about 1 to 2 m across the Subject Lands. Continued groundwater monitoring through the winter and spring of 2021 will confirm seasonal high groundwater levels.

4.1.2 Surface Water Resources

4.1.2.1 Headwater Drainage Features

As was discussed in **Section 3.2.5.2**, all HDFs on the Subject Lands were assessed using the TRCA HDFA Guidelines (2014b). There are eight (8) tributaries on the Subject Lands; six (6) are headwaters to the West Humber River and two (2) are headwaters to the Main Humber River. For the purposes of the HDFA, the eight tributaries were subdivided into forty-three (43) reaches (**Figure 3.2.5.2b**). Based on the findings of the Aquafor Beech Limited (2013) HDFA and 2020 HDFA validation exercise completed by Beacon in 2020, management recommendations have been assigned to each reach in accordance with the TRCA HDFA Guidelines (2014b).

The TRCA HDFA Guidelines (2014b) include six classes of management depending on the level of ecohydrological functions supported by an HDF reach. An abbreviated summary of the management categories is provided below to inform the constraint analysis.

1. Protection – protect and/or enhance in situ;
2. Conservation – maintain, relocate and/or enhance within its riparian corridor;
3. Mitigation – replicate or enhance functions;
4. Recharge Protection – maintain water balance;
5. Maintain or Replicate Terrestrial Linkage – maintain or replicate linkage corridor; and
6. No Management Required – no mitigation or management required.

There are sixteen (16) HDF reaches that have been identified as No Management (ref. **Table 6**). These reaches can be removed without any need for mitigation or management and it is therefore recommended that they be classified as low constraint features for the purposes of the CEISMP constraint analysis.

There are thirteen (13) HDF reaches that have been identified as Mitigation (ref. **Table 6**). If necessary, these reaches can be removed provided their functions can be replicated or enhanced as part of the future development using LIDs and lot-level controls. It is therefore recommended that they be classified as moderate constraint features for the purposes of the CEISMP constraint analysis.

There are an additional thirteen (13) reaches that have been identified as Conservation (ref. **Table 6**). If necessary, these reaches can be relocated and/or enhanced as part of the future development using natural channel design and wetland creation methods. It is therefore recommended that they be classified as moderate constraint features for the purposes of the CEISMP constraint analysis.

There is one (1) HDF reach (WHT6-A) that has been identified as Protection. This reach is to be protected but can be enhanced using natural channel and wetland design principles. It is therefore recommended that this reach be classified as a high constraint feature for the purposes of the CEISMP constraint analysis.

4.1.2.2 Geomorphological Hazards

As was discussed in **Section 3.2.5.2**, HDFs with drainage areas less than 100 hectares do not generate sufficient hydraulic energy to initiate migration and the associated risk of potential erosion for property and infrastructure. Due to the poorly defined nature of the HDFs and absence of evidence of active geomorphic processes (i.e., erosion, aggradation or migration), it is our opinion that there are no geomorphic hazards that would be considered constraints to future development. The regulatory floodline represents a more appropriate tool for delineating the hazard limits of these drainage features.

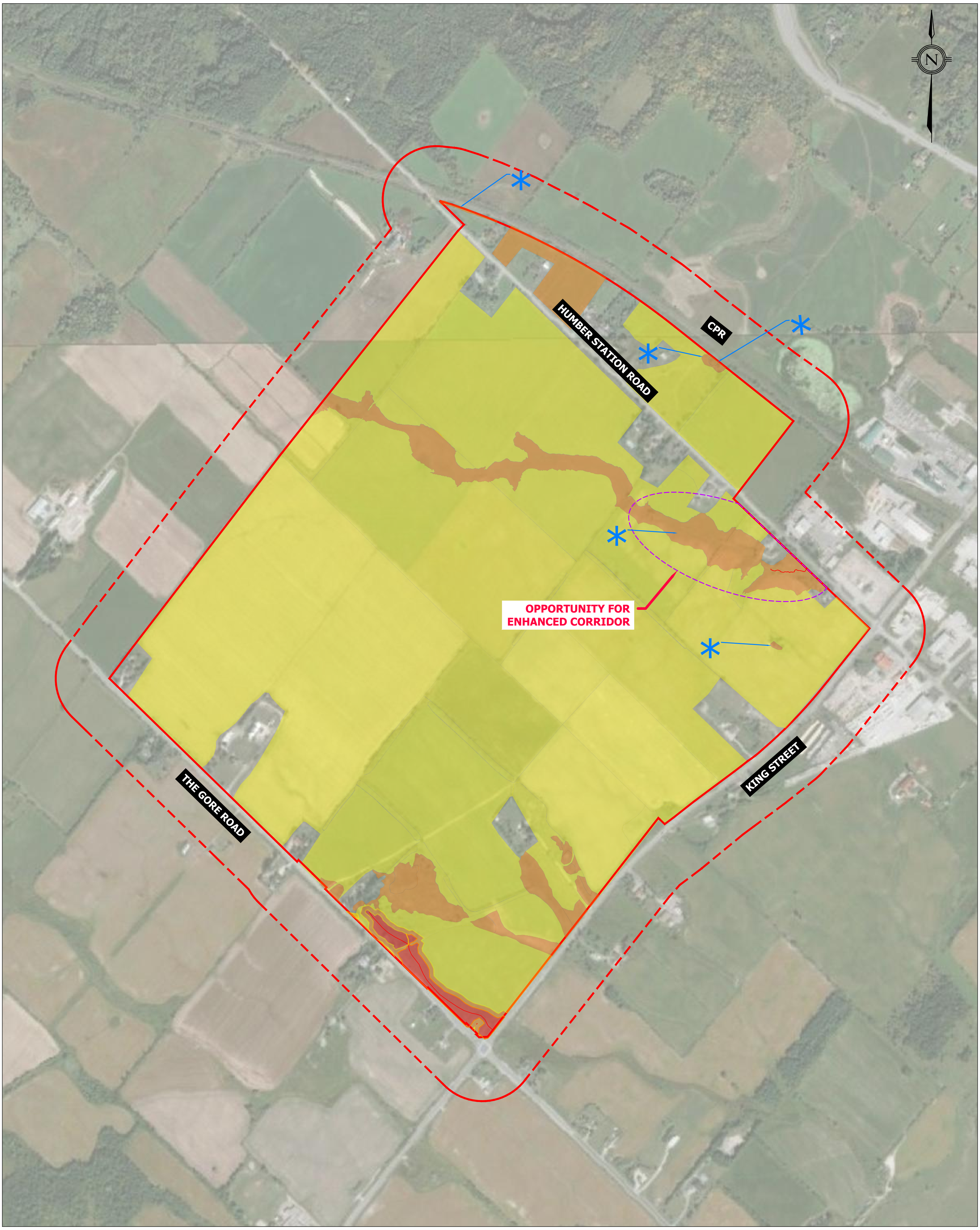
4.1.2.3 Flood Hazards

The drainage features within the Study Area are all considered to be headwater features and generally do not require flood mapping due to their small corresponding drainage areas (less than 50 hectares), with the exception of West Humber River Tributary (WHT6), which has a larger drainage area, but is proposed to be realigned.

The existing HEC-RAS model geometry for the West Humber and Main Humber Rivers was established in the Humber River Hydrology Update prepared by TRCA and Civica Infrastructure (April 2018). TRCA provided this model to Urbantech. The model geometry for the existing conditions was updated with detailed LIDAR / site survey information in several locations, with a focus on the more significant crossings of Humber Station Road, the CPR line and King Street. The HEC-RAS model was also refined using the updated flows from the existing hydrologic model created based on the pre-development drainage plan. Refer to FSR Drawing 202 for the existing Regional flood mapping drawing and FSR Appendix 2 for the hydraulic and hydrologic model results (Urbantech Consulting 2021). This regional flood mapping was used to identify the limits of existing flood hazards and is shown on the comprehensive constraint map (**Figure 4.2**).

4.1.2.4 Slope Hazards

There are no valleylands or steep slopes associated with the Subject Lands that would represent a slope hazard. As such, slopes do not represent a constraint to future development.



LEGEND:

▭ SUBJECT LANDS

▭ STUDY AREA (120 m)

▭ OPPORTUNITY FOR ENHANCED CORRIDOR

CONSTRAINT ANALYSIS

🟥 HIGH CONSTRAINT:

REDSIDE DACE HABITAT
FISH HABITAT
HEADWATER DRAINAGE FEATURE IDENTIFIED FOR PROTECTION

🟧 MODERATE CONSTRAINT:

EXISTING FLOODPLAIN
UNEVALUATED WETLANDS PLUS 10 m BUFFER
EASTERN MEADOWLARK HABITAT
HEADWATER DRAINAGE FEATURE IDENTIFIED FOR CONSERVATION AND MITIGATION

🟨 LOW CONSTRAINT:

HEADWATER DRAINAGE FEATURE IDENTIFIED FOR NO MANAGEMENT
AGRICULTURAL LANDS AND CULTURAL VEGETATION COMMUNITIES

✱ OPPORTUNITY TO COMBINE SMALL, ISOLATED WETLAND COMMUNITIES INTO A CORRIDOR

NOTE: REFER TO FIGURE 3.2.5.2b FOR HEADWATER FEATURE MANAGEMENT RECOMMENDATIONS

BEACON ENVIRONMENTAL

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Bolton-Macville Community-Comprehensive Environmental Impact Study and Management Plan

PROJECT No.

FIGURE 4.2

COMPREHENSIVE CONSTRAINTS AND OPPORTUNITIES MAP

JANUARY 2021

SCALE: 1:7500

4.1.3 Water Balance Considerations

One component of achieving the sustainability and adaptive management objectives for the community is the integration of best management practices pertaining to maintaining as closely as possible, pre-development ground water conditions post-development. With changes in impervious areas, and potential changes to surface and ground water quality and quantity, best management practices which serve to promote post-development groundwater infiltration/recharge, and maintain pre-development water balance conditions to the greatest feasible extent are required.

4.1.3.1 Site Level Water Balance

To understand existing hydrologic conditions across the Subject Lands, a Thornthwaite site level water balance assessment was completed as discussed in **Section 3.2.6.1** of this report. The assessment was completed to provide a baseline for the volume of infiltration, runoff, evapotranspiration and evaporation currently generated as a result of existing conditions. The annual volumes of generated were calculated as follows:

- Evaporation - 3,708 m^3/year;
- Evapotranspiration - 953,773 m^3/year;
- Infiltration - 158,426 m^3/year; and
- Runoff - 312,260 m^3/year.

With the construction of impervious surfaces across the Subject Lands as a result of development, without mitigation, inevitable changes to hydrologic systems are anticipated. The changes would include reduced area where evapotranspiration and infiltration can occur and increased evaporation and runoff from impervious surfaces. The reduction in infiltration is of particular concern when trying to maintain the integrity of local water resources. As a result, best management practices and Low Impact Development (LID) measures which serve to promote post-development groundwater infiltration are recommended.

The success of LIDs to provide increased infiltration across the post-development Subject Lands is dependent on the permeability of underlying native soils. Based on infiltration testing completed by DS and reported under Section 4.3.4 of the Hydrogeological Investigation (**Appendix B**), the Subject Lands primarily consists of a low permeable silty clay till with a measured infiltration rate ranging from about 16 to 38 mm/hr with an average of 26 mm/hr. Soils with infiltration rates over 15 mm/hr are considered suitable for Soakaways, infiltration trenches and chambers (CVC and TRCA 2010). Applicable LIDs anticipated to provide an appropriate level of mitigation are discussed in **Section 5.3.4** of this report.

4.1.3.2 Wetland Water Balance Risk Evaluation

To aid in determining the level of risk and evaluation requirements for retained wetlands (W1 through W6) within the Subject Lands, an assessment was completed using the Wetland Water Balance Risk Evaluation guidelines provided by the TRCA (2017). The guideline provides a four-step process as follows:

1. *Determine which retained wetland(s) may be impacted by the proposal.*
2. *Determine the magnitude of potential hydrological change.*

3. *Determine the sensitivity of the wetland and its associated flora and fauna to hydrological change.*
4. *Integrate information from step 1, 2, and 3 to assign a level of risk to the proposal.*

Section 6.3 of the Hydrogeological Investigation (**Appendix B**), provides the criteria and evaluation for determining the magnitude of potential hydrological impact to Wetlands W1 through W6. The analysis completed shows there is a Low magnitude of hydrological change as a result of Impervious Cover Score (ICS) and a High magnitude of hydrological change as a result of Changes to Catchment Size for (CCS) each of the wetland units. The overall magnitude of hydrological change is provided in **Table 17** below.

Within **Table 17** below, the sensitivity of the wetlands from an ecological perspective (i.e., Step three within the TRCA Guidance Document) were determined with the following CEISMP findings:

- Vegetation Community Type (ELC): **Section 3.3.2** and **Figure 3.2.2**;
- High Sensitivity Fauna Species: **Sections 3.3.6**, **3.3.7**, **3.3.8** and **Appendix I**;
- High Sensitivity Flora Species: **Section 3.3.4** and **Appendix D**;
- Significant Wildlife Habitat: **Sections 3.3.9.4** and **3.9.5.5**; and
- Hydrological Classification Considering Ecology: **Figure 3.2.2**.

Table 17. Wetland Water Balance Risk Evaluation Summary

<table>
<tr><th colspan="7"><i>Hydrological Considerations</i></th></tr>
<tr><th>Wetland Number</th><th colspan="2">Impervious Cover Score</th><th colspan="2">Change in Catchment Area (%)</th><th colspan="2">Overall Magnitude of Hydrological Change</th></tr>
<tr><td>W1</td><td colspan="2">0.6</td><td colspan="2">84 % decrease</td><td colspan="2">High</td></tr>
<tr><td>W2</td><td colspan="2">3.2</td><td colspan="2">48 % decrease</td><td colspan="2">High</td></tr>
<tr><td>W3</td><td colspan="2">0.8</td><td colspan="2">87 % decrease</td><td colspan="2">High</td></tr>
<tr><td>W4</td><td colspan="2">3.4</td><td colspan="2">76 % decrease</td><td colspan="2">High</td></tr>
<tr><td>W5</td><td colspan="2">1.4</td><td colspan="2">77 % decrease</td><td colspan="2">High</td></tr>
<tr><td>W6</td><td colspan="2">2.1</td><td colspan="2">76 % decrease</td><td colspan="2">High</td></tr>
<tr><th colspan="7"><i>Ecological Considerations</i></th></tr>
<tr><th>Wetland Number</th><th>Vegetation Community Type (ELC)</th><th>High Sensitivity Fauna Species</th><th>High Sensitivity Flora Species</th><th>Significant Wildlife Habitat*</th><th>Hydrological Classification Considering Ecology</th><th>Overall Ecological Wetland Sensitivity</th></tr>
<tr><td>W1</td><td>Medium</td><td>None</td><td>-</td><td>None</td><td>High</td><td>High</td></tr>
<tr><td>W2</td><td>Medium</td><td>High</td><td>-</td><td>High</td><td>High</td><td>High</td></tr>
<tr><td>W3</td><td>Low</td><td>Low</td><td>-</td><td>None</td><td>Palustrine</td><td>TBD-</td></tr>
<tr><td>W4</td><td>Medium</td><td>Low</td><td>-</td><td>None</td><td>High</td><td>High</td></tr>
<tr><td>W5</td><td>Medium</td><td>None</td><td>-</td><td>None</td><td>High</td><td>High</td></tr>
<tr><td>W6</td><td>Medium</td><td>None</td><td>-</td><td>None</td><td>High</td><td>High</td></tr>
<tr><th colspan="7"><i>Overall Wetland Risk Ranking</i></th></tr>
<tr><th>Wetland Number</th><th colspan="6">Overall Wetland Risk Ranking</th></tr>
<tr><td>W1</td><td colspan="6">HIGH</td></tr>
<tr><td>W2</td><td colspan="6">HIGH</td></tr>
<tr><td>W3</td><td colspan="6">HIGH</td></tr>
<tr><td>W4</td><td colspan="6">HIGH</td></tr>
<tr><td>W5</td><td colspan="6">HIGH</td></tr>
<tr><td>W6</td><td colspan="6">HIGH</td></tr>
</table>

*Refers to Candidate Significant Wildlife Habitat to be confirmed through further study at the draft plan stage.

4.1.4 Natural Heritage Constraints

4.1.4.1 Significant Natural Heritage Features

Based on the evaluation of significance presented in **Section 3.3.9**, it was determined that significant natural heritage features in the Study Area are primarily associated with the watercourses and wetlands on the Subject Lands and Study Area.

Significant natural heritage features identified within the Study Area include the following:

- Fish Habitat;
- Significant Habitat for Endangered and Threatened Species (refer to **Section 4.1.4.3**);
- Other Wetlands;
- Significant Wildlife Habitat; and
- Linkages.

The features listed above qualify as components of the Town's Ecosystem Framework by satisfying the criteria and definitions in the MOP.

4.1.4.2 Natural Heritage System

Currently, there is no formalized natural heritage system identified for the Study Area. The Subject Lands are located outside provincial plan areas (i.e., the Greenbelt Plan, the Niagara Escarpment Conservation Plan and the Oak Ridges Moraine Conservation Plan). The Subject Lands do not overlap with any components of the provincial Growth Plan Natural Heritage System, Region of Peel Greenlands System or Town of Caledon Environmental Policy Area. The only feature in the Study Area that is recognized as part of the above systems is the provincially significant wetland feature that partially overlaps with the eastern portion of the Study Area to the east of the CPR line.

It should be noted that as part of the Town's Bolton Residential Expansion Study, Dougan & Associates *et al*. (2014a and 2014b) had developed a preliminary natural heritage system for the for the Subject Lands. This preliminary natural heritage system was developed primarily to assist the Town with its calculations to determine future developable area contained within the Option 3 lands (Subject Lands). It was recognized that this system would be further refined through the LOPA process.

Through the additional work completed as part of this CEISMP, a natural heritage system has been developed for the Study Area. The proposed natural heritage system is discussed in **Section 5.2**.

4.1.4.3 Species at Risk

As noted in **Section 3.3.9.6** and detailed in **Appendix I**, the following endangered and threatened and/or their habitat is present on the Subject Lands:

- Eastern Meadowlark (*Sturnella magna*) - Threatened;
- Redside Dace (*Clinostomus elongatus*) - Endangered; and
- SAR Bats:
    - Eastern Small-footed Myotis (*Myotis leibii*) - Endangered;
    - Little Brown Myotis (*Myotis lucifugus*) - Endangered;
    - Northern Myotis (*Myotis septentrionalis*) - Endangered; and
    - Tricoloured Bat (*Perimyotis subflavus*) - Endangered.

This report identifies SAR habitats and species at a landscape level rather than on a case-by-case basis. A strategy for all SAR known to the Study Area to be used at the draft plan stage is included in **Section 9**.

Eastern Meadowlark

Eastern Meadowlark has been recorded in various location the Subject Lands and Study Area in 2013/2014 (Dougan & Associates *et al.* 2014a and 2014b), and habitat remaining for this species during the last breeding bird survey in 2020 was ELC Unit 3d as the results of the last breeding bird survey provide a higher level of confidence of actual breeding locations (refer to **Figure 3.3.9**). Other areas where Eastern Meadowlark had been recorded are now farmed and no longer provide suitable habitat. Removal of the habitat for this species for agricultural purposes is permitted under the provisions of Ont. Reg. 242/08 under the *Endangered Species Act*. Therefore, ELC Unit 3d is constrained within the Macville Community Secondary Plan.

Redside Dace

Through reviewing the Background Environmental Study (Dougan & Associates *et al*. 2014b), Jackie Burkart from the MNRF (March 11, 2016) requested more details and provided the following comment:

- *Any features considered to be Redside Dace 'contributing habitat' will require maintenance and / or replication of functions.*
- *Where degradation to aquatic systems has been noted (e.g., barriers to fish migration, undersized culverts) it is recommended that opportunities for restoration be identified through consultation with MNRF.*
- *Restoration should aim to maintain or improve suitable habitat for Redside Dace and other species. Where stream realignments and / or the removal of features is contemplated, it is recommended that a comprehensive fisheries compensation plan be developed, in consultation with MNRF and other agencies.*

Redside Dace is a federally and provincially endangered fish species that occupies watercourses south of the Subject Lands; historic correspondence and available resources for the Study Area indicate the potential for contributing habitat for Redside Dace only. Contributing habitat is regulated through the *Endangered Species Act*.

Habitat mapping guidelines for the identification of habitat of Redside Dace in relation to the PPS (**Section 2**) are under development and not yet available. For the purposes of this study, the intention was to identify Redside Dace habitat using guidance provided in the Redside Dace Recovery Strategy (Redside Dace Recovery Team 2010) which recommends:

> *All reaches currently occupied by Redside Dace, upstream headwaters (natural heritage features and supporting functions supporting the occupied reaches) and historically occupied reaches where there is a high likelihood of rehabilitation be prescribed as habitat within a habitat regulation under the Endangered Species Act, 2007.*
>
> *Redside Dace habitat consists of two elements. The first element includes bankfull stream width within the aquatic resource area. The second element of habitat includes the meander belt width of the stream and associated riparian habitat that is a minimum of 30 metres from the meander belt (measured horizontally).*

The drainage features on the Subject Lands are HDF's, and the meander belt is not applicable in this situation. Additionally, a majority of these HDF's do not maintain a baseflow and course sediment supply functions are limited as most of the HDF's are farmed and/or tiled. Those that could provide potential Redside Dace contributing habitat that could constrain the development are those that have permanent flow and a coolwater thermal regime (i.e. HDF reaches WHT1-A and WHT1-B).

SAR Bats (Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis and Tricoloured Bat)

As Ontario's bat species at risk only became listed as endangered in 2013, the habitat for these species was not discussed in the previous background studies prepared by Dougan & Associates *et al.* (2014a and 2014b). These listed species include:

- Little Brown Myotis or Little Brown Bat (*Myotis lucifugus*);
- Northern Myotis (*Myotis septentrionalis*);
- Tri-colored Bat (*Perimyotis subflavus*); and
- Eastern Small-footed Bat or Eastern Small-footed Myotis (*Myotis leibii*).

As species specific regulations have not yet been developed for the listed bat species, their habitat continues to be defined using the general habitat definition under the ESA, however MECP has focused their regulatory and protection efforts on maternity roosts.

In 2017 a guidance document was prepared by the province to assist in identifying potential maternity roost habitats within treed areas. The document - A *Survey Protocol for Species at Risk Bats within Treed Habitats Little Brown Myotis, Northern Myotis & Tri-Colored Bat* (MNRF 2017) - states that suitable maternity roost habitat includes any coniferous, deciduous or mixed wooded ecosite, including treed swamps, that includes trees at least 10 cm diameter-at-breast height (dbh). Based on the ELC work completed in **Section 3.3.2**, it was determined that there is only one ELC community in the Study Area would qualify as providing potential maternity roost habitat. This community corresponds with ELC Unit 12, an Organic Deciduous Swamp. It is anticipated that this community will be protected within the future natural heritage system. No snag surveys have been completed to confirm the presence/absence of suitable maternity habitat trees. Therefore, it is recommended that the potential habitat be confirmed through site-specific studies at the draft plan stage.

As several of the listed bat species are also known to establish maternity roosts in buildings, it is recommended that the buildings on the Subject Lands be screened for potential habitat and that exit surveys be completed for any buildings that could potentially support bats to determine in listed species are present or absent. This should be completed through site-specific studies at the draft plan stage (as discussed in **Section 9**).

4.2 Constraint and Opportunities Mapping

Based on the constraints and opportunities identified above, a map was prepared to summarize the spatial extent of the various constraints and opportunities where applicable. The purpose of the map is to inform and guide the design and development of the Macville Community Land Use Plan and Preliminary Framework Plan. To assist with the design, constrained lands were ranked based on their levels of significance and sensitivity as follows:

A **High Constraint** rating has been generally been assigned to areas that support features and functions that are highly sensitive and/or to otherwise constrained lands. Development is generally not permitted with high constraint areas with limited exceptions.

A **Moderate Constraint** rating has been assigned to areas that support less sensitive features and functions that can be replaced or replicated and/or to otherwise constrained lands. Development is permitted within moderate constraint areas where it can be demonstrated that habitats and functions can be replaced and replicated to achieve a net ecological benefit.

A **Low Constraint** rating has been assigned to areas that support features and functions that support little to no valued ecological functions and/or to otherwise constrained lands. Development is permitted in low constraint areas with little to no mitigation required.

For the purposes of developing a comprehensive constraint map for the Study Area, constraint ratings have been assigned to features and areas as follows:

Areas of High Constraint

- Provincially Significant Wetlands
- Habitats of Endangered & Threatened Species
- Fish Habitat
- Headwater Drainage Features with Management Recommendation of Protection
- High Quality Wildlife Habitat
- High Quality Natural Communities

Areas of Moderate Constraint

- Unevaluated Wetlands
- Floodplains
- Headwater Drainage Features with Management Recommendation of Conservation or Mitigation
- Cultural and Degraded Natural Communities
- Low Quality Wildlife Habitat

Areas of Low Constraint

- Headwater Drainage Features with Management Recommendation No Management
- Agricultural Lands
- Cultural Vegetation Communities

A Comprehensive Constraints and Opportunities Map is presented in **Figure 4.2**.

5. Development of the Macville Community Land Use Plan and Preliminary Framework Plan

The Macville Community Secondary Plan is the outcome of years of land use planning which initially commenced in 2010 when the Town of Caledon adopted Official Plan Amendment 226 (OPA 22) to update population and employment forecasts and allocations for the 2031 planning horizon. Since 2010, the planning process has included the Bolton Residential Expansion Study (BRES) which was undertaken by the Town of Caledon to identify a recommended expansion area to accommodate the allocated growth. Through this process, the Subject Lands (BRES Option 3) were identified as to preferred option for this growth based on several screening criteria that consider the existing natural heritage features.

The goal for the Macville Community Land Use Plan is to create a complete, compact, livable, walkable, cyclable and transit-oriented community which integrates and protects the area's headwaters and wetlands into a natural heritage system.

The Macville Community has been designed to achieve the following objectives:

a) Create a transit-oriented community anchored by a GO Transit hub that balances pedestrian, cycling, transit and vehicular connections;
b) Provide a high-quality built form character and architectural design that exemplifies and promotes the identity of Caledon;
c) Establish a vibrant, mixed-use environment that attracts activity throughout the day and evening;
d) Create a central character avenue with an attractive, high quality streetscape and built form design that links the community;
e) Establish a range and mix of housing types that reinforce identifiable neighbourhoods and achieve density targets;
f) Create walkable, pedestrian scaled neighbourhoods with amenities and transit stops within walking distance and a safe, comprehensive path and trail system that links with the broader Caledon network;
g) Protect and enhance significant and sensitive natural heritage features within a natural heritage system, and to compliment this system with open spaces along with a hierarchy of park spaces with flexible design and innovative programming options to serve the neighbourhood needs;
h) Integrate appropriate low-impact development strategies as a key component of open space and built form design; and
i) Integrate smart community technologies that establish broadband connectivity for an improved quality of life through learning, work and play.

The design of the Macville Community Land Use Plan is the outcome of integrated and iterative approach. Key initial considerations for the community design were integration of a proposed natural heritage system (see **Section 5.2**) and areas required to accommodate future stormwater management facilities (see **Section 5.3**). As the locations of the natural heritage system and stormwater management area are generally fixed, the limits of these areas were used to create the foundational framework for the community design to which other elements were subsequently added (i.e., roads, greenways, development blocks). Through an iterative process, the project study team has refined the community design to meet the various objectives noted above and to achieve consistency with the Town's strategic directions and goals and environmental performance measures.

5.1 Description of the Land Use Plan and Preliminary Framework Plan

The Macville Community Land Use Plan (**Figure 5.1a**) and Preliminary Framework Plan **(Figure 5.1b**) were developed with extensive input from the multi-disciplinary project study team to ensure consistency with the Town's principles, strategic directions, and goals.

The Secondary Plan Land Use Plan (**Figure 5.1a**) has been designed to establish a transit-oriented community, including an active transportation strategy with cycling infrastructure throughout, integration of the environmental policy area, mixed housing types, high quality architecture, walkability and a main street with central character. Land Use Designations on the Secondary Plan Land Use Schedule include Low Density Residential, Medium Density Residential, Mixed Use, GO Transit Hub, Commercial/Mixed Use, Institutional, Employment, Open Space Policy Area, Environmental Policy Area, and Stormwater Pond Facility. These Land Use Designations have been implemented through the Preliminary Framework Plan (**Figure 5.1b**), where various types of residential built forms at varying densities, as well as mixed uses, institutional uses and GO Transit Hub uses have been integrated into the Plan layout. The net Subject Lands area is 181.90 hectares (ha), however, after deducting 1.43 ha for road widening and 10.52 ha of NHS, the net developable area of the Preliminary Framework Plan is 169.95 ha Refer to **Figure 5.1b** for site statistics of the Framework Plan.

One of the earliest components for consideration that led to the Plan layout was the delineation of the Environmental Policy Areas both within and beyond the Plan Area. These areas represent constraints to development and special consideration is given to the siting and sizing of these areas within the Plan layout. Infrastructure considerations, including stormwater management, roads and servicing have also been considered as early components affecting the Plan layout. As well, logical siting of the elementary and secondary school sites was considered early in the Plan evolution.

Establishing a transit-oriented community requires creating a community which is anchored to the Transit hub area, while introducing higher densities, a mix of built forms and mixed uses close to the Hub, and creating a balance of walkability, cyclability, transit opportunities and vehicular connections and enhanced connectivity in all travel modes both within and beyond the Plan area. The Preliminary Framework Plan achieves this by creating a central character avenue with attractive, high quality streetscape and built form design that links the community, infrastructure, and mixed uses. The Plan has been structured with distinct neighbourhood areas and two-character district areas which are anchored by the Transit Hub at the eastern limit of the Plan Area. The Plan protected and enhances the Environmental Policy Areas and introduces a series of high-quality parks and open spaces, as well as a range and mix of land uses and residential built forms throughout the Plan.

5.2 Natural Heritage System

As was discussed in **Section 3.3.1.**, the Subject Lands are primarily under agricultural use and natural heritage resources are limited to several headwater drainage features and wetlands located on the southern portion of the Subject Lands. Existing biophysical resources in the Study Area were characterized using primary and secondary data collected and analysed in accordance with accepted technical standards, protocols and guidelines as is outlined in **Section 3**. The significance of the various natural heritage resources was evaluated using provincial, regional and local scale environmental planning criteria and environmental performance measures as outlined in **Section 3.3.9**. The findings of this evaluation were used to identify constraints to development as well as opportunities for enhancing ecosystem functions as outlined in **Section 4**. The proposed natural heritage system is intended to integrate all high and moderate constraint features while allowing for reconfiguration of moderate constraint features provided a net gain in area and function can be achieved. The multi-disciplinary team used this information to engage in an iterative process to balance the community objectives. The limits of the proposed natural heritage system in conjunction with the limits of the proposed stormwater management facilities required to service the future community were further refined to establish the future limits of development which formed the basis for the Land Use Plan and Preliminary Framework Plan.

The proposed natural heritage system has been designed to include all the significant natural heritage resources identified on the Subject Lands, except for a small field in the northern portion of that has been identified as habitat for threatened Eastern Meadowlark. The proposed natural heritage system is comprised of two separate blocks which are proposed to be designated as Environmental Policy Area on the Land Use Plan and Preliminary Framework Plan (ref. **Figures 5.1a & 5.1b**, respectively).

On the southern portion of the Subject Lands, the proposed natural heritage system is comprised of the following features:

1. Unevaluated wetland features W1, W2, W3, W4, W5 and W6;
2. Headwater Reaches (WHT1-A to WHT1-E; WHT2-A; WHT2-B; WHT2-F; WHT3-A; WHT3-B);
3. Direct Fish Habitat (WHT1-A; WHT1-B; WHT6-A);
4. Contributing Habitat for Endangered Redside Dace (WHT1A; WHT1-B); and
5. Significant Wildlife Habitat – (Turtle overwintering & nesting – ELC Unit 10a).

To protect these features a buffer of 10 m has been applied based on the future land use scenario of low-density residential development adjacent to these features. As the boundaries of these unevaluated wetland features were staked by MNRF in 2016 and represent the outermost components of the proposed natural heritage system, the application of a 10 m buffer to the surveyed limits of these wetlands results are considered appropriate and reliable for designating the limits of the areas to be designated as Environmental Policy Area in the Land Use Plan.

On the remainder of the Subject Lands, natural heritage resources are limited to a few small isolated unevaluated wetlands and headwater drainage features. All wetlands have been assigned a moderate constraint rating and only one headwater tributary (WHT6) was identified as a high and moderate constraint feature. The lower reaches of this tributary have been assigned management classifications of protect (WHT6-A) and conservation (WHT6-B). This tributary feature also supports wetlands W7 and W8. This headwater feature and its associated wetlands form a narrow linear strip that does not connect to any other features in the landscape. The downstream reach of Tributary WHT6 effectively terminates at Humber Station Road and the upstream reaches terminate in agricultural fields. All the wetland features are represented by reed canary grass marshes that support limited native diversity and two wetlands are associated with dug pond features that are too small to support wildlife staging, breeding or overwintering habitat functions.

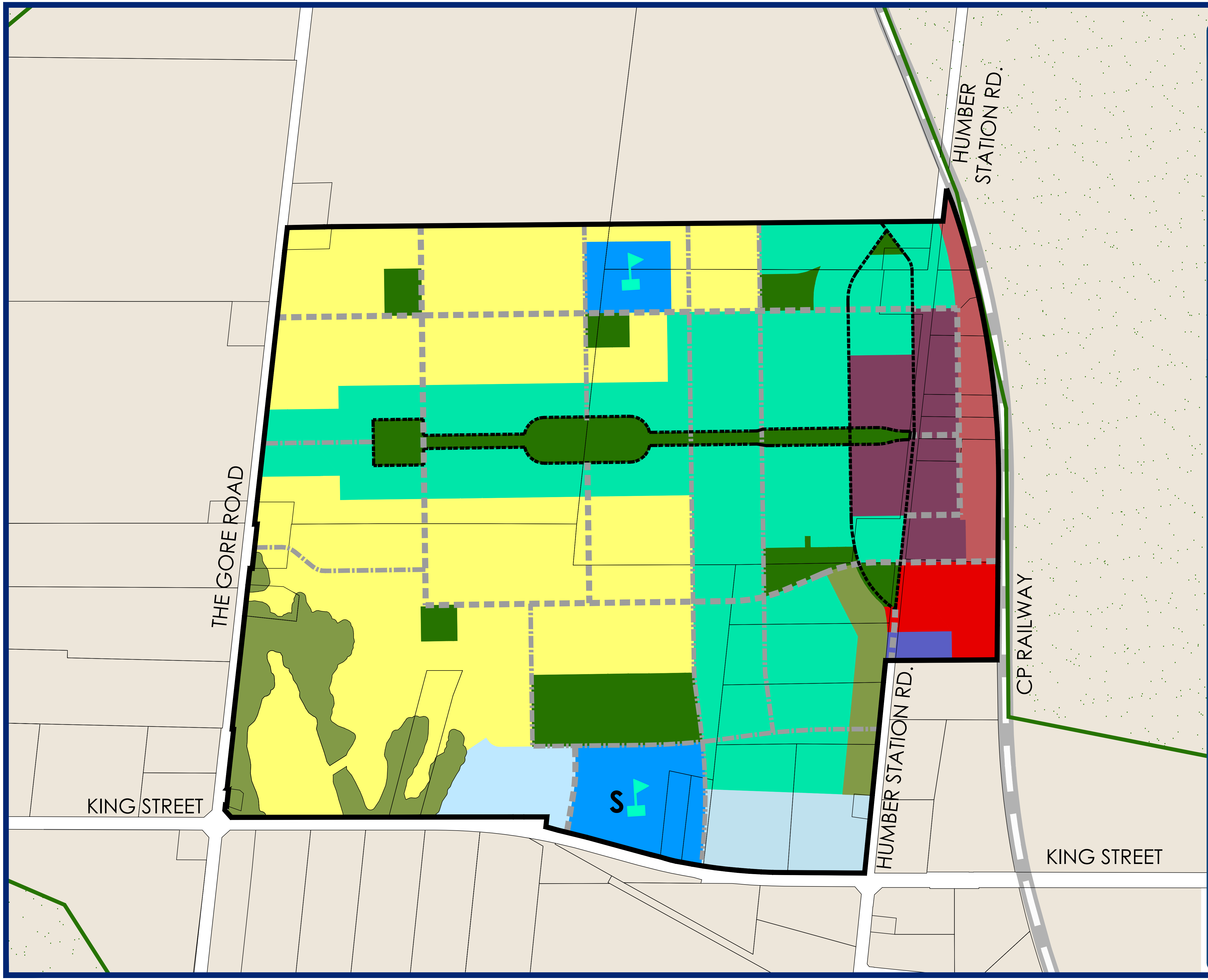
Due to the fragmented and isolated nature of these wetland features (ELC Units 7e, 7f, 7l, 13 and 14a) it was determined that retaining these features within the future urban matrix would not provide for an interconnected natural heritage system. Removal of these isolated features to accommodate development was also not considered feasible as it could result in a loss to ecosystem functions. Instead, it is proposed that Tributary WHT6, which contains wetlands W7 & W8 and represents the

TOWN OF CALEDON

Schedule C-8

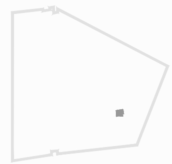
(A Subschedule to Schedule "C")

MACVILLE SECONDARY PLAN: LAND USE PLAN



- 🟨 Low Density Residential
- 🟩 Medium Density Residential
- 🟪 Mixed-Use
- 🟥 GO Transit Hub
- 🟥 Commercial/Mixed Use
- 🟦 Institutional
- 🟪 Employment
- 🟩 Open Space Policy Area
- 🟨 Environmental Policy Area
- ▨ Boundary of Greenbelt Plan Area
- 🟦 Stormwater Pond Facility
- ☐ Settlement Boundary
- ⚑ Elementary School
- S⚑ Secondary School
- ▬ ▬ Conceptual Road Network (22m R.O.W.)
- ▬·▬ Conceptual Road Network (19.5m R.O.W.)
- ------ One-Way Local Loop R.O.W.
- ╪ Railway

Figure 5.1a



Base Data Source: Teranet, 2013

0 0.125 0.25 0.5 km

DRAFT

- All Units In Metric Unless Otherwise Noted.
- Base Information Obtained From Various Sources And Is Approximate.
- Schedule / Plan Information Is Conceptual And Requires Verification by Appropriate Agency.

GERRARD DESIGN

MACVILLE | Caledon, Ontario

PRELIMINARY FRAMEWORK PLAN

JAN 12, 2021
PROJECT 1420
SCALE 1:8000

Figure 5.1b

BRES AREA 3 TOTAL

LAND USE SUMMARY

	Site Area	181.86 ha.	449.38 ac.	
	Net Site Area (Post Land Exchange)	181.90 ha.	449.47 ac.	
	NON-DEVELOPABLE			
🟦	Road Widening	1.43 ha.	3.53 ac.	
🟩	Proposed Environmental Protection Area	10.52 ha.	25.99 ac.	
	Net Area	169.95 ha.	419.95 ac.	100.0%
	DEVELOPABLE			
	Residential (see 'UNIT SUMMARY')	61.96 ha.	153.10 ac.	36.5%
🟪	Employment - Office/Innovation	0.52 ha.	1.28 ac.	0.3%
🟦	GO Station Lands	3.89 ha.	9.61 ac.	2.3%
🟥	Commercial/Mixed Use	3.03 ha.	7.49 ac.	1.8%
🟧	Low-Medium Density Blocks	2.30 ha.	5.68 ac.	1.4%
🟧	Medium Density Blocks	14.19 ha.	35.06 ac.	8.3%
▨	Flex Denisty Residential/Mixed Use Blocks	1.43 ha.	3.53 ac.	0.8%
🟪	Mixed Use Blocks	5.20 ha.	12.85 ac.	3.1%
🟩	Parks	10.79 ha.	26.66 ac.	6.3%
🟦	Schools	7.20 ha.	17.79 ac.	4.2%
🟦	SWM Ponds	8.57 ha.	21.18 ac.	5.0%
🟩	Vista/Walkway	0.53 ha.	1.31 ac.	0.3%
⬜	Right of Way	50.34 ha.	124.39 ac.	29.6%
	TOTAL (Net Developable)	169.95 ha.	419.95 ac.	100.0%

	UNIT SUMMARY	Unit *width*	Unit Depth	Unit Count	Lot Mix	Frontage *(m)*	Area		% Net Res	Net Density (uph)	Population Yield
	BLOCK 1										
▨	Flex Denisty Residential/Mixed Use Blocks										
	Townhouses	md	n/a	20	0%		0.89 ha.	2.20 ac.		147.2	273
	Apartment Units	md	n/a	111	2%						
	BLOCK 2										
🟪	Mixed Use Blocks										
	Townhouses	hd	n/a	15	0%		1.17 ha.	2.89 ac.		173.5	404
	Apartment Units	hd	n/a	188	3%						
	BLOCK 3										
🟪	Mixed Use Blocks										
	Townhouses	hd	n/a	7	0%		1.05 ha.	2.59 ac.		255.2	518
	Apartment Units	hd	n/a	261	4%						
	BLOCK 4										
▨	Flex Denisty Residential/Mixed Use Blocks										
	Townhouses	hd	n/a	5	0%		0.54 ha.	1.33 ac.		255.6	268
	Apartment Units	hd	n/a	133	2%						
	BLOCK 5										
🟧	Low-Medium Density Blocks										
	Townhouses	md	n/a	6	0%		1.00 ha.	2.47 ac.		264.0	509
	Apartment Units	md	n/a	258	4%						
	BLOCK 6										
🟧	Low-Medium Density Blocks										
	Townhouses	md	n/a	22	0%		0.86 ha.	2.13 ac.		155.8	281
	Apartment Units	md	n/a	112	2%						
	BLOCK 7										
🟪	Mixed Use Blocks										
	Townhouses	hd	n/a	12	0%		2.43 ha.	6.00 ac.		151.0	712
	Apartment Units	hd	n/a	355	5%						
	BLOCK 8										
🟪	Mixed Use Blocks										
	Townhouses	hd	n/a	0	0%		1.40 ha.	3.46 ac.		233.6	621
	Apartment Units	hd	n/a	327	5%						
	BLOCK 9										
🟧	Low-Medium Density Blocks										
	Townhouses	md	n/a	0	0%		0.63 ha.	1.56 ac.		268.3	321
	Apartment Units	md	n/a	169	2%						
	BLOCK 10										
🟧	Medium Density Blocks										
	Townhouses	md	n/a	55	1%		2.14 ha.	5.29 ac.		161.2	722
	Apartment Units	md	n/a	290	4%						
	BLOCK 11										
🟧	Medium Density Blocks										
	Townhouses	md	n/a	54	1%		2.16 ha.	5.34 ac.		173.1	775
	Apartment Units	md	n/a	320	5%						

	BLOCK 12												
🟧	Low-Medium Density Blocks												
	Townhouses		md		n/a	13	0%		0.67 ha.	1.66 ac.		186.6	253
	Apartment Units		md		n/a	112	2%						
	BLOCK 13												
🟧	Medium Density Blocks												
	Townhouses		md		n/a	15	0%		0.73 ha.	1.80 ac.		183.6	273
	Apartment Units		md		n/a	119	2%						
	BLOCK 14												
🟧	Medium Density Blocks												
	Townhouses		md		n/a	15	0%		0.73 ha.	1.80 ac.		183.6	273
	Apartment Units		md		n/a	119	2%						
	BLOCK 15												
🟧	Medium Density Blocks												
	Townhouses		md		n/a	8	0%		0.53 ha.	1.31 ac.		201.9	213
	Apartment Units		md		n/a	99	1%						
	BLOCK 16												
🟧	Medium Density Blocks												
	Townhouses		md		n/a	8	0%		0.53 ha.	1.31 ac.		201.9	213
	Apartment Units		md		n/a	99	1%						
	BLOCK 17												
🟧	Medium Density Blocks												
	Townhouses		md		n/a	0	0%		2.40 ha.	5.93 ac.		194.2	885
	Apartment Units		md		n/a	466	7%						
	BLOCK 18												
🟧	Medium Density Blocks												
	Townhouses		md		n/a	0	0%		1.88 ha.	4.65 ac.		218.6	781
	Apartment Units		md		n/a	411	6%						
	BLOCK 19												
🟧	Medium Density Blocks												
	Townhouses		md		n/a	86	1%		3.10 ha.	7.66 ac.		105.8	726
	Apartment Units		md		n/a	242	4%						
	CONDO												
🟨	Detached Homes (Condo)	*(36')*	11.00	x	27.0	18	0%	198.0	1.79 ha.	4.42 ac.	2.9%	14.5	96
🟫	Detached Homes (Condo)	*(38')*	11.60	x	27.0	5	0%	58.0					
🟩	Detached Homes (Condo)	*(45')*	13.72	x	27.0	3	0%	41.2					
	FREEHOLD												
🟪	Rear Lane Towns (3 Storey)	*(20')*	6.10	x	21.0	68	1%	414.8	1.09 ha.	2.69 ac.	1.8%	62.4	211
🟪	Rear Lane Mixed Use Towns (3 Storey	*(20')*	6.10	x	23.0	38	1%	231.8	0.62 ha.	1.53 ac.	1.0%	61.3	118
🟪	Rear Lane Towns (3 Storey)	*(20')*	6.10	x	23.0	643	9%	3,922.3	10.75 ha.	26.56 ac.	17.3%	59.8	1,993
🟪	Back-to-Back Towns	*(21')*	6.40	x	13.5	94	1%	601.6	0.95 ha.	2.35 ac.	1.5%	98.9	291
🟧	Standard Towns (2 Storey)	*(25')*	7.60	x	27.0	252	4%	1,915.2	6.00 ha.	14.83 ac.	9.7%	42.0	781
🟦	Detached Homes	*(40')*	12.20	x	23.75	29	0%	353.8	0.88 ha.	2.17 ac.	1.4%	33.0	107
🟦	Detached Homes	*(44')*	13.40	x	23.75	29	0%	388.6	0.94 ha.	2.32 ac.	1.5%	30.9	107
🟩	Detached Homes	*(34')*	10.40	x	27.0	133	2%	1,383.2	4.31 ha.	10.65 ac.	7.0%	30.9	492
🟨	Detached Homes	*(36')*	11.00	x	27.0	333	5%	3,663.0	10.50 ha.	25.95 ac.	16.9%	31.7	1,232
🟫	Detached Homes	*(38')*	11.60	x	27.0	522	8%	6,055.2	17.04 ha.	42.11 ac.	27.5%	30.6	1,931
🟩	Detached Homes	*(45')*	13.72	x	27.0	172	3%	2,359.8	7.09 ha.	17.52 ac.	11.4%	24.3	636
	TOTAL					6,871	100%	21,586.5	61.96 ha.	153.10 ac.	100.0%	110.9	17,017

ROW SCHEDULE

	(m) width	*(lin.m)*	*(lin.m)* Half
Major Collector	**22.0**	4,210.3	0.0
Minor Collector	**19.5**	4,703.8	6.9
Local Road	**18.0**	12,474.9	112.7
Window Road	**16.0**	1,548.4	0.0
Central Spine Road	**14.0**	2,266.2	0.0
Lane	**11.0**	23.0	0.0
Condo Lane	**10.3**	356.4	0.0
Lane	**8.0**	2,975.5	0.0
Lane	**6.5**	225.3	0.0
ROW TOTAL		28,783.8	119.6

BRES AREA 3 TOTAL

LAND USE SUMMARY

	Site Area	181.86 ha.	449.38 ac.	
	Net Site Area (Post Land Exchange)	181.90 ha.	449.47 ac.	
	NON-DEVELOPABLE			
🟦	Road Widening	1.43 ha.	3.53 ac.	
🟩	Proposed Environmental Protection Area	10.52 ha.	25.99 ac.	
	Net Area	169.95 ha.	419.95 ac.	100.0%
	DEVELOPABLE			
	Residential (see 'UNIT SUMMARY')	61.96 ha.	153.10 ac.	36.5%
🟪	Employment - Office/Innovation	0.52 ha.	1.28 ac.	0.3%
🟦	GO Station Lands	3.89 ha.	9.61 ac.	2.3%
🟥	Commercial/Mixed Use	3.03 ha.	7.49 ac.	1.8%
🟧	Low-Medium Density Blocks	2.30 ha.	5.68 ac.	1.4%
🟧	Medium Density Blocks	14.19 ha.	35.06 ac.	8.3%
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🟪	Mixed Use Blocks	5.20 ha.	12.85 ac.	3.1%
🟩	Parks	10.79 ha.	26.66 ac.	6.3%
🟦	Schools	7.20 ha.	17.79 ac.	4.2%
🟦	SWM Ponds	8.57 ha.	21.18 ac.	5.0%
🟩	Vista/Walkway	0.53 ha.	1.31 ac.	0.3%
⬜	Right of Way	50.34 ha.	124.39 ac.	29.6%
	TOTAL (Net Developable)	169.95 ha.	419.95 ac.	100.0%

UNIT SUMMARY

			Unit *width*		Unit Depth	Unit Count	Lot Mix	Frontage *(m)*	Area		% Net Res	Net Density (uph)	Population Yield
	Condo												
🟧	Low-Medium Density Blocks												
	Townhouses		md		n/a	41	1%		SEE AREA ABOVE			300.9	1,364
	Apartment Units		md		n/a	651	9%						
🟧	Medium Density Blocks												
	Townhouses		hd		n/a	241	4%		SEE AREA ABOVE			169.6	4,861
	Apartment Units		hd		n/a	2,165	32%						
▨	Flex Density Residential/Mixed Use Blocks												
	Townhouses		hd		n/a	25	0%		SEE AREA ABOVE			188.1	541
	Apartment Units		hd		n/a	244	4%						
🟪	Mixed Use Blocks												
	Townhouses		hd		n/a	34	0%		SEE AREA ABOVE			224.0	2,254
	Apartment Units		hd		n/a	1,131	16%						
🟨	Detached Homes (Condo)	*(36')*	11.00	x	27.0	18	0%	198.0	1.79 ha.	4.42 ac.	2.9%	14.5	96
🟫	Detached Homes (Condo)	*(38')*	11.60	x	27.0	5	0%	58.0					
🟨	Detached Homes (Condo)	*(45')*	13.72	x	27.0	3	0%	41.2					
	FREEHOLD												
🟪	Rear Lane Towns (3 Storey)	*(20')*	6.10	x	21.0	68	1%	414.8	1.09 ha.	2.69 ac.	1.8%	62.4	211
🟪	Rear Lane Mixed Use Towns (3 Storey	*(20')*	6.10	x	23.0	38	1%	231.8	0.62 ha.	1.53 ac.	1.0%	61.3	118
🟪	Rear Lane Towns (3 Storey)	*(20')*	6.10	x	23.0	643	9%	3,922.3	10.75 ha.	26.56 ac.	17.3%	59.8	1,993
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🟧	Standard Towns (2 Storey)	*(25')*	7.60	x	27.0	252	4%	1,915.2	6.00 ha.	14.83 ac.	9.7%	42.0	781
🟦	Detached Homes	*(40')*	12.20	x	23.75	29	0%	353.8	0.88 ha.	2.17 ac.	1.4%	33.0	107
🟦	Detached Homes	*(44')*	13.40	x	23.75	29	0%	388.6	0.94 ha.	2.32 ac.	1.5%	30.9	107
🟩	Detached Homes	*(34')*	10.40	x	27.0	133	2%	1,383.2	4.31 ha.	10.65 ac.	7.0%	30.9	492
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🟫	Detached Homes	*(38')*	11.60	x	27.0	522	8%	6,055.2	17.04 ha.	42.11 ac.	27.5%	30.6	1,931
🟨	Detached Homes	*(45')*	13.72	x	27.0	172	3%	2,359.8	7.09 ha.	17.52 ac.	11.4%	24.3	636
	TOTAL					6,871	100%	21,586.5	61.96 ha.	153.10 ac.	100.0%	110.9	17,017

ROW SCHEDULE

	(m) *width*	*(lin.m)*	*(lin.m)* *Half*
Major Collector	**22.0**	4,210.3	0.0
Minor Collector	**19.5**	4,703.8	6.9
Local Road	**18.0**	12,474.9	112.7
Window Road	**16.0**	1,548.4	0.0
Central Spine Road	**14.0**	2,266.2	0.0
Lane	**11.0**	23.0	0.0
Condo Lane	**10.3**	356.4	0.0
Lane	**8.0**	2,975.5	0.0
Lane	**6.5**	225.3	0.0
ROW TOTAL		28,783.8	119.6

largest habitat block be transformed into an enhanced corridor/greenway that is centred roughly on existing reaches WHT6-A to WHT6-C. It is estimated that the total area of the fragmented wetlands is 1.19 ha, and to ensure there is no net loss of wetlands as result of the development, at least 1.19 ha of wetland will be compensated for in the enhanced corridor/greenway. This would ensure that the ecosystem functions of these features are retained on the landscape.

A conceptual design for this enhanced corridor/greenway has been prepared by the Study Team using natural channel design principles. Within the FSR, Drawing 401 contains an illustration of the channel cross-sections while Drawing 304 illustrates the channel in plan-view (Urbantech Consulting 2021). The proposed conceptual corridor design incorporates the following elements:

- Conveyance of regional storm;
- Meanderbelt width of 12 m;
- Low flow channel with a naturalized, sinuous planform and design elements, such as secondary channels and medial bars to enhance aquatic and terrestrial habitat conditions;
- Creation of hummocky, wetland habitat area within the floodplain equivalent to that of wetlands removed (1.19 ha);
- Minimum 30 m bottom width to facilitate creation of at least 1.19 ha of wetland compensation;
- Minimum 53 m top width;
- Maximum 3:1 side slopes;
- 2-3 m wide trail system along the top of slope abutting developable lands; and
- Stone core pocket wetland at SWMF 1 outfall and associated conveyance channel.

The proposed enhanced corridor/greenway will create a single contiguous natural heritage system block that will provide for significantly enhanced ecosystem functions relative to that of the existing isolated features on the northern and eastern portions of the Subject Lands.

The corridor dimensions have been validated to ensure that various design objectives noted above can be achieved. This level of detail was required to ensure that the extent and limits of Environmental Policy Area are appropriately reflected on the Land Use Plan and Preliminary Framework Plan.

Upon receiving approval in principle for the proposed enhanced corridor/greenway, the Study Team will prepare and submit a separate Corridor Design Brief for Tributary WHT6 for review and approval.

5.3 Stormwater Management Strategy

Under existing conditions, the majority of the Subject Lands (consisting of the western, central and southeastern portions) drain to the West Humber River. Surface drainage leaves the Subject Lands via culverts located along King Street West (five culverts) and Humber Station Road (one culvert). The northeastern portion of the Subject Lands is located within the Main Humber River watershed. Surface flow from this area drains toward the CPR line and is conveyed downstream via three (3) culverts under the rail line.

Under proposed conditions, the stormwater management strategy developed by Urbantech Consulting (2021) maintains the approximate pre-development watershed divide, as well as individual subcatchment/outlets within each watershed. Outside of alterations to imperviousness, this approach minimizes, to the greatest extent possible, changes to overall drainage patterns within the Subject

Lands. The existing external drainage area north of Subject Lands (81 ha) will be directed to the proposed enhanced corridor/greenway west of Humber Station Road via a clean water pipe (CWP). This includes drainage area from west of The Gore Road.

The major and minor drainage systems designed by Urbantech Consulting (2021) will convey storm runoff to two (2) proposed end-of-pipe stormwater management facilities (SWMF) prior to discharge to receiving drainage features within the Subject Lands. SWMF1 is generally situated northwest of the intersection of King Street and Humber Station Road. SWMF 2 is located north of King Street, abutting Wetland Unit 6 (W6) of the NHS within the Subject Lands.

As described in the FSR (Urbantech 2021), SWM targets / sizing criteria for the Subject Lands were established based on the TRCA (2012a) Stormwater Management Criteria document and TRCA (Civica 2018) Humber River Hydrology Update pre-development conditions, in addition to the following:

- Ensure that existing flow rates downstream of the Subject Lands are not exceeded under post-development condition;
- Provide adequate drawdown time / erosion control to protect the form and function of downstream receiving reaches;
- Meet the Enhanced (Level 1) criteria as per the MOE SWM Planning and Design Manual (March 2003) for stormwater quality treatment;
- Maintain recharge volumes through the use of low impact development and other practices, as required; and
- Maintain water balance to wetland features.

5.3.1 Quantity Control

Quantity control target release rates for SWMF 1 and 2 were determined based on unit flow rates for the 2-year to 100-year storm events as identified by TRCA (Civica 2018) for the West Humber River watershed and the associated contributing drainage area to each SWMF. In accordance with direction provided by TRCA (email dated April 17, 2020), control of the Regional storm will also be provided. SWM pond outlets have been designed to ensure that post-development peak flow rates for the 2-year to 100-year storm events do not exceed the pre-development conditions at each of the modelled Flow Node locations. Both facilities will have multiple outlet controls including an extended detention outlet, quantity control, emergency spillway and a maintenance sump.

The proposed pond outfall locations are illustrated on Drawings 601 and 602 of the FSR (Urbantech Consulting 2021). In accordance with the TRCA (2012a) Stormwater Management Criteria document, the outfalls have been placed:

- Outside of the 25-year floodline, where possible;
- Outside of the 100-year erosion limit, where possible;
- Outside of the meander belt, where applicable; and
- Optimal 45-degree angle of release to receiving reaches to reduce erosion impacts where possible.

Design elements including stone-core wetlands and, in the case of the enhanced corridor/greenway, conveyance channel, are proposed to provide energy dissipation, water quality benefits and enhanced detention/retention at both outfalls.

5.3.2 Quality Control

SWF forebays have been designed according to the settling and dispersion length equations provided in Section 4.6.2 of the MOE SWM Planning and Design Manual (2003). Permanent pool volumes have been designed to meet the Enhanced (Level 1) criteria as per the MOE SWM Planning and Design Manual.

5.3.3 Erosion Control

Erosion control requirements for SWMF 1 and 2 will be met by providing a minimum 48-hour (maximum 72-hour) drawdown time for the 25mm storm event. The SWMF outlets will be designed with multiple outlet controls, including an extended detention outlet to address erosion control. A preliminary extended detention orifice dimension of 100 mm was determined by Urbantech Consulting (2021) for SWMF 1 and 2 referencing the required drawdown time (i.e., minimum 48 hours) and target extended detention release rates of 0.060 m^3/s and 0.030 m^3/s, respectively, under approximately 0.5m to 1m of head (i.e., extended detention level). The minimum orifice size of at least 100mm is recommended to prevent potential blockage by debris, etc.

5.3.4 LID and Site Water Balance

To achieve the water balance requirements, the FSR (Urbantech Consulting 2021) identified the following Low Impact Development (LID) measures as being most feasible for application in the Subject Lands:

- **Downspout Disconnection:** Roof leader discharge to pervious surfaces such as lawns or to LID measures provides a source of clean water that can be infiltrated. This is a low / no maintenance, lot-level control that is typically implemented by default.
- **Additional Topsoil Depth:** Coupled with downspout disconnection, an additional depth of topsoil beyond the minimum requirements provides additional storage volume at the lot-level which reduces runoff volume and promotes filtration / infiltration. This is a low / no maintenance practice.
- **Swales:** Swales will be required in the Subject Lands to convey surface flows and have the added benefit of encouraging infiltration as well as peak flow / velocity reduction and improvements to water quality. Suggested swale locations include:
    - Swales in Greenland corridors;
    - Swales in Parks and Schools (public ownership);
    - Swales downstream of stormwater management outfalls;
    - Swales adjacent to rear lots located within buffers;
    - Overland flow easements; and
    - Side Yard / Rear Yard swales (private ownership).
- **Infiltration Facilities:** Dedicated infiltration facilities involve construction below grade and their performance is subject to the groundwater table elevations and infiltration rates of the native material. Infiltration facilities should be designed with an emergency overflow spillway to the storm sewer system to prevent infiltration trenches from being fully saturated.
- **Rain Gardens:** Rain gardens are landscape elements that are designed to receive and attenuate / infiltrate runoff, usually from nearby roof areas. Rain gardens require some

maintenance and are typically situated on private property. The longevity of these features is subject to the homeowner.

- **Rainwater Harvesting:** Rainwater harvesting typically consists of the use of rain barrels within private property to attenuate stormwater for later use for irrigation. This measure is not guaranteed to remain in place over the long-term, as their longevity is subject to the homeowner. However, it is recommended that rainwater harvesting be considered on a larger scale to supplement the municipal supply to irrigate park / open space areas.

LID techniques were selected based on the Preliminary Framework Plan land use concept and preliminary site grading. The proposed LID features and the LID Map will be further developed following the completion of additional studies. Selection of the LID techniques should consider the maintenance requirements as some of the technologies proposed may be privately-owned and operated, while others may be in public ownership and operated and maintained by the municipality.

5.4 Servicing Strategy

5.4.1 Water Supply

As determined in the Bolton Residential Expansion Study (Region of Peel, September 24, 2020) the Subject Lands are generally outside of the range of elevations associated with Pressure Zone 6 of the existing water distribution infrastructure in Bolton. As such, ultimate development of the Option 3 lands will require the addition of Pressure Zone 7. Previous studies completed in support of BRES identified a new Zone 7 booster pumping station at King Street and Coleraine Drive. Ultimately, floating storage is proposed in the form of an elevated tank (ET) to provide storage for flow equalization, fire demands and emergencies. The ET is to be situated in the vicinity of the northwest corner of the Option 3 lands. The excerpt from the Peel Region study is included in Appendix 9 of the FSR (Urbantech Consulting 2021).

A technical memorandum (June 1, 2020) has been prepared by R.J. Burnside & Associates Limited on behalf of the Bolton Option 3 Landowners Group to provide water distribution servicing recommendations in support of interim and ultimate development of the Subject Lands.

Water servicing can be provided for the entire Subject Lands with the following provisions:

- A new Booster Pumping Station is constructed in the vicinity of Coleraine Drive and King Street and the diameter of the proposed trunk watermain from the Booster Pumping Station to a point approximately 1200 m southwest is increased to 600 mm, from the currently proposed 400 mm diameter required for the ultimate build out condition;
- The Booster Pumping Station will require appropriately sized booster pumps to provide the ADD, MDD and PHD within the 40 psi to 100 psi pressure range; and
- The Booster Pumping Station will also require a fire pump to provide the Subject Lands with 220 L/s of fire flow.

It is noted that further consultation with Peel Region and Town of Caledon will be required regarding the external watermain alignment and necessary EA requirements for the external infrastructure. The specific arrangement of the Booster Pumping Station would be determined during detailed design.

Based on the preliminary water modeling by Burnside, the external trunk watermain size is increased from 400mm diameter (recommended by Bolton Residential Expansion Area Study) to 600mm diameter to address the future potential population density increase.

5.4.2 Wastewater

The proposed development is a tributary to the South Peel Wastewater System. As confirmed by the Bolton Residential Expansion Area Servicing Study, prepared by the Region of Peel dated September 24, 2020, the proposed conveyance system for the sanitary flow from the Subject Lands is the existing trunk sewer on Coleraine Drive. Sanitary flow is treated ultimately at the G.E. Booth Wastewater Treatment Plant.

The Bolton Residential Expansion Study (BRES) indicates that both the Options 3 and 4 lands are to be serviced by gravity by connecting a new trunk sewer to the existing 750mm diameter sanitary trunk on Coleraine Drive at manhole 38 located approximately 700m north of George Bolton Parkway.

While it is anticipated that the existing Coleraine Drive trunk sanitary has enough capacity to service all phases of the development, further coordination with the Region of Peel infrastructure planning group will be required to confirm the ultimate Option 4 drainage boundary and whether additional flows from the lands north of MSVP could be also accommodated in the downstream system.

The Region of Peel Bolton Residential Expansion Area Servicing Study identified the future trunk sewer along King Street and Coleraine Drive as the ultimate servicing outlet for the Subject Lands. High level details of the external trunk alignment are provided in the FSR (Urbantech Consulting 2021)**.** The Region study has considered separate servicing solutions for each Residential Expansion Options, but the FSR recommends combining the sanitary outlet for Option 3 and a portion of Option 4 and 5 lands by rerouting the external trunk sewer.

Compared to the Region of Peel proposal, the proposed trunk sewer alignment by the development would slightly reduce the length of the external infrastructure and minimize the potential servicing issues associated with the utility conflicts and traffic management along King Street and Coleraine Drive. In addition, the suggested trunk alignment provides an accessible outlet for future development Option 4 and 5 areas. It is noted that further consultation with Peel Region and Town of Caledon will be required regarding the external trunk sewer alignment and necessary EA requirements for the external infrastructure.

6. Impact Assessment

6.1 Approach

The CEISMP TOR requires that an impact assessment for the natural features associated with the Study Area. More specifically:

> *Through an analysis of the dynamics and interrelationships of the ecosystem, the study will assess the potential environmental impacts of locating residential uses and the*

associated infrastructure within the respective study areas, and their compatibility with the Town's ecosystem goals, objectives, policies and performance measures.

One of the primary objectives followed in designing the Preliminary Framework Plan for the Macville Community was to protect existing natural heritage features and functions within an enhanced NHS and to locate development outside of natural hazards (as described in **Section 5.1**). Since impact avoidance is generally the most effective means of reducing the risk of development impacts on the natural environment, the CEISMP has recommended that the future development limits be established outside of any significant natural heritage features and natural hazards as explained in **Section 4**. Therefore, the impacts are generally limited to those that are indirect, which can be mitigated.

As with the other components of this CEISMP, an integrated multi-disciplinary approach has been applied to assessing the potential impacts of redeveloping the Subject Lands, as shown in **Table 18** below. This approach allows for assessment of some of the more complex biophysical relationships documented within the Subject Lands and the Study Area, such as relationships between ground and surface water resources in sustaining wetlands, and fish and wildlife habitat.

The impact assessment presented in this CEISMP is based on:

- The most detailed level of information available related to biophysical resources based on primary and secondary data and analyses (as presented in **Section 3**); and
- The findings of the constraint analyses (presented in **Section 4**) to identify sensitive and significant natural features and ecological functions that require protection to maintain the integrity and biodiversity of the natural heritage within the Study Area, as well as to identify natural hazards present.

The impact assessment matrix is structured to:

- Identify the specific development activity (impact source);
- Describe the potential effect on environmental receptors (features and functions);
- Recommend mitigation measures to address potential impacts (to be implemented through environmental management plans detailed in **Section 7**); and
- Describe the net effect on the biophysical environment.

The impact assessment matrix is organized according to ecosystem components (e.g., geology, landforms, hydrogeology, hydrology, aquatic systems, terrestrial systems, etc.). The matrix describes the impact source(s) (development/ site alteration activity), the potential impact to the impact receptor(s) (features, attributes and functions), the recommended mitigation (including special monitoring or management needs), and the anticipated residual impacts.

As the community has been designed to avoid direct impacts to most natural heritage features and ecological functions, the impact assessment is focussed primarily on addressing indirect impacts.

Table 18. Impact Assessment Matrix

Category	Feature/Function	Proposed Activity	Potential Impacts	Recommended Mitigation/Management	EMP Section	Effect
Geology	**Bedrock Geology**	Grading and Servicing	Bedrock on the Subject Lands is at least 10 m below ground surface and will not be impacted by grading and servicing.	None	7.4	Neutral
	Surficial Geology/ Physiography/ Topography	Site Preparation, Grading, Servicing	The topography of the Subject Lands is gently rolling topography and slopes generally to the south. Relief across the Subject Lands ranges from approximately 281 metres above sea level (masl) at the highest point in the northwest corner, to 262 masl in the southwest corner. To accommodate future development, the subject lands will be graded. Based on the preliminary grading plans, it is not anticipated that the magnitude of these grade changes will alter the character of the landform, however topographic relief will be affected at a local scale.	• Maintain a cut and fill balance to the extent feasible to minimize importing and exporting. • Match grades at outer property limits. • Match grades at EPA feature limits.	7.4	Neutral
Soils	**Topsoil**	Site Preparation, Grading, Servicing	Site preparation will require topsoil striping and stockpiling to facilitate grading and servicing. Topsoil resources can be lost through mixing with sub soils and exposure to sun, wind, and water erosion.	• Protect and reuse topsoil resources by minimizing exportation or importation. • Implement Best Management BMP's such as proper separation, stockpiling and erosion control measures, amendment and reapplication to the site following construction. • Develop Soil Management Plans in accordance with TRCA's *Preserving and Restoring Healthy Soil: Best Practices for Urban Construction* (TRCA 2012b). • Conform to the requirements of the Town of Caledon Fill By-Law (2007-59)	7.5	Neutral
Air Quality	**Air**	Site Preparation, Grading, Servicing	Dust from the construction activities could degrade local air quality and have localized short-term negative impacts on vegetation resources in the adjacent EPA.	• Prepare and implement a Dust Management Plan (DMP) prior to site preparation. • Dust should be monitored and managed throughout the construction period and dust suppression measures implemented. • Conform to the requirements of the Town of Caledon Fill By-Law (2007-59)	7.5	Neutral
Groundwater	**Groundwater Flows**	Grading, Servicing and Development	The direction of groundwater flow in the larger study area is expected to be in a southeasterly direction towards the Humber River and/or Lake Ontario in the south. Based on the groundwater levels at the Site, the direction of groundwater flow generally coincides with the regional flow towards the southeast, however a local groundwater divide is noted along the central portion of the Site, where a secondary flow towards the southwestern corner of the Subject Lands is also noted. The installation of site servicing utility lines and underground basement/parking levels and/or foundation has the potential to disrupt the pre-existing groundwater flow dynamics at the Site.	• Implement Best Management Practices (BMPs) for servicing construction. • Utilize trench plugs or anti-seepage collars along installed services to prevent redirection of groundwater flows and water table lowering. • All excavations for site servicing and/or underground levels should be backfilled with soil material of similar permeabilities to the excavated parent native soil to minimize disruption to the groundwater flow regime. It is recommended that backfilling of all excavations or trenches, where necessary, be completed using the excavated native soil.	7.2	Neutral
	Groundwater Quality	Grading, Servicing and Development	Under the post-development scenario, contaminants such as oil, sand, salt and other debris may also affect the water quality of surface runoff and consequentially that of the groundwater systems.	• Implement the Erosion and Sediment Control Plan (ESC Plan) as detailed in the FSR (Urbantech Consulting 2021). • Implement the Stormwater Management Strategy and Plan as detailed in the FSR (Urbantech Consulting 2021). • Implement Low Impact Development (LIDs) Strategy and Plan as detailed in the FSR (Urbantech Consulting 2021).	7.3	Neutral

	Dewatering	Grading, Servicing and Development	Temporary dewatering operations during the construction period has the potential for impacts to existing natural surface water features and/or users of groundwater in the area.	• Develop and implement a Dewatering Management Plan (DMP) at the detailed design stage to ensure groundwater is managed appropriately.
				  • Secure permits from the MECP for dewatering activities.
				  • Groundwater infiltration into the temporary excavations will be controlled by the Contractor.
				  • If there are exceedances of the discharge water against the PWQO criteria, then pre-treatment should be completed prior to discharging into the receiving surface water source.
				  • Where dewatering is required, effluent shall be discharged in a way that prevents sedimentation to the watercourses.
					7.6	Neutral

Surface Water	**Drainage Patterns**	Grading, Servicing and Development	The proposed development will result in alterations to drainage catchment areas. As noted in Section 4.1.3.2, it is anticipated that there will be a runoff deficit to the wetland features which has the potential to impact the wetlands. It is anticipated that these impacts can be mitigated through implementation of a variety of measures to ensure wetlands functions are maintained.	• The targets for runoff and infiltration will be established through the Feature Based Wetland Water Balance Analysis once completed. • A combination of mitigation measures (SWM, LIDs and cut-off swales, etc.) will be explored so as not adversely affect flows and habitat functions. • See FSR and Hydrogeological Investigation	7.3, 7.4	Neutral

Category	Feature/Function	Proposed Activity	Potential Impacts	Recommended Mitigation/Management	EMP Section	Effect
	Headwater Drainage Features	Grading, Servicing and Development	HDFs in the Study Area have been assessed and management recommendations assigned to determine which features are to be retained, relocated, or removed and functions replicated or not. As was discussed in **Section 4.1.2.1**, 16 of the 43 HDF reaches require no mitigation and another 3 are low functioning and will be removed but have their conveyance functions replicated by maintaining downstream flows through the development design. Another 13 HDF reaches are classified as conservation and most of these will be retained in-situ, except for WHT6-B and WHT6-C which will be relocated to an enhanced corridor greenway where their functions will be replicated and enhanced. One HDF reach (WHT6-A) was classified as protection. This feature will be retained in-situ, but subject to natural channel design and wetland enhancement. Also see Wetlands.	• Maintain existing water balance to HDF reaches identified as protection, conservation or mitigation. • Replicate the ecological functions of any HDFs ranked as protection, conservation or mitigation • Prepare a Corridor Design Brief for Tributary WHT6 demonstrating how functions are to be replicated and enhanced. • Construct the proposed enhanced corridor/greenway for Tributary WHT6.	7.1, 7.3	Neutral-Positive
	Surface Water Runoff	Grading, Servicing and Development	Stormwater runoff captured by the proposed stormwater infrastructure could exacerbate the transitional/adjustment erosion processes in downstream reaches without appropriate quantity control.	• Implement SWM plan. • Refer to FSR (Urbantech Consulting 2021)	7.3, 7.4, 7.5	Neutral
	Geomorphological Processes	Grading, Servicing and Development	Grading and development will increase the overall area of impervious surfaces which will result in decreased infiltration and increased runoff. These increases can result in more frequent short duration high flow events, leading to increased erosion.	Utilize established thresholds for determining appropriate release rates from the stormwater management ponds. The SWM outfall will require site specific geomorphic assessments for appropriate design to avoid and minimize impacts.	7.3	Neutral
	Water Quality	Grading, Servicing and Development	Stormwater runoff captured by the proposed stormwater infrastructure could affect water quality in downstream reaches if released without quality control.	• Refer to FSR (Urbantech Consulting 2021) • Implement BMPs outlined in the Guidance for Development Activities in Redside Dace Protected Habitat (MNRF 2016)	7.3, 7.4	Neutral
	Temperature	Grading, Servicing and Development	Stormwater runoff captured by the proposed stormwater infrastructure could affect water quality in downstream reaches if released without thermal control. The proposed SWM Pond will store the equivalent volume of the 10 mm storm event between a depth of 1.5 m for the bottom draw outlet which is in accordance with *Guidance for Development Activities in Redside Dace Protected Habitat* (MNRF 2016).	• Refer to FSR (Urbantech Consulting 2021)	7.3	Neutral

	Site Water Balance	Grading and Development	Grading activities and conversion of the Subject Lands from agricultural lands to a mix of mainly residential development units may result in some compaction of native soils and will result in an increase in the overall imperviousness of the Subject Lands. During the post-construction period, there will be an increase in the area of impervious surfaces which in turn will result in an overall decrease in the available pervious area in which infiltration can occur. In the post-construction scenario, a decrease in the annual AET and infiltration volumes is anticipated. Further, there will be an increase in the volume of evaporation and runoff.	• Surficial LID techniques recommended for the Study Area include:
				  • increasing topsoil thickness across low and medium density lots, boulevards and parks;
				  • reducing lot grading;
				  • directing roof runoff to pervious areas (i.e., rear yards) via downspout disconnection will be implemented to provide lot level controls; and
				  • Runoff in rear yards (natural runoff plus downspout disconnection) conveyed to rear lot grassed swales and infiltration trenches in the adjacent NHS.
				• BMPs for topsoil placement will be used to minimize compaction.
					7.2	Neutral

	Feature Based Water Balance Analysis	Grading and Development	The proposed development will result in changes to the existing drainage areas and has the potential to impact on the water balances of existing natural heritage features that are proposed for protection within the natural heritage system. Depending on the magnitude of the changes there could also be changes to the hydrology and hydro regimes sustaining features such as wetlands and HDFs. A wetland water balance risk evaluation was completed and determined that the majority of the features are within the high-risk category and require further investigation.	• It is recommended that a Wetland Water Balance Analysis be prepared in accordance with TRCA guidelines once more baseline hydrogeological data is available (see Section 9 – Future Work). • Depending on the findings of the Wetland Water Balance Analysis, mitigation measures may need to be applied. • Surpluses can be addressed by implementing LIDs and enhanced storage and detention measures. • Deficits can be addressed by implementing, split drainage on Lots, Roof Drainage Collection Systems.	TBD	TBD
Natural Heritage System	**Linkages**	Grading, Servicing and Development	Existing linkages on the Subject Lands are limited to local linkages, which are limited in terms of the level of function they provide in their current state.	• Encourage wildlife passage through the NHS and parks as a means of reducing the potential for vehicular impacts.	7.1	Neutral
	Significant Woodlands	Grading, Servicing and Development	There are no significant woodlands on or adjacent to the Subject Lands.	None.	N/S	Neutral

Category	Feature/Function	Proposed Activity	Potential Impacts	Recommended Mitigation/Management	EMP Section	Effect
	Wetlands	Grading, Servicing and Development	There are no provincially significant wetlands associated with the Subject Lands, however a portion of the Study Area overlaps with part of a wetland features that is identified as provincially significant. All wetlands on the Subject Lands are unevaluated will be protected within the proposed natural heritage system. As some wetland features are isolated (ELC Units 7e, 7f, 7l, 13 and 14a), it is proposed that these be consolidated and enhanced within an enhanced corridor/greenway along a re-aligned Tributary WHT6. The proposed corridor has been sized to ensure that an equivalent area of wetland habitat can be accommodated. The development plan proposes a road crossing of one wetland features (ELC Unit 7a). The crossing will result in the loss of wetland area. The loss of this wetland habitat will be offset by creating an equivalent area of wetland in the enhanced corridor/greenway and has already been accounted for in the conceptual design.	Potential impacts to wetlands can be reduced by implementing the following impact avoidance and mitigation measures: • Naturalize Buffers using native species; • Avoid directing untreated runoff to the wetlands; • Implement recommendations from the ESC Plan including measures as outlined in the *Guidance for Development Activities in Redside Dace Protected Habitat* (MNRF 2016) and *Erosion and Sediment Control Guideline for Urban Construction* (2006) to be provided at the detailed design stage; • Implement ESC Plan as detailed in the FSR (Urbantech Consulting 2021). measures at limit of development in advance of site preparation activities and outside the wetland boundaries when constructing SWM outfalls and bridge abutments; • Install ESC fencing around the work area required for removal of cart paths and culverts; • Restore affected areas with native vegetation.	7.1	Positive
	Valleylands	Grading, Servicing and Development	There are no valleylands associated with the Subject Lands.	None.	N/A	Neutral
	Trees	Grading, Servicing and Development	The majority of the Subject Lands is comprised of agricultural land and is relatively open. It is anticipated that all trees situated in areas to be developed will be removed. These removals are not anticipated to adversely impact the NHS, as the trees removed will be replaced with site-appropriate native and non-invasive species. No trees will be removed from the proposed NHS.	More trees will be planted than removed to accommodate development. Tree preservation and replacement requirements are addressed in the Arborist Report (Beacon 2020).	7.1	Positive
Wildlife	**Birds**	Grading, Servicing and Development	The open land bird species found within the Subject Lands are expected to undergo a moderate shift in species diversity and numbers with residential development. However, roughly the same number of species would be expected in the agricultural areas both pre- and post-development, and species in both cases would be disturbance-tolerant species. For instance, one would expect fewer or no Savannah Sparrows, Song Sparrows and Eastern Kingbirds, but more Mourning Doves, N. Cardinals, Chipping Sparrows. All the wetland and edge species that occur within the NHS are expected to remain subject to the usual annual variation.	• Undertake vegetation / tree clearing between August and April so as not to impact breeding birds and not contravene the *Migratory Birds Convention Act.* • Establish Buffers and fencing at development limits adjacent to the NHS to reduce human encroachments and predation by pets. • Post signage to keep pets and people out of the wooded valley feature (except where trails allow).	7.1	Neutral
	Reptiles	Grading, Servicing and Development	No significant reptile habitats (i.e., hibernacula, nesting sites) have been identified on the Subject Lands. However, the protected NHS could provide habitat for a range of amphibians and reptiles and may include some significant habitats for these species. No such habitats will be removed from the proposed NHS which contains meadows and wetlands.	• The loss of potential foraging habitats for snakes can be mitigated by retaining meadow and other types of habitats within the NHS and through the creation of the greenway corridor. • The nearby PSW will be protected from development, which provides great habitat for reptile use. • It is recommended that reptile protection be specifically addressed at the Draft Plan stage.	7.1	Neutral
	Amphibians	Grading, Servicing and Development	No significant amphibian habitats (i.e., breeding sites) have been identified on the Subject Land. In the adjacent lands, the protected Bolton PSW provides amphibian habitat. No such habitats will be removed from the proposed NHS which contains wetlands.	• The loss of potential habitats for amphibians can be mitigated by retaining wetlands and other types of habitats within the NHS and through the creation of the greenway corridor. • The nearby PSW will be protected from development, which provides great habitat for amphibian use. • It is recommended that amphibian protection be specifically addressed at the Draft Plan stage.	7.1	Neutral
	Mammals	Grading, Servicing and Development	All the mammal species that are currently present on and adjacent to the Subject Lands are urban tolerant species and expected to remain in the post development environment. Like the birds, it is anticipated there will be a slight shift in species assemblages toward a greater number of species that are more tolerant of urban environments. For example, Deer use is expected to decrease, while Raccoon and Striped Skunk populations could increase. Wildlife movement patterns in the general vicinity are expected to change as landscape resistance will increase as a result of development. It is expected that future wildlife movement will be more concentrated to the north and east in the Humber River valleylands.	• Encourage wildlife passage through the NHS and parks as a means of reducing the potential for vehicular impacts.	7.1	Neutral
	Significant Wildlife Habitat (SWH)	Grading, Servicing and Development	Candidate SWH identified through this CEISMP is primarily located in the Natural Heritage System that will be protected from development.	• Implement and naturalize Buffers as recommended in this EIS. • Install fencing between rear lots and the NHS to limit encroachments. • Through the Draft Plan stage, we recommend basking surveys for turtles and reptiles, as well as searches for turtle nests.	7.1	Neutral-Positive

Category	Feature/Function	Proposed Activity	Potential Impacts	Recommended Mitigation/Management	EMP Section	Effect
Fish Habitat	**Fish Habitat**	Grading, Servicing and Development	The CEISMP has identified that HDF reaches WHT1-A, WHT1-B and WHT6-A provide fish habitat. No development or site alteration is proposed within the HDF reaches WHT1-A and WHT1-B, however HDF reach WHT6-A will be enhanced through the proposed enhanced corridor/greenway.	Potential impacts to fish habitat can be reduced by implementing the following measures: • Develop and implement ESC and Spill Prevention plans at the draft plan stage. • Minimize non-essential vegetation clearing and grading, and integrate a phasing workplan for grading and construction; • Stabilize soils that will be exposed for long periods of time; and • During site preparation and construction ensure surface water is properly managed and treated using approved BMPs. Mitigation measures for flood control, water quality, temperature impacts, and erosion are noted above under Surface Water.	7.1, 7.3, 7.5	Positive
Provincially Threatened and Endangered Species	**Eastern Meadowlark**	Grading, Servicing and Development	Eastern Meadowlark is a Provincially Threatened bird species that breeds in grasslands of various types. Eastern Meadowlark has been recorded in various location the Subject Lands and Study Area in 2013/2014 (Dougan & Associates *et al.* 2014a and 2014b), and habitat remaining for this species during the last breeding bird survey in 2020 was ELC Unit 3d as the results of the last breeding bird survey provide a higher level of confidence of actual breeding locations (refer to **Figure 3.3.9**). Other areas where Eastern Meadowlark had been recorded are now farmed and no longer provide suitable habitat.	It is recommended that Eastern Meadowlark be surveyed for at the at the Draft Plan stage. The removal of the Eastern Meadowlark habitat will need to be mitigated through compensation (e.g., creation new or enhanced habitat, that is the same size as that being removed) in accordance with the *Endangered Species Act* and regulations pertaining to this species.	7.1	Neutral
	SAR Bats		There are four endangered bat species in Ontario: Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis and Tricoloured Bat. Based on the ELC work completed, it was determined that one ELC community in the Study Area could be suitable maternity roost habitat: Organic Deciduous Swamp (ELC Unit 12), which is protected by the NHS. Additionally, anthropogenic structures on the Subject Lands have the potential to provide SAR bat maternity roost habitat.	It is recommended that SAR bats be surveyed for at the at the Draft Plan stage. The removal of the SAR Bat habitat will require a permit under the *Endangered Species Act* and regulations pertaining to this species.	7.1	Neutral
	Redside Dace	Site Preparation, Grading, Servicing and Development	This CEISMP has identified potential for contributing habitat for Redside Dace habitat along two reaches of Tributary WHT1 on the Subject Lands (WHT1-A & WHT1-B). No development or site alteration is proposed within the HDF reaches WHT1-A and WHT1-B and their associated wetlands. All grading, servicing and development will occur outside potential contributing habitat for this species and will therefore not have a direct impact on the identified habitat. Furthermore, a wetland buffer has been proposed that will mitigate most indirect impacts the habitat. Potential residual indirect impacts that may result from the proposed development are outlined below: **Grading** • Potential to introduce sediments and nutrients into the drainage features. • Alterations to existing drainage catchment areas has the potential to temporally and spatially alter surface water inputs which can affect flows, erosion rates and water temperatures. **Servicing** • Installation of underground services has the potential to alter groundwater flows and pathways, which may reduce baseflow contribution to HDFs, resulting in thermal impacts and altered baseflows. Installation of underground services may require dewatering of groundwater which may result in reduced baseflow contributions and increase flows at discharge location. **Development:** • Development is proposed adjacent to HDF reaches WHT1-A and WHT1-B. • Development will create impervious surfaces that will increase overall runoff volumes and decrease infiltration within the catchment areas of features. • Decreases to infiltration can reduce base flow contributions to these HDFs and impact fisheries through reduced flow and elevated temperatures. • Increased runoff and flows to the downstream drainage features can result in erosion and flooding.	Mitigation measures will be implemented in accordance with the *Guidance for Development Activities in Redside Dace Protected Habitat* (MNRF 2016). Potential impacts to Redside Dace in downstream reaches can be reduced by implementing the following measures: • Develop and implement ESC and Spill Prevention plans at the draft plan stage. • The ESC Plan should include a multi barrier approach be applied around areas identified as contributing Redside Dace habitat. The multi-barrier should consist of a double row straw bale reinforced sediment fence; • Minimize non-essential vegetation clearing and grading, and integrate a phasing workplan for grading and construction; • Stabilize soils that will be exposed for long periods of time and store stockpiled soil outside of the potential Contributing Redside Dace habitat; • During site preparation and construction ensure surface water is properly managed and treated using approved BMPs; and • If water is to be discharged directly to Contributing Redside Dace habitat, all plans must be approved by MECP. Mitigation measures for flood control, water quality, temperature impacts, and erosion are noted above under Surface Water.	7.1, 7.3, 7.5	Neutral

7. Environmental Management Plan

The CEISMP TOR requires that an environmental management strategy be created as part of this report. More specifically:

> *The study will outline an environmental management strategy for the preferred development locations which will recommend measures for the management, enhancement, restoration and monitoring of the ecosystem.*

The Macville Community Land Use Plan and Preliminary Framework Plan were designed with the objective or protecting, maintaining and enhancing the natural heritage system, thereby avoiding directly impacting upon the ecosystems in the Study Area. Consequently, the Impact Assessment presented in **Section 6** of this CEISMP was focussed primarily on evaluating and mitigating potential indirect impacts that could adversely affect natural heritage features and ecological functions. Included in the Impact Assessment Matrix presented in **Table 18** are recommendations for various mitigation measures that are to be implemented during development of the future community to ensure the natural heritage features and ecological functions are protected, maintained and enhanced. These various recommendations have been compiled into several management plans that describe the measures in further detail. Implementation of these management plans will ensure that the Town’s environmental performance measures can be satisfied while developing this community.

7.1 Natural Heritage Resource Management Plan

As was described in **Section 5.2**, a proposed natural heritage system was developed through this CEISMP and has been identified as EPA on the Macville Community Land Use Plan and Preliminary Framework Plan. The natural heritage system is comprised of two blocks. The larger block is located on the southern portion of the Subject Lands and is comprised of existing wetlands and HDFs. The smaller block located on the eastern portion the Subject Lands is represented by a proposed enhanced corridor/greenway system centred on Tributary WHT6. This corridor has been designed consolidate several small isolated wetland features into a single contiguous wetland centred on a realigned tributary corridor.

Under the proposed Land Use Plan and Preliminary Framework Plan, this natural heritage system will be protected within an EPA land use designation which effectively mitigates most direct impacts through impact avoidance. The features that comprise the natural heritage system will however require some level of management to ensure protection and enhancement can be achieved. The following subsections include recommendations for protecting, maintaining, restoring and enhancing the natural heritage resources and ecological functions associated with these systems. As one EPA is based on protecting existing features and the other EPA is based on creating new features, the management requirements for each are discussed separately below.

7.1.1.1 Southern Natural Heritage System

The southern natural heritage system is anchored by three tributary systems of the West Humber River (WHT1, WHT2 and WHT3). Associated with these tributaries are a complex of wetland communities

W1 to W6). These wetlands are comprised mainly of mineral reed canary grass and cattail marshes, shallow aquatic wetlands associated with a dug pond, and a couple organic marsh and swamp communities. Most of these wetland communities are sustained by surface water, however there is evidence to suggest that some are seasonally sustained by groundwater discharge. These groundwater inputs contribute to baseflows along Tributary WHT1 and contribute to more perennial flows and cooler stream temperatures. For this reason, this tributary and its associated wetlands have been identified as fish habitat as well as potential contributing habitat for endangered Redside Dace that are known to occur downstream of the study area.

<u>Protection</u> of the natural heritage features and ecological functions associated with the natural heritage system can be achieved by:

1. Prohibiting development and site alteration within the natural heritage features;
2. Maintaining the existing water balances of the natural heritage features by implementing the recommendations in the SWM Management Plan and LID Management Plan;
3. Applying as 10 m buffer to the limits of the staked wetland features; and
4. Placing the natural heritage features and associated buffers within an EPA designation.

<u>Maintenance and enhancement</u> of the ecological integrity of the natural heritage features of their ecological functions can be achieved by:

1. Removing foreign waste and debris from the natural heritage features;
2. Controlling populations of invasive species present within the natural heritage features;
3. Restoring native species diversity to the habitats by planting appropriate native vegetation;
4. Enhancing wildlife habitat through plantings and artificial habitat creation (e.g. bird/bat boxes snake hibernacula, turtle nesting area);
5. Enhance fish habitat by providing more divers riparian cover and removing barriers to fish passage;
6. Integrating trails within buffers to provide for formal separation between the limits of development and the natural heritage features;
7. Naturalizing the buffers with dense shrub planting to create a living fence barrier between development and natural features;
8. Incorporating LIDs within buffers to maximize their effectiveness;
9. Installing fencing at the limits of development;
10. Posting educational signage in the buffer to discourage encroachments into the natural heritage features; and
11. Monitoring the health and condition of the natural heritage features and performance of environmental protection and management systems as outlined in **Section 8**.

7.1.1.2 Tributary WHT6 Enhanced Corridor/Greenway

As was discussed in **Section 5.2**, a conceptual plan was developed for the WHT6 tributary corridor/greenway to confirm that the corridor has been sized appropriately on the Land Use Plan and Preliminary Framework Plan and can meet the following design objectives:

- Conveyance of regional storm;
- Accommodation of meander belt;
- Sinuous low flow channel;

- Run, riffle, and pool habitats;
- Low gradient profile to promote wetland establishment;
- Wetland habitat area equivalent to that of wetlands removed (1.19 ha);
- 2.5:1 - 3:1 side slopes; and
- 2-3 m wide trail system on top on one side.

As the proposed Tributary WHT6 corridor/greenway will be newly created, the protection requirements applied to it are different from that applied to existing natural heritage features and systems. For example, buffers are typically applied to existing natural heritage features to mitigate the effects of intruding new land uses or new stressors to adjacent lands, however in this case, the corridor is being constructed at the same time as the rest of the development and therefore does not necessitate a buffer as no new land uses or stressors are being introduced. Therefore, the focus of protection efforts has been focussed on measures that can be applied to retaining the biodiversity of the existing wetland features that will be relocated within the new corridor.

Protection, Maintenance and Enhancement of habitats, biodiversity and ecological functions can be achieved by including the following in the Corridor Design Brief for Tributary WHT6:

1. A Wetland Protection and Salvage Plan that describes in detail:
    a. How the various wetland features to be removed will be protected in the interim while the channel corridor is constructed;
    b. How the soil seedbanks from these wetlands will be salvaged, stockpiled and reapplied to the constructed corridor, and
    c. Permitting requirements.

2. Details of the following:
    a. Ecological design goals and objectives; and
    b. Landscaping and Habitat Creation Plans.

Monitoring requirements for the corridor is as outlined in **Section 8**.

7.2 Groundwater Resource Protection

Based on an assessment of the hydrogeological conditions on the Subject Lands, an Environmental Management Plan has been prepared to be utilized during and following the construction period. The Environmental Management Plan includes the recommended monitoring program, triggers for mitigation and recommended mitigation measures for groundwater levels and discharge of water during construction. The Environmental Management Plan for the protection of groundwater resources is presented in Table 12 of the Hydrogeological Investigation (**Appendix B**). Components of this plan have been incorporated into the integrated multi-disciplinary Impact Assessment Matrix provided in **Table 18** of this CEISMP.

7.3 Water Balance Management Plan

7.3.1.1 Site Water Balance

The results of the post-development site water balance assessment as provided in Section 5.3 of the Hydrogeological Investigation (**Appendix B**), shows there is an overall decrease in evapotranspiration (AET) and infiltration in comparison to pre-development conditions across the Subject Lands. A summary of the results without mitigation is provided in **Table 19** below:

Table 19. Summary of Pre- and Post-Development Site Water Balance (without Mitigation)

	Pre-Development	Post-Development	Change
ET (m^3/year)	3,708	150,605	146,897
AET (m^3/year)	953,772	276,441	-677,331
Infiltration (m^3/year)	158,426	46,976	-111,450
Runoff (m^3/year)	312,260	954,144	641,884

In the post-construction scenario, an increase in impervious surfaces result in a decrease in area where evapotranspiration and infiltration can occur. A reduction in infiltration could reduce groundwater levels and potentially change groundwater gradients and groundwater contributions to onsite wetlands. To minimize the effects of increased impervious area, LID measures which promote onsite infiltration should be incorporated into the development plan. Currently, the following LID measures are under consideration to meet the water balance deficit:

- Downspout Disconnection;
- Additional Topsoil Depth;
- Swales;
- Infiltration Facilities;
- Rain Gardens; and
- Rainwater Harvesting.

Stormwater management practices for the developed subject Lands should include directing clean sources of storm water (e.g., roof and pervious area) towards the above considered LID facilities to allow for storage and gradual re-infiltration of collected storm water. It should be noted that if any stormwater is collected from surface runoff over impervious lands, then pre-treatment of the collected water will be required prior to permitting infiltration into the ground through any LID facilities.

At this stage, a detailed LID plan was not available for review. For this reason, a post-development water balance with mitigation, to account for the effectiveness of the proposed LID mitigation measures to meet the water balance deficit, could not be completed. During the detailed design stage, a water balance assessment which takes into account actual mitigation plans will need to be completed.

7.3.1.2 Feature Based Water Balance

The proposed development will result in changes to the existing drainage areas and has the potential to impact on the water balances of existing natural heritage features that are proposed for protection within the natural heritage system. Depending on the magnitude of the changes there could also be changes to the hydrology and hydro regimes sustaining features such as wetlands and HDFs. A wetland water balance risk evaluation was completed and determined that most features fall within the high-risk category and require further investigation.

As baseline hydrogeological data is still being gathered, it is not yet possible to complete the Wetland Water Balance Analysis in accordance with TRCA guidelines. It is recommended that the baseline monitoring continue over the spring and summer of 2021, and that this data be used along with continuous modelling to refine mitigation measures and tools required to address potential deficits or surpluses.

7.4 Stormwater Management Plan

7.4.1.1 SWM Strategy and Objectives

The SWM strategy maintains the approximate pre-development watershed divide between the West Humber River and Humber River as well as the individual subcatchments/outlets within each watershed as described in **Section 5.3**. This approach ensures that, with appropriate SWM controls, minimizes change to the overall drainage patterns and sources of drainage to each outlet aside from that associated with increased imperviousness.

Two (2) end-of-pipe stormwater management facilities (wet ponds) are proposed to treat the post-development drainage areas within the West Humber watershed illustrated in FSR Drawing 501 (Urbantech Consulting 2021). It is noted that while quantity controls are not required within the Main Humber River watershed, water quality controls will be provided within these lands, as required.

Pond 1 is situated generally northwest of the intersection of King Street and Humber Station Road and immediately north of King Street. Pond 2 is situated in the southwest of the Subject Lands, east of the EPA. Preliminary sizing of these facilities is provided in the FSR (Urbantech Consulting 2021).

Other SWM facility types (dry ponds, wetlands, etc.) were not considered for this development. Wet ponds were determined to be more appropriate in terms of meeting the quality and quantity control requirements for the subject lands.

The SWM facilities have been situated in the proposed locations for the following reasons:

- To make use of existing/natural low points in terrain to minimize earthworks/cut and fill operations and maintain existing drainage patterns as much as possible;
- To maintain a permanent pool and drain into the receiving channels / existing / planned storm sewer outlets;
- To locate SWM facilities adjacent to the EPA and maintain flow input locations along the receiving channels where possible;

- To minimize storm sewer infrastructure size and avoid potential servicing crossing conflicts; the contributing areas to the SWM facilities are generally limited to 60 ha; and
- To optimize land use by maximizing tableland and serviceable area.

As shown on FSR Drawings 501-503 (Urbantech Consulting 2021), the SWM facilities are located at the proposed drainage outlets along King Street and are linked to a proposed EPA corridor (Pond 1) and existing EPA lands (Pond 2). These locations represent the low areas within the West Humber subcatchments intersected by the Subject Lands.

7.4.1.2 Quantity Control

The SWM targets / sizing criteria for the Subject Lands were established based on the TRCA SWM Criteria (2012a) and the TRCA pre-development hydrologic model presented in the Humber River Hydrology Update (Civica 2018).

These studies involved hydrologic modelling for pre- and post-development conditions, resulting in SWM design criteria to control the post-development drainage areas to pre-development flow rates, in addition to meeting the following requirements:

- Ensure that existing flow rates downstream of the subject lands are not exceeded under post-development conditions, thereby providing flood protection for properties downstream of the Subject Lands;
- Maintain recharge volumes through the use of low impact development and other practices as required based on hydrogeological assessments; and
- Maintain water balance to wetland features.

Table E.1: Summary of Unit Flow Relationships, Humber River Watershed in the TRCA SWM Criteria (2012a) provided the equations to determine the quantity control unit flow rates for the 2-year to 100-year storm events within the West Humber River watershed.

Regional control of post-development flow rates to pre-development levels is provided, as evaluated at a common downstream location. Regional storm control is required as per email correspondence with TRCA dated April 17, 2020.

7.4.1.3 Quality Control

Quality control is provided to ensure:

- MECP-recommended stormwater quality treatment of runoff; and
- Adequate drawdown time / erosion control to protect the form and function of watercourses downstream of the SWM facilities.

The following specific SWM criteria were established, for quality control:

Permanent Pool Volume - each stormwater management facility within Subject Lands must meet the Enhanced (Level 1) criteria as per the MOE SWM Planning and Design Manual (March 2003).

Extended Detention / Erosion Control – The extended detention volume for erosion control is based on detention of the 25mm storm event from 48 hours to 72 hours for controlled release from the SWM ponds.

7.5 Low Impact Development (LID) Plan

To achieve the water balance targets noted in the preceding section, the SWM strategy must incorporate measures to direct the excess runoff from impervious surface into pervious areas or Low Impact Development (LID) measures to promote attenuation / infiltration.

TRCA have endorsed the use of LID measures, particularly in a “treatment-train” approach involving consecutive stormwater management / LID measures in series to enhance the overall performance, reliability, and effluent water quality. LID measures were discussed in Section 5.3.4. Additional LID measures for feasible application in conjunction with storm drainage and stormwater management techniques in the Subject Lands include:

Roof Drainage Collector (RDC) System: This approach would be targeted toward mitigation of the infiltration deficit to the individual wetlands. An RDC system would consist of a “third pipe” within the proposed ROW collecting clean roof water drainage, as well as drainage from rear lot pervious areas. It will be confirmed that the cross sections of the receiving ROWs can accommodate the RDC system. In order to maintain the feasibility of implementing the RDC system, specifically in terms of scope and cost, the system would be proposed in conjunction with additional selected LID measures.

Bioswales: Bioswales are enhanced vegetated swales with an infiltration component. They are vegetated open channels designed to convey, treat and attenuate stormwater runoff. Their implementation is subject to development density, topography and depth to the water table. Bioswales enhance the treatment functionality of a basic grass-lined channel by incorporating modified geometry and flow checks to reduce runoff and enhance contaminant removal. Flow checks can create temporary ponding areas that allow sedimentation, filtration through the root zone and soil matrix, evapotranspiration, and infiltration into the underlying native soil. Bioswales are intended to treat first flush flows which ultimately discharge into the storm sewer system via overflows. Bioswales can be implemented in right-of-ways with or without curb and gutter to reduce impervious cover and add to the natural landscape.

Perforated Pipe Systems: Perforated pipe systems are underground stormwater conveyance systems that allow for infiltration thereby attenuating runoff and reducing contaminant loads to downstream receiving systems. The perforated pipes are installed in gently sloping granular stone beds lined with geotextile fabric. Stormwater runoff infiltrates from the pipes into the gravel bed and underlying native soil as it is being conveyed from source areas to the receiving system. Installation is subject to topography, water table depth and runoff quality. Perforated pipe systems can be used to augment, and occasionally take the place of, conventional storm sewer pipes in order to treat runoff from roofs, walkways, parking lots and low-to-medium traffic roads, with adequate pre-treatment. A design variation can include perforated catchbasins, where the catchbasin sump is perforated to allow runoff to infiltrate into the underlying native soil. Perforated pipe systems are often installed as part of bio-swale systems.

Extended Tree Pits: Extended tree pits are a form of bioretention. They are enlarged planting areas located typically in a row, within the ROW and take advantage of the landscaped space between the sidewalk and the street. They can be designed to take runoff from the sidewalk or street. Stormwater is diverted into the expanded tree pit using curb cuts or trench drains. They are typically designed to be offline, that is when they are full the stormwater will bypass the practice and flow to the downstream street inlet. If large mature canopy trees are desired, then additional soil volume should be provided in the tree pit.

As a form of bioretention, extended tree pits can be considered wherever water can be conveyed to a landscaped area. They are installed close to the impervious area that generates the runoff and can be installed within various forms of development including commercial, institutional, and residential sites in spaces that are traditionally pervious and landscaped. Extended tree pits are able to fit into ultra-urban development contexts.

The opportunities for LIDs within ROWs are to be further explored following the Town's review of the alternative ROW design standards presented in the Urban Design Guidelines.

7.6 Erosion and Sediment Control Plan

Rigorous erosion and sediment control measures will be designed, implemented and maintained throughout the construction period. At detailed design, an Erosion and Sediment Control Plan will be prepared and designed in conformance with the Town and Conservation Authority guidelines. Erosion and sediment control will be implemented for all construction activities including topsoil stripping, earthworks, foundation excavation and stockpiling of materials and will remain in place and functional until bare surfaces are stabilized.

The following erosion and sediment control measures should be considered for use during construction:

- Natural features will be staked and temporary fencing provided to keep machinery out of sensitive areas;
- Sediment control fence and snow fence will be placed prior to earthworks;
- Logistics/construction plan will be implemented to limit the size of disturbed areas, minimizing the non-essential clearing and grading areas;
- Temporary sediment ponds;
- Rock check-dams and cut-off swales will be provided, where required, in order to control, slow down and direct runoff to sediment basins;
- Sediment traps will be provided;
- Gravel mud mats will be installed at construction vehicle access points to minimize off-site tracking of sediments;
- All temporary erosion and sediment control measures will be routinely inspected / monitored and repaired during construction. Temporary controls will not be removed until the areas they serve are restored and stable; and
- The "multiple barrier approach" will be applied to all construction stages to ensure erosion is prevented rather than reduced. Recommended measures are to be installed prior to the initiation of the earthworks and grading.

- Reference will be made to the Guidelines for Erosion and Sediment Control for Urban Construction Sites prepared by the Greater Toronto Conservation Authorities (2020) when preparing Erosion and Sediment Control Plans.

7.7 Construction Dewatering Management Plan

7.7.1.1 Permanent Drainage (Long-term Discharge)

Based on the preliminary designs, the proposed plans for development will consist of low-rise and mid-rise residential blocks, commercial and institutional zones, storm water management (SWM) ponds and greenspace. Development of the Subject Lands will also include the construction of roadways and associated storm, sanitary sewer and water distribution infrastructure. Given that the detailed design of the proposed plans for development is not currently finalized, it is assumed that the proposed residential blocks will comprise of one (1) to two (2) level of underground basement and/or parking. Further, the institutional and mixed commercial use blocks and the GO station block will be constructed slab-on-grade.

Based on the findings of the subsurface drilling investigation, there are significant variations noted in the subsurface stratigraphic and groundwater conditions across the Subject Lands. The construction of the low-rise residential blocks and the site servicing will encounter varying subsurface conditions at different locations across the Subject Lands. Based on the review of the proposed preliminary grading plans, it is understood that the site grades will generally range from approximately 280.0 masl in the northwestern corner to an approximate elevation of 262.2 masl in the southwest and 265.1 masl in the southeastern corner of the Site. For the purpose of assessing the requirements for groundwater control and dewatering during the construction period, a conceptual model of the Subject Lands has been prepared based on the proposed site grading and the worst-case subsurface conditions. Conceptual models for the mid-rise residential development and the two (2) storm water management ponds are prepared based on inference from nearby boreholes and monitoring wells in the locality of these proposed structures.

The results of the groundwater monitoring to-date indicate that the groundwater levels at the Subject Lands ranged from 0.1 m (Elev. 275.7 masl) to 6.8 m (Elev. 255.2 masl) below the existing ground surface (bgs). The highest measured groundwater level of 0.1 m below ground surface is considered to be localized in the south-central portion of the Site. For the purpose of assessing the requirements for groundwater control and dewatering during the construction period for the low-rise residential development and the site servicing, the prevailing groundwater table at the Subject Lands is considered to be the next highest measured water level of 1.2 m bgs (BH20-6, September 2020).

It is expected that the trenching and excavation earthwork during the construction period will extend below the groundwater table in certain areas of the Subject Lands and groundwater control and dewatering will be required to ensure the excavation area remains dry and safe. Generally, the excavations will be completed into the cohesive clayey silt till, however will extend into the underlying silty sand till / silt unit in certain locations. The site services trenching and the excavation for the storm water management pond in the southeastern corner of the development has the potential to encounter modern alluvium deposits which may provide higher flows of groundwater seepage. The geometric mean hydraulic conductivity for the overburden across the Subject Lands is estimated to be 2.0×10^{-7} m/sec.

The dewatering estimates for the site servicing and residential block developments also includes provision for controlling storm water in the excavation area from an incidental 2-year storm event. As per the Ministry of Transportation (MTO) Intensity-Distribution-Frequency (IDF) curves for the Town of Caledon, a 2-Year storm that is 2-hours in duration would result in a 13.5 mm/hr of rainfall intensity.

Detailed calculations for construction dewatering flow estimates are provided within the Hydrogeological Investigation (**Appendix B**). Considering the unsealed excavation method, the total estimated steady-state flow rates for temporary dewatering volumes for each development type was estimated as follows:

- Site servicing (30 m x 2 m per day) **– 15,500 L/day**;
- SWM Pond 1 **– 205,000 L/day**;
- SWM Pond 2 **– 230,500 L/day** ;
- 1x Residential Block, Low-Rise **– 62,000 L/day**; and
- 1x Residential Block, Mid-Rise **– 102,500 L/day**.

Given that the detailed design for the proposed plans for development were not available at the time of writing this report, various assumptions were made to assess the requirements for groundwater control and dewatering during the construction period. During the detailed design stage, if the assumptions made therein Section 7.0 of the Hydrogeological Investigation (**Appendix B**) deviate from the finalized developmental designs, DS should be consulted to revise the estimated groundwater seepage rates and permitting requirements.

7.7.1.2 Permanent Drainage (Long-term Discharge)

It is expected that the proposed mid-rise residential structures will comprise of underground basements/parking levels that will extend below the groundwater table at the Site. For this reason, control of permanent drainage within these structures will likely be required. For the purpose of assessing permanent flows into the private water drainage system, the following design considerations relative to groundwater conditions are assumed:

- Monitoring Wells BH20-11, BH20-14, BH20-15 and Borehole BH20-10 are located in close proximity to the mid-rise residential blocks and are considered for estimating the construction dewatering/control requirements. The highest groundwater level measured in the east-central portion of the Subject Lands is at Elev. 264.8 masl (BH20-11).
- The mid-rise residential structures will comprise of two (2) levels of underground basement/parking (P2). The finished floor elevation (FFE) of the P2 level will extend to a depth of approximately 6 m (Average Estimated Elev. 261.5 masl) below ground surface. The sub-drains will be installed to a depth of approximately 0.3 m (~ 1 ft.) below P2 FFE slab to an approximate elevation of 261.2 masl. On this basis, the sub-drains will be situated approximately 3.6 m below the groundwater table and will be completed into the clayey silt till, however may extend into the silty sand till / silt unit in some areas.

The total flows into the permanent drainage system of the mid-rise residential structure during the long-term is estimated to be on the order of 55,000 L of water to be removed over a 1-day period. These long-term rates include a 50% safety factor on the anticipated permanent drainage flows.

It is understood that the low-rise residential block will include one (1) level of underground basement, which will likely be constructed above the water table and with a water-proofing membrane. A perimeter drainage system will be installed, however all collected percolating stormwater will be discharged to landscaped/vegetated areas of individual residential lots. Further, the institutional and commercial zones will be constructed slab-on-grade. For this reason, all low-rise residential blocks, institutional and commercial zones are not anticipated to require any permanent groundwater drainage control.

Given that the detailed design for the proposed plans for development were not available at the time of writing this report, various assumptions were made to assess the requirements for groundwater control and dewatering during the construction period. During the detailed design stage, if the assumptions made therein Section 7.0 of the Hydrogeological Investigation (**Appendix B**), deviate from the finalized developmental designs, then DS should be consulted to revise the estimated permanent drainage rates and permitting requirements.

7.7.1.3 Permit Requirements

Environmental Activity and Sector Registry (EASR) /Permit to Take Water (PTTW) Application

An Environmental Activity Sector Registration (EASR) Posting is required to be submitted to the Ministry of the Environment, Conservation and Parks (MECP) if the taking of groundwater and stormwater for a temporary construction project is between 50,000 L/day and 400,000 L/ day. The EASR application is an online registry and should be submitted to the MECP before commencing any construction dewatering operations. A PTTW is required to be submitted to the MECP if the taking of groundwater and stormwater for a temporary construction project is greater than 400,000 L/ day.

During the construction period, the anticipated groundwater dewatering volumes throughout the Subject lands are expected to be between 50,000 L/day and 400,000 L/ day. As a result, on any given day, an EASR Posting with the MECP is anticipated to be required prior to commencing any construction dewatering operations. It should be noted that the above dewatering estimates are based on the assumption that the excavation at any given day will only include one (1) unit services trench and one (1) of each type of residential block (low-rise and mid-rise) to be opened concurrently. If additional excavations/trenches are opened simultaneously at any given day beyond the above and other assumptions made in Section 7.0 of the Hydrogeological Investigation (**Appendix B**), then additional dewatering volumes can be expected. If the dewatering rates at any given day exceed 400 m^3, then a PTTW from the MECP will be required during the construction period.

During the post-construction period, the anticipated permanent drainage flows are anticipated to be about 55,000 L/day for a mid-rise residential block. Given that the estimated permanent drainage flows are expected to be greater than the MECP threshold of 50,000 L/day, a long-term PTTW will be required in support of permanent groundwater control for the mid-rise residential blocks should design details corroborate the assumptions made in this assessment.

Discharge Permits (Construction Dewatering and Permanent Drainage)

The Subject Lands are located within the Humber River watershed, which is located within the regulatory jurisdiction of the TRCA. A discharge permit may be required from the TRCA, Peel Region and/or Town of Caledon if the water is to be discharged to a nearby/on-site surface water feature during the construction period. A discharge and monitoring plan will need to be prepared prior to obtaining a discharge approval from the TRCA, Peel Region and/or Town of Caledon.

If the private water during the post-construction period is anticipated to be discharged into the proposed municipal sewer system, a sewer discharge agreement with the Town of Caledon and/or Regional Municipality of Peel will be required prior to any discharging operations.

8. Long Term Environmental Monitoring Plan and Comprehensive Adaptive Management Plan

As was discussed in **Section 3**, monitoring of various biophysical parameters within the Study Area commenced in 2013 in support of the Town of Caledon Bolton Residential Expansion Study process. Additional monitoring was completed to gather the required technical information to support the Macville Community CEISMP. Much of this monitoring has now been completed, however some hydraulic and hydrogeological monitoring is ongoing, and it is proposed that this monitoring continue through the remainder of the planning stages as well as during and following construction.

The CEISMP TOR requires that both a Long-Term Environmental Monitoring Plan (LTEMP) and a Comprehensive Adaptive Management Plan (CAMP) be prepared. From the descriptions provided in the CEISMP TOR, the LTEMP and CAMP are highly interrelated. While the CEISMP TOR suggest that these two monitoring items be presented as separate chapters, we believe that because of their inter-relatedness that they instead be combined into a single chapter.

The primary objective of the LTEMP is to monitor changes to various environmental parameters over time, including pre-development, during development and post-development, and where possible to identify the causal factors. Where unanticipated changes are observed through monitoring that can also be clearly be attributed to the change in land use, then the LTEMP should provide an evaluation to assess whether intervention is necessary.

The primary objective of the CAMP is to monitor the effectiveness of the mitigation measures and environmental management strategies that have been implemented as part of the future development to ensure they are performing as intended and to identify an adaptive process through which adjustments can be made should monitoring reveal that these measures and strategies are not performing as intended.

The LTEMP and CAMP have been integrated into **Table 20** below. For continuity, the table follows as similar framework used in the Impact Assessment Matrix (**Table 18**).

Table 20. Long Term Environmental Monitoring Plan (LTEMP) and Comprehensive Adaptive Management Plan (CAMP)

Category	Long Term Environmental Monitoring Plan							Comprehensive Adaptive Management Plan		Responsibilities for Monitoring and Cost*
	Performance Measure Indicator(s)/ Objectives(s)	Monitoring Parameter	Monitoring Target(s) or Threshold(s)	Methods / Protocols / Analyses	Monitoring Frequency and Duration			Trigger	Response	
					Pre-Construction	During Construction	Post-Construction			
PHYSICAL RESOURCES										
Groundwater Quantity	To assess changes in the groundwater elevations and horizontal and vertical flow conditions in the study area over the established monitoring period.	1a. Groundwater Elevations	No specific targets or thresholds. Will be assessed relative to baseline conditions.	• Manual measurements from monitoring wells and continuous interval readings (using data loggers) at selected locations. • Manual and continuous water level measurements from drive-point piezometers installed along watercourse banks at selected locations.	For 1 to 2 years prior to construction. Monthly manual measurements for first year and quarterly for second year to assess seasonal conditions. Continuous interval readings at selected locations	Quarterly manual measurements and continuous interval measurements during construction at selected locations until 85% build-out.	Continuous interval measurements at selected locations for 5 years following 85% build-out. Quarterly manual measurements at selected locations at 1, 3 and 5 years following 85% build-out.	Significant change in ground water elevation in comparison to baseline conditions.	Opportunity to re-assess SWM Plan for enhanced infiltration or redirection of stormwater.	DS Consultants Ltd. and Urbantech Consulting
		1b. Groundwater Flow Direction (inferred from elevations and gradients)	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Mapping of interpreted potentiometric surface elevations and groundwater flow directions using groundwater elevation monitoring data.	Once prior to construction.	Annually during construction until 85% build-out.	Once at 1, 3 and 5 years following 85% build-out.	Significant change in ground water flow in comparison to baseline conditions.	Opportunity to re-assess SWM Plan for enhanced infiltration or redirection of stormwater.	DS Consultants Ltd. and Urbantech Consulting
Groundwater Quality	To assess changes in groundwater quality conditions during monitoring period.	2. Groundwater Quality: General Chemistry	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Sampling from selected wells and laboratory analysis of general quality indicators: pH, conductivity, total dissolved solids (TDS), basic ions (including chloride and nitrate) and selected metals. Sampling is to occur from the same wells each monitoring year, except in cases where wells have been decommissioned due to construction	Once prior to construction for selected monitoring wells.	Annual collection and analysis of groundwater from selected monitoring wells until 85% build-out.	Once at 1, 3 and 5 years following 85% build-out.	Significant change in ground water quality in comparison to baseline conditions.	Opportunity to re-assess SWM Plan for enhanced infiltration or redirection of stormwater. Opportunity to alter land use practices to protect groundwater quality	DS Consultants Ltd. and Urbantech Consulting
Surface Water Quantity	To assess potential changes in flow conditions in HDFs	3. HDF Flow Conditions	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Spot flow measurements at selected locations (as established for the baseline conditions).	Quarterly for 1-2 years prior to construction.	Quarterly for duration of construction period until 85% build-out.	Quarterly manual measurements at selected locations at 1, 3 and 5 years following 85% build-out.	Significant change in HDF water flow in comparison to baseline conditions.	Apply findings and results to future development to reduce long-term impact. Can also be applied in determining any required fisheries compensation from future development. Modify outflow rates as necessary to optimize: • Storm flow rate control • Base flow augmentation • Seasonal stormwater management considerations	DS Consultants Ltd. and Urbantech Consulting

Category	Long Term Environmental Monitoring Plan							Comprehensive Adaptive Management Plan		Responsibilities for Monitoring and Cost*
	Performance Measure Indicator(s)/ Objectives(s)	Monitoring Parameter	Monitoring Target(s) or Threshold(s)	Methods / Protocols / Analyses	Monitoring Frequency and Duration			Trigger	Response	
					Pre-Construction	During Construction	Post-Construction			
									Opportunity to re-assess SWM Plan for enhanced infiltration or redirection of stormwater.	
Surface Water Quality	To assess changes to water quality. To provide reference data for assessing water quality in relation to SWM outfall locations.	4. HDF Water Quality: Temperature	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Temperature loggers installed in selected locations along HDFs.	Continuous logging at 15-minute intervals from May to October for 2 years at selected locations.	Continuous logging at 0.25 hr intervals from May to October for duration of construction period until 85% build-out.	Continuous logging at 15-minute intervals from May to October for (a) years 1, 3 and 5 following 85% build-out, and (b) 1 and 3 years following 100% build-out.	Significant change in HDF water temperature in comparison to baseline conditions.	Evaluate potential to alter SWM management operational characteristics to minimize thermal impacts (outflow rates, permanent pool depth) to optimize performance.	DS Consultants Ltd. and Urbantech Consulting
		5a. HDF Water Quality: General Chemistry – Lab Analysis	PWQO Limits for Ontario and relative to baseline conditions.	Surface water sampling and general quality analysis from selected locations HDFs. Quality parameters include pH, hardness, total suspended solids (TSS), basic ions (including chloride), nutrients (including phosphorus) and total metals. Locations include upstream and downstream of SWM outfalls.	Wet and dry samples taken quarterly, and event based for 1 to 2 years prior to construction.	Wet and dry samples taken quarterly, and event based for duration of construction period until 85% build-out.	Wet and dry samples taken quarterly, and event based (a) 1, 3 and 5 years following 85% build-out and (b) 1 and 3 years following 100% build-out.	Significant change in HDF water chemistry in comparison to PWQO Limits for Ontario and baseline conditions.		DS Consultants Ltd. and Urbantech Consulting
		5b. Stream Water Quality: General Chemistry – In Situ Analysis	PWQO Limits for Ontario and relative to baseline conditions.	Field measurements of pH (field), conductivity, total dissolved solids (TDS), turbidity and dissolved oxygen (DO) from select surface water sampling sites.	In-situ readings taken quarterly, and event based for 1 to 2 years prior to construction.	In-situ readings taken quarterly, and event based for duration of construction period until 85% build-out.	In situ readings taken quarterly and event based (a) 1, 3 and 5 years following 85% build-out and (b) 1 and 3 years following 100% build-out.			DS Consultants Ltd. and Urbantech Consulting
Water Balance	To assess potential changes in water balance (surface water quantity and groundwater recharge)	6. Water Budget	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Groundwater and surface water levels to be assessed as per Monitoring Parameter 1 and 3. Water level trends correlated to established baselines conditions are necessary to assess changes to groundwater recharge and surface water runoff resulting from development. Continued monitoring of wetland water levels is required to observe changes to the established hydroperiods and to determine the effectiveness of the mitigation measures (including the LIDs).	See Monitoring Parameters 1 and 3.	See Monitoring Parameters 1 and 3.	See Monitoring Parameters 1 and 3.	Significant change in water balance (surface water quantity and groundwater recharge) in comparison to baseline conditions.	Apply findings and results to future development to reduce long-term impact. Can also be applied in determining any required fisheries compensation from future development. Modify outflow rates as necessary to optimize: • Storm flow rate control • Base flow augmentation • Seasonal stormwater management considerations Opportunity to re-assess SWM Plan for enhanced infiltration or redirection of stormwater.	DS Consultants Ltd. and Urbantech Consulting
Stormwater Ponds	To confirm SWM Ponds meet Town of Caledon design criteria, including	7. SWM Ponds Design (including	Built in accordance with the approved design.	Following the construction of the SWM facilities, a qualified professional is required to certify that the constructed facilities and structural details were	Not Applicable	Survey and certification of SWM Ponds required once after construction, including assessment of	Inspection monitoring 4 times per year or following significant rainfall events for at least 2 years	SWM Pond not built in accordance with the approved design.	SWM Pond to be redesigned to meet the design criteria of the Town of Caledon.	DS Consultants Ltd., Urbantech Consulting and Beacon

Category	Long Term Environmental Monitoring Plan							Comprehensive Adaptive Management Plan		Responsibilities for Monitoring and Cost*
	Performance Measure Indicator(s)/ Objectives(s)	Monitoring Parameter	Monitoring Target(s) or Threshold(s)	Methods / Protocols / Analyses	Monitoring Frequency and Duration			Trigger	Response	
					Pre-Construction	During Construction	Post-Construction			
	inspection monitoring.	landscaper plantings)		monitored and inspected routinely during construction and, as such, are built in accordance with the approved design.		plantings once each year as per warranty.	following 85% build-out, or every second year until Town assumption. Qualitative monitoring of landscape plantings once at 5 years following 85% build-out.	Decline of vegetation in comparison to initial planting conditions.	Refine vegetation management strategies to achieve desired natural cover, including additional plantings as required. Apply findings and results to future development phases.	
	To confirm SWM Ponds meet Town and MOECC ECA water level and flow criteria.	8. SWM Ponds Water Levels and Flow	Analysis should yield an estimate of the drawdown time for a particular rainfall event and a rough estimate of the hydrograph.	Flow loggers to be deployed downstream of the flow control orifice in the outlet control structure to record flow changes following precipitation events at 15-minute intervals. Continuous water level readings should be recorded from a secure station near the sediment forebay headwalls.	Not Applicable	Continuous readings at 15-minute intervals from April/May to October/November starting once the pond has been constructed and filled until 85% build-out.	Continuous readings at 15-minute intervals for 3 years from April/May to October/November following 85% build-out. If SWM pond not assumed by Town after 3 years, continuous hourly readings may be required every second year until Town assumption or as agreed by the Town.	Significant change in SWM Pond water levels and flow in comparison to Town and MOECC ECA water level and flow criteria.	Modify outflow rates as necessary to optimize: • Storm flow rate control • Base flow augmentation • Seasonal stormwater management considerations Opportunity to re-assess SWM Plan for enhanced infiltration or redirection of stormwater.	DS Consultants Ltd. and Urbantech Consulting
	To confirm SWM Ponds meet Town and MOECC ECA water quality criteria.	9. SWM Ponds Water Quality: Temperature	None but to serve as reference for discharge temperatures.	Temperature data loggers to be deployed seasonally each year at each pond's inlet, maximum depth, mid depth, surface, and at discharge point of bottom draw. Temperature loggers to be time synchronized with a recording frequency set at 15-minute intervals. One oxygen/temperature profile to be completed in mid-August of year 2.	Not Applicable	Continuous readings at 15-minute intervals from April/May to October/November starting once the pond has been constructed and filled until 85% build-out.	Continuous readings at 15-minute intervals for 3 years from April/May to October/November following 85% build-out. If SWM ponds not assumed by Town after 3 years, continuous hourly readings may be required every second year until Town assumption or as agreed by the Town.	Significant change in SWM Pond water temperature in comparison to Town and MOECC ECA water quality criteria.	Evaluate potential to alter SWM management operational characteristics to minimize thermal impacts (outflow rates, permanent pool depth) to optimize performance.	DS Consultants Ltd. and Urbantech Consulting
		10. SWM Ponds Water Quality: General Chemistry (Laboratory and *in situ*)	None but to serve as reference for discharge quality.	Water quality samples to be taken at each pond inlet and pond outlet at least 6 to 8 times per year. Water quality sampling parameters for laboratory analysis include pH, hardness, total suspended solids (TSS), basic ions (including chloride), nutrients (including phosphorus) and total metals. *In situ* field measurements to include: pH (field), conductivity, turbidity and dissolved oxygen (DO).	Not Applicable	Wet and dry samples taken quarterly, and event based each starting once the ponds have been constructed and filled until 85% build-out. Between 6 and 8 samples to be collected annually and to include dissolved oxygen (DO).	Wet and dry samples taken quarterly, and event based for at least 2 years following 85% build-out, or every second year until Town assumption.	Significant change in SWM Pond water chemistry in comparison to Town and MOECC ECA water quality criteria.		DS Consultants Ltd. and Urbantech Consulting
	To confirm SWM Ponds meet Town of Caledon design criteria prior to assumption.	11. SWM Ponds Sediment Depth	The greater of 5% decrease in TSS removal efficiency or 50% available forebay volume.	Disk/Rod Method or Town-Approved Alternative; min. 2 perpendicular transects, min. 5 points per transect.	Not Applicable	Not Required	Once prior to assumption by the Town.	Different SWM Pond sediment depth in comparison to Town of Caledon design criteria prior to assumption.	Evaluate potential to alter SWM management operational characteristics to minimize thermal impacts (outflow rates, permanent pool depth) to optimize performance.	DS Consultants Ltd. and Urbantech Consulting

Category	Long Term Environmental Monitoring Plan							Comprehensive Adaptive Management Plan		Responsibilities for Monitoring and Cost*
	Performance Measure Indicator(s)/ Objectives(s)	Monitoring Parameter	Monitoring Target(s) or Threshold(s)	Methods / Protocols / Analyses	Monitoring Frequency and Duration			Trigger	Response	
					Pre-Construction	During Construction	Post-Construction			
LID Measures	To assess performance of LID measures	12. Groundwater Levels and Infiltration Rates of Infiltration in Selected LIDs as applicable	No specific targets or thresholds. Groundwater levels will be assessed in relation to overall water table elevations compared to pre-construction water table elevations.	Visual inspection of all LID areas to confirm installation as specified and certification of LIDs by a Qualified Inspector. Monitoring of standpipes installed in selected LIDs with level loggers, and measurement of groundwater levels in wells and piezometers (as per Monitoring Parameter 1a) for assessment of the overall groundwater conditions in the developed area. Water quality measurements (specifically temperature with temperature loggers) will be obtained from the outflow drains from neighbourhood park to storm sewer, if feasible.	Pre-construction (baseline data) from Ecosystem Component Monitoring Parameter 1a – Groundwater Levels to be referenced. Monitoring within selected LIDs to occur in the "during construction" phase following their construction and certification.	Each LID selected for monitoring will be assessed for infiltration rate immediately following installation. Monitoring of the water levels and infiltration rates in selected LIDs will occur quarterly (i.e., once in spring, summer, fall and winter) for 2 years following construction and certification of the trenches.	Monitoring of the water levels and infiltration rates in selected LIDs will occur quarterly (i.e., once in spring, summer, fall and winter) in years 1, 3 and 5 following 85% buildout. Monitoring of the water levels and infiltration rates in selected LIDs will occur quarterly (i.e., once in spring, summer, fall and winter) at years 1 and 3 following 100% buildout if deficiencies identified.	Significant change in groundwater levels in selected LIDs in relation to overall water table elevations compared to pre-construction water table elevations	Opportunity to re-assess SWM Plan for enhanced infiltration or redirection of stormwater.	DS Consultants Ltd. and Urbantech Consulting
		13. Stream Water Quality Downstream of LIDs	See Monitoring Parameters 5a. Stream Water Quality: General Chemistry – Lab Analysis and 5b. Stream Water Quality: General Chemistry – In Situ Analysis	DS Consultants and Urbantech						DS Consultants Ltd. and Urbantech Consulting
Erosion & Sediment Control (ESC) Measures	To confirm that all ESC measures have been implemented and are performing as per specifications.	14. Condition of ESC Measures	All ESC fencing, check dams, and sediment pond or equivalent are in good working order.	Visual inspection prior to and following all significant rainfall events (10 mm) or days of cumulative rainfall, after significant snowmelt events, and daily during extended rain or snowmelt periods.	ESC measures are generally installed as the first step of construction. As such, the monitoring will be further detailed as part of the "During Construction" monitoring.	Comprehensive inspection immediately following installation but prior to grading or site alteration. Weekly reporting during active construction. Routine inspections also required following all significant (i.e., 10 mm or more) rainfall events, following significant snowmelt events, and during extended rain or snowmelt periods.	During construction monitoring will apply until the site is stabilized, at which time the relevant ESC measures will be removed and the ESC monitoring will cease.	ESC measures have become damaged or ineffective.	Immediately fix ESC measures.	Beacon
NATURAL HERITAGE RESOUCES										
Fluvial Geomorphology and Aquatic Habitat	To assess conformance of the constructed Tributary WHT6	15. Stream Morphology and Aquatic Habitat Conditions	Overall maintenance of channel form (I.e., minimal evidence	The following monitoring protocols will be implemented at approximately the same time (summer or fall) of each year:	Once prior to construction to confirm baseline conditions and establish	Construction of the low flow channel will be supervised by a Qualified Inspector.	**Year 1** As-built survey immediately following construction to evaluate	Significant changes in channel form/cross-sectional area.	Opportunity to re-assess SWM Plan to evaluate storm flow rate control or seasonal stormwater management considerations.	Beacon

Category	Long Term Environmental Monitoring Plan							Comprehensive Adaptive Management Plan		Responsibilities for Monitoring and Cost*
	Performance Measure Indicator(s)/ Objectives(s)	Monitoring Parameter	Monitoring Target(s) or Threshold(s)	Methods / Protocols / Analyses	Monitoring Frequency and Duration			Trigger	Response	
					Pre-Construction	During Construction	Post-Construction			
	with design drawings and monitor for adjustments in channel form/function. To assess changes to aquatic habitat in the study area over the established monitoring period. Aspects of aquatic habitat are also being monitored through Measure 4. Stream Water Quality: Temperature, Measure 5a. Stream Water Quality: General Chemistry – Lab Analysis, and Measure 5b. Stream Water Quality: General Chemistry – In Situ Analysis.		of active erosion, bankfull dimensions/cross-sectional area remain generally consistent over monitoring period). Channel design enhancement elements are performing as intended. Overall maintenance and/or enhancement of aquatic habitat over monitoring period	• As-built survey for the constructed low flow channel. • General field reconnaissance to identify areas of potential concern • Repeated photographs from known vantage points.	vantage points for repeated photographs.		conformity of the low flow channel with design specifications and to obtain reference data for comparison with subsequent surveys. Monitoring parameters will include a digital survey of a longitudinal profile of the channel centreline and four detailed cross-sections (two pools, two riffles); and General field reconnaissance along the entire length of the constructed channel immediately following the first large flooding event to identify any potential areas of concern. Repeated photographs from a known vantage point to assess design performance and document observed indicators of channel adjustment (i.e., bank erosion, bed incision/scour, sedimentation). **Years 2-5** Annual post-construction monitoring of the realigned channel during the summer or fall, including: • Longitudinal profile of the channel centreline; • Detailed cross-sections (one pool, one riffle); and • Repeated photographs from a known vantage point	Design enhancement element failure or evidence of excessive erosion. Significant evidence of erosion or aggradation.	Design remediation to address areas of concern.	

Category	Long Term Environmental Monitoring Plan							Comprehensive Adaptive Management Plan		Responsibilities for Monitoring and Cost*
	Performance Measure Indicator(s)/ Objectives(s)	Monitoring Parameter	Monitoring Target(s) or Threshold(s)	Methods / Protocols / Analyses	Monitoring Frequency and Duration			Trigger	Response	
					Pre-Construction	During Construction	Post-Construction			
							to assess design performance and document observed indicators of channel adjustment (i.e., bank erosion, bed incision/scour, sedimentation). Plantings will be monitored within their warranty period and as a completed project in year five.			
Buffer Areas – Naturalization Plantings	To assess the survival and condition of buffer and naturalization plantings to ensure that: a) the plantings are installed and established as per the approved landscape plans; and b) over time, the areas become self-sustaining naturalized communities.	16. Buffer Zone Naturalization Plantings	Plantings healthy, well-established and in general conformance with the landscaping plans.	The condition of these plantings will be assessed using visual assessments and comparisons with contractor drawings.	Not Applicable	Once at time of installation, and annually for 2 years following installation in fall.	Once at 5 years following 85% build-out.	Significant change in health of vegetation plantings in comparison to established conditions.	Refine vegetation management strategies to achieve desired vegetation diversity, including additional plantings as required. Apply findings and results to future development phases.	Beacon
Buffer integrity and effectiveness in limiting encroachments in NHS	To evaluate the effectiveness of buffers in reducing the number and extent of human-related disturbances / encroachments into the NHS.	17. Human-Related Disturbances in NHS adjacent to Proposed Development	No specific targets or thresholds. Will be assessed relative to baseline conditions with consideration for approved activities (e.g., trail, plantings, culverts) in this zone.	The NHS edge assessed will include the buffer and at least 20 m into the adjacent natural features. Approved versus unsanctioned disturbances will be distinguished. Disturbances in the Buffer/Enhancements versus the Key Features will also be distinguished.	Once prior to development in summer.	None	Once at 1, 3 and 5 years following 85% build-out in summer.	Compromised integrity and human-related disturbances / encroachments into the NHS. compromised (i.e. informal trails, unauthorized gates, pet encroachment, etc.).	Implement corrective actions/measures such as: developing and enforcing bylaws, and educating residents. Implement Management strategies to reduce stress and restore buffer functions.	Beacon
Ecological Communities	To assess changes in floristic	18. Plant Diversity	No specific targets or thresholds. Will	The floristic quality of vegetation communities within the natural heritage system will be determined by undertaking	Once prior to development	None	Once in year 5 following 85% build-out.	Significant change in plant diversity in NHS in	Refine vegetation management strategies to achieve desired	Beacon

Category	Long Term Environmental Monitoring Plan							Comprehensive Adaptive Management Plan		Responsibilities for Monitoring and Cost*
	Performance Measure Indicator(s)/ Objectives(s)	Monitoring Parameter	Monitoring Target(s) or Threshold(s)	Methods / Protocols / Analyses	Monitoring Frequency and Duration			Trigger	Response	
					Pre-Construction	During Construction	Post-Construction			
	quality within the NHS		be assessed relative to baseline conditions.	a floristic quality assessment (FQA). These values can be compared over time to identify trends.				comparison to baseline conditions.	vegetation diversity, including additional plantings as required. Apply findings and results to future development phases.	
	To assess the distribution and abundance of invasive plant species within the NHS	19. Extent of invasive species in NHS	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Vegetation surveys will identify populations of invasive species. The location of the species and their population densities will be mapped and described to facilitate comparison over the long-term.	Once prior to development	None	Once in year 3 and 5 following 85% build-out.	Significant change in extent of invasive species in NHS in comparison to baseline conditions.	Implement an appropriate management strategy to eliminate or reduce invasive species cover. Apply findings and results to future development phases.	Beacon
	To assess changes in the type and extent of natural cover within the NHS.	20. Vegetation community types	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Ecological communities will be classified according to ELC standards. The area of each ELC vegetation type will be estimated using aerial photography. GIS analyses will be used to compare changes in area over time.	Once prior to development	None	Once in year 5 following 85% build-out.	Significant change in vegetation community types in NHS in comparison to baseline conditions.	Refine vegetation management strategies to achieve desired natural cover, including additional plantings as required Apply findings and results to future development phases.	Beacon
Natural Heritage Wildlife – Breeding Birds	To assess changes in the diversity and abundance of breeding avian species within the NHS	21. Breeding Bird Diversity and Abundance	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Breeding bird surveys will be conducted at fixed plot locations throughout the NHS using standard protocols concerning weather and time of year (late May to early July), and twice per breeding season.	Twice each year for at least 2 years prior to construction.	Twice each year during construction until 85% build-out.	Twice in years 1, 3 and 5 following 85% build-out.	Significant change in the diversity and abundance of breeding avian species within the NHS in comparison to baseline conditions.	Apply findings and results to future development to reduce long-term impacts.	Beacon
Natural Heritage Wildlife – Breeding Anurans	To assess changes in the diversity and abundance of breeding anurans species within the NHS	22. Anuran Diversity and Abundance	No specific targets or thresholds. Will be assessed relative to baseline conditions.	Surveys following Marsh Monitoring Program protocols	Three times per year for at least 2 years prior to construction	Twice each year during construction until 85% build-out.	Twice in years 1, 3 and 5 following 85% build-out.	Significant change the diversity and abundance of breeding anurans species within the NHS in comparison to baseline conditions.	Identify potential stressors to the amphibian community and implement an appropriate management strategy to eliminate or reduce impacts. A wetland performance reviews may be warranted if amphibian breeding is not sustained. Apply findings and results to improve current habitat and to guide future development to reduce long-term impacts.	Beacon

*Costing to be determined once LTEMP and CAMP approved.

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9. Future Work

This CEISMP and companion FSR (Urbantech Consulting 2021) include sufficient detail to implement the recommendations of the Environmental Management Plan (**Section 7**) and the Long-Term Environmental Monitoring Plan and Comprehensive Adaptive Management Plan (**Section 8**) at the Site-Specific level. It is anticipated that future development of the Subject Lands will proceed through submission of several draft plans or site plan applications.

Based on the comprehensiveness of the characterization work, opportunity and constraint analysis, impact assessment and proposed environmental management and monitoring plans contained in this CEISMP, preparing site-specific studies would result in considerable redundancy in reporting as well as review time. For these reasons, it is not recommended that additional site-specific Environmental Impact Studies (EISs) and Functional Servicing Reports (FSRs) be prepared in support of future draft plan and site plan applications. Instead, it is recommended that proponents of future development prepare a Compliance Letter to the satisfaction of the Town, Region of Peel and TRCA summarizing how the proposed development plan conforms to the goals, objectives, targets, environmental management and monitoring plans outlined in this CESIMP and associated FSR (Urbantech Consulting 2021).

For future development applications that have a high level of conformity with the CEISMP and FSR (Urbantech Consulting 2021), the Compliance Letter could take the form of a checklist. For development applications that deviate substantially from the recommendations, the Compliance Letter may need to be accompanied by technical briefs or studies. It is also recommended that applicants prepare and submit Terms of Reference for the Compliance Letter to the Town, Region of Peel and TRCA for their review and approval to ensure the scope and content of each Compliance Letter is consistent with agency expectations.

As is noted in the CEISMP, there are a few outstanding information and data gaps related to property access and/or seasonal monitoring constraints. It is anticipated that these data gaps will be filled when access is provided or through ongoing monitoring work. These information gaps are not significant and should not affect the community design or the recommended Environmental Management Plans.

The gaps should be filled either through ongoing work at the Secondary Plan level or through future site-specific investigations to be included with the Compliance Letters described above.

Future work to be completed at the secondary plan as well as at the site-specific levels is provided below in **Table 21**. Property numbers as described in this table are illustrated on **Figure 9**.

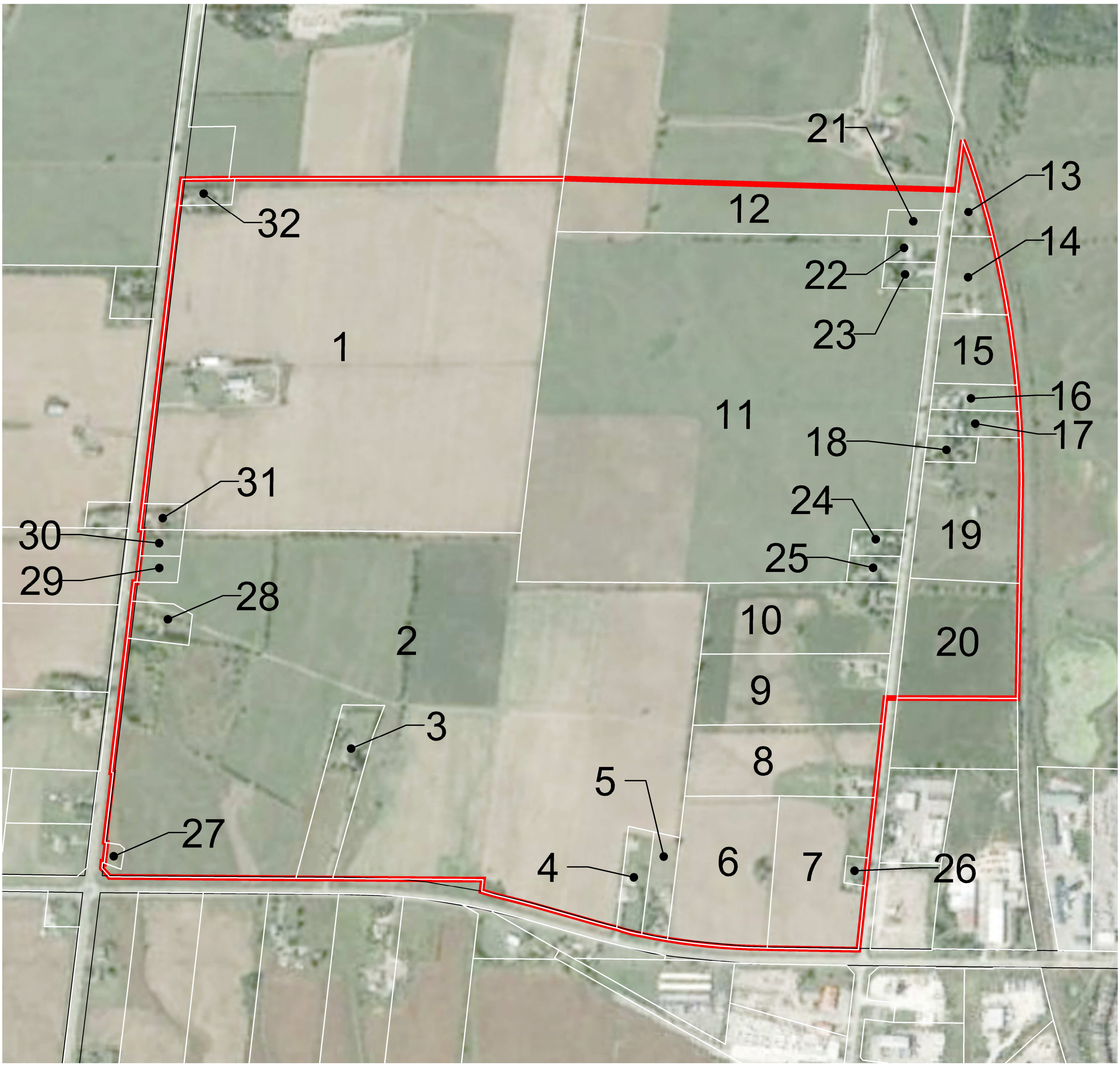
Table 21. Summary of Future Work to be Completed at Secondary Plan and Site-Specific Levels

<table>
<tr><th colspan="3">Secondary Plan Level</th></tr>
<tr><td colspan="3">1. All recommended LTEMP-CAMP monitoring to be completed at Secondary Plan level unless otherwise specified.</td></tr>
<tr><td colspan="3">2. Ongoing Hydrogeological monitoring</td></tr>
<tr><td colspan="3">3. Detailed Corridor Design Brief for Tributary WHT6</td></tr>
<tr><td colspan="3">4. Completion of Feature Based Wetland Water Balance once continuous modelling information is available.</td></tr>
<tr><td colspan="3">5. Prepare ESC Plans</td></tr>
<tr><th colspan="3">Site-Specific Level – Compliance Letter</th></tr>
<tr><th>Properties (refer to Fig. 9)</th><th>Study Type</th><th>Details</th></tr>
<tr><td>2</td><td>Turtle Basking and Nesting Surveys</td><td>Confirmation that the pond and wetlands are used for overwintering and/or nesting.</td></tr>
<tr><td>1-10, 13, 14, 16-19, 22-29, 31, 32</td><td>Snake Hibernacula Surveys</td><td>Cover board surveys and/or inspection of likely sites during emergence.</td></tr>
<tr><td>1-5, 8-10, 1, 14, 16-19, 22-26, 28, 31, 32</td><td>Bat Maternity Colony Surveys</td><td>Snag survey of swamp community.
Exit surveys for all structure with potential habitat.</td></tr>
<tr><td>14, 15</td><td>Notice of Activity for Eastern Meadowlark</td><td>Section 23.6 of the Ont. Reg 242/08 under the provincial ESA allows for removal of Eastern Meadowlark habitat provided certain conditions can be satisfied including demonstrating a benefit to the species. Section 23.2 of Ont. Reg. 242/08 contains provisions to allow for removal of breeding habitat for Eastern Meadowlark within settlement areas and these are to be followed.</td></tr>
<tr><td>3-6, 12, 14, 16-26, 28-32</td><td>Tree Inventories and Preservation Plans</td><td>Fill in gaps for trees not assessed by Beacon.</td></tr>
<tr><td>2, 3, 7, 10, 19, 27</td><td>Monarch Habitat Surveys</td><td>Survey for Monarch and its habitat.</td></tr>
</table>

10. Policy Conformity Assessment

The CEISMP TOR requires that the report addresses applicable environmental planning policies. It states that *the CEISMP is intended to clearly reference relevant policy, legislative and technical requirements and describe how the CEISMP meets or exceeds these requirements*.

A summary of applicable federal, provincial, and municipal environmental planning policies and regulations relevant to the LOPA application were discussed in **Section 2**. An evaluation of how the Macville Community Land Use Plan and Preliminary Framework Plan comply with the applicable environmental policies and legislation is summarized below in **Table 22**.



- All Units In Metric Unless Otherwise Noted.
- Detailed engineering/environmental work may result in further non-developable areas on Subject Lands
- Option 3 Gross area excludes Humber Station Road (1.80 ha. / 4.45 ac.) within the Subject Lands
- Aerial Photo: Google Earth, Approx. Fall 2016

GERRARD DESIGN

Caledon, Ontario

MACVILLE COMMUNITY PROPERTIES

JAN 5, 2021

SCALE 1:7500

ID	Owner	Gross Area (ha)	Gross Area (ac)	% of Gross Area	Net Area (ha)	Net Area (ac)	% of Net Area
1	ARGO MACVILLE I CORPORATION	39.62	97.90	22.1%	39.34	97.21	23.3%
2	SPEIRS, BRENDA-ESTATE; SPEIRS, ROBERT GEORGE; SPEIRS, ROBERT GEORGE	54.02	133.49	30.1%	46.95	116.02	27.8%
3	BASILE, NINO; BASILE, ELENA	2.00	4.94	1.1%	1.21	2.99	0.7%
4	TUNG, GIAN; BHULLAR, GURVARINDER	0.80	1.98	0.4%	0.79	1.95	0.5%
5	ZINGARO, ELISABETTA; ZINGARO, STEFANO	0.82	2.03	0.5%	0.81	2.00	0.5%
6	MOSCONE, DARIO; MOSCONE, VITTORIA	4.36	10.77	2.4%	4.31	10.65	2.6%
7	HUMBERKING (II) DEVELOPMENTS LIMITED	4.10	10.13	2.3%	3.56	8.80	2.1%
8	HUMBERKING (III) DEVELOPMENTS LIMITED	4.10	10.13	2.3%	3.62	8.95	2.1%
9	HUMBERKING (II) DEVELOPMENTS LIMITED	4.02	9.93	2.2%	3.50	8.65	2.1%
10	HUMBERKING (I) DEVELOPMENTS LIMITED	4.05	10.01	2.3%	3.71	9.17	2.2%
11	ARGO MACVILLE II CORPORATION	38.42	94.94	21.4%	38.42	94.94	22.8%
12	WESTLAKE, ROY ALBERT	5.35	13.22	3.0%	5.35	13.22	3.2%
13	KIRBY, DAVID SCOTT; KIRBY, MARLENE; KIRBY, DARLENE	0.63	1.56	0.4%	0.63	1.56	0.4%
14	BUDGE, RONALD JOHN	1.27	3.14	0.7%	1.27	3.14	0.8%
15	ARGO HUMBER STATION LIMITED	1.59	3.93	0.9%	1.59	3.93	0.9%
16	BAINS, RUPINDER; DHILLON, BALWINDER; DHILLON, LAKHVIR	0.68	1.68	0.4%	0.68	1.68	0.4%
17	RENZETTI, MICHAEL PATRICK; RENZETTI, CHERYL LYNN	0.72	1.78	0.4%	0.72	1.78	0.4%
18	GILL, TARNPREET; GILL, GURPREET	0.41	1.01	0.2%	0.41	1.01	0.2%
19	DI LEO, CLEMENTINA; DI LEO, GIUSEPPE	4.02	9.93	2.2%	3.85	9.51	2.3%
20	CERVINI, DOMENICO; CERVINI, ROSA; CERVINI, PIERINO	4.06	10.03	2.3%	4.04	9.98	2.4%
21	HANSEN, LAURA ELLEN; WESTLAKE, ROY ALBERT	0.41	1.01	0.2%	0.41	1.01	0.2%
22	MASON, RUTH JEANNETTE; MASON, LLOYD AMBROSE	0.41	1.01	0.2%	0.41	1.01	0.2%
23	GHOTRA, DALJIT; GHOTRA, LAKHVIR	0.41	1.01	0.2%	0.41	1.01	0.2%
24	VENDITTI, ALEXANDER	0.41	1.01	0.2%	0.41	1.01	0.2%
25	QUADRINI, NANCY; QUADRINI, RICO	0.40	0.99	0.2%	0.40	0.99	0.2%
26	GILL, KULWINDER; SINGH, STIFEN	0.18	0.44	0.1%	0.16	0.40	0.1%
27	SPEIRS, BRENDA MARGARET-ESTATE; SPEIRS, ROBERT GEORGE	0.12	0.30	0.1%	0.00	0.00	0.0%
28	NELSON, JOYCE MARLENE	0.69	1.71	0.4%	0.36	0.89	0.2%
29	SPEIRS, BRENDA MARGARET	0.32	0.79	0.2%	0.25	0.62	0.1%
30	SPEIRS, ROBERT WILFRED	0.32	0.79	0.2%	0.31	0.77	0.2%
31	KAUR, GAGANDEEP; SINGH, RAVINDER	0.35	0.86	0.2%	0.32	0.79	0.2%
32	ZALEWSKI, WALDEMAR STANISLAW; ZALEWSKI, CAROLYN MAY;	0.41	1.01	0.2%	0.39	0.96	0.2%
		179.47	443.48	100%	168.59	416.59	100%

- All Units In Metric Unless Otherwise Noted.
- Detailed engineering/environmental work may result in further non-developable areas on Subject Lands
- Option 3 Gross area excludes Humber Station Road (1.80 ha. / 4.45 ac.) within the Subject Lands
- Aerial Photo: Google Earth, Approx. Fall 2016

GERRARD DESIGN

Caledon, Ontario

JAN 5, 2021

MACVILLE COMMUNITY PROPERTIES

Table 22. Policy Compliance Assessment

APPLICABLE POLICY / LEGISLATION	RELEVANT CEISMP FINDINGS	COMPLIANCE
Federal *Fisheries Act* (1985) and Fisheries Protection Policy Statement (2013)	HDF reaches WHT1-A, WHT1-B and WHT6-A provide direct fish habitat. HDF reaches WHT1-A and WHT1-B will be protected within the proposed NHS. Reach WHT-6-A will be enhanced and contained within the proposed enhanced corridor/greenway.	No impacts to direct fish habitat. HDF Reach WHT6-A to be enhanced. Potential indirect impacts to fish habitat will be mitigated by implementing a range of measures (see **Table 18**), including, but not limited to: • enhanced level treatment through stormwater management; • LIDs to sustain pre-development baseflows; • Develop and implement ESC and Spill Prevention plans at the draft plan stage; • riparian buffers of 10 m; and • naturalization of riparian buffers.
Federal *Species at Risk Act* (2002)	HDF reaches WHT1-A and WHT1-B in the Study Area could support contributing habitat of a Federally Endangered fish species: Redside Dace (*Clinostomus elongatus*).	See above and below as it relates to Redside Dace. If water is to be discharged directly to Contributing Redside Dace habitat, all plans must be approved by MECP.
Provincial *Endangered Species Act* (2007)	The Study Area potentially supports contributing habitat of one Provincially Endangered fish species (Redside Dace). Potentially suitable habitat for Provincially Endangered bats may also be present in the Study Area with the Organic Deciduous Swamp (ELC Unit 12) as well as anthropogenic structures. Eastern Meadowlark, a threatened species, has been confirmed on the Subject Lands within ELC Unit 3d.	See *Fisheries Act* and *Species at Risk Act* above. Future work will be required at the Site-Specific Level to demonstrate compliance with *Endangered Species Act*. Refer to **Section 9**.
Provincial Policy Statement (2020) Section 2.1 – Natural Heritage		
1. Habitat for Threatened and Endangered Species	Habitat for Provincially Endangered and Threatened species has been identified on the Subject Lands and has been addressed in accordance with the regulations of the *Endangered Species Act* (see above).	See *Endangered Species Act* above.
2. Significant Valleylands	There are no significant valleylands associated with the Study Area.	N/A
3. Significant Wetlands	There are no Provincially Significant Wetlands on the Subject Lands, however, the Bolton Wetland Complex occurs in the Study Area. All other wetlands in the Study Area are not considered significant. Irrespective of their significance status, all wetlands are subject to Town's Environmental Performance Measures policies. See Town of Caledon Policy Conformity below.	No impacts to significant wetlands.
4. Significant Woodlands	There are no significant woodlands associated with the Study Area.	N/A
5. Significant Wildlife Habitat (SWH)	The Subject Lands and Study Area could support the following Candidate SWH categories: seasonal wildlife concentration areas, specialized habitats for wildlife, habitat	Candidate SWH that has been identified through this CEISMP is limited to features that will ultimately form part of the future NHS. Habitat for Monarch as well as snake hibernacula could exist outside the NHS.

APPLICABLE POLICY / LEGISLATION	RELEVANT CEISMP FINDINGS	COMPLIANCE
	for species of conservation concern and animal movement corridors. This includes: - Snake hibernacula; - Overwintering and nesting turtles; - Habitat for species of conservation concern; and - Animal movement Corridor.	Wildlife Habitat shall be studied and evaluated through site specific studies at the Draft Plan stage of the application. Refer to **Section 9**.
6. Significant Areas of Natural and Scientific Interest	There are no Areas of Natural of Scientific Interest associated with the Study Area	N/A
7. Fish Habitat	See text above re: *Federal Fisheries Act*	See text above re: *Federal Fisheries Act*
Provincial Policy Statement (2020) Section 2.2 - Water	No impacts to sensitive water features anticipated.	This CEISMP and companion reports have identified mitigation measures to be implemented to reduce impacts to surface water and groundwater resources.
Provincial Policy Statement (2020) Section 2.3 – Natural Hazards	The natural hazards in the Study Area are associated with the floodplain of Headwater Drainage Feature WHT6.	The proposed enhanced corridor/greenway for Tributary WHT6 has been designed to fully contain the regional floodline under future conditions. The natural hazards will not be in conflict with future development.
Region of Peel Official Plan	Policy 2.3.2.6 prohibits development and site alteration within the Core Areas of the Greenlands System with some exceptions such as forest, fish and wildlife management or passive recreation. Core Areas of the Regional Greenlands System that overlap with the Study Area include: - Significant Wetland (east of Subject Lands in Study Area); - Significant Habitat of Threatened and Endangered Species (SAR Bats, Eastern Meadowlark, Redside Dace); and - Stream Corridors (HDF reaches WHT1-A, WHT1-B and WHT6-A). Natural Areas and Corridors (NACs) that overlap with the Study Area include: Significant Wildlife Habitat and Fish Habitat. Potential Natural Areas and Corridors that overlap with the Study Area include: Unevaluated wetlands. NAC's and PNAC's represent natural features and areas that are considered locally important. Regional policies pertaining to NAC's and PNAC's defer their interpretation,	- No impacts to significant wetlands. - Refer to *Endangered Species Act* above. - Development will occur outside of floodplains. - Unevaluated Wildlife Habitat shall be studied and evaluated through site specific studies at the Draft Plan stage of the application. Refer to **Section 9**. - See text above re: *Federal Fisheries Act* - Most of the Other Wetlands will be protected with the exception of ELC Unit 7e, 7f, 7l, 13 and 14a, which will be compensated for within the proposed enhanced corridor/greenway on the southeastern boundary of the Subject Lands.

APPLICABLE POLICY / LEGISLATION	RELEVANT CEISMP FINDINGS	COMPLIANCE
	protection, restoration, enhancement, proper management and stewardship to local municipalities.	
Town of Caledon – Environmental Performance Measures	Town of Caledon's Performance Measures (Official Plan Section 3.2.5) deals with Environmental Performance Measures. As per the assessment in **Section 3.3.9**, the Study only supports 7 of 17 of the Performance Measures: • Wetlands; • Habitat of Threatened and Endangered Species; • Fisheries; • Wildlife Habitat; • Valley and Stream Corridors; • Groundwater; and • Soils. Policies for each of these performance Measures are found within the Town's Official Plan, and those applicable to this CEISMP have been summarized below: Policy 3.2.5.4 - Wetlands New development is prohibited in Wetland Core Areas, and new development will also not be permitted in Other Wetlands unless it can be demonstrated that the development will not degrade the ecosystem integrity. Policy 3.2.5.9 - Habitat of Threatened and Endangered Species New development is prohibited in Significant Habitat of Threatened and Endangered Species but may be permitted in accordance with provincial and federal legislation. Policy 3.2.5.10 - Fisheries New development is prohibited in Core Fishery Resource Areas, and any development adjacent to these areas that will harmfully alter, disrupt or destroy fish habitat is prohibited. Additionally, quality and quantity of water entering these areas, and well as riparian buffers, shall be maintained and enhanced where appropriate. Policy 3.2.5.11 - Wildlife Habitat New development is prohibited with Significant Wildlife Habitat, and Unevaluated Significant Wildlife Habitat shall be studied. Other Wildlife Habitat may be developed with appropriate approvals. Policy 3.2.5.12 - Valleyland and Stream Corridors New development is prohibited in Valleyland and Stream Corridors and risk management of these resources must be examined through the planning process. Additionally,	• No development will occur within a Wetland Core Area, and a majority of the Other Wetlands will be protected with the exception of ELC Unit 7e, 7f, 7l, 13 and 14a, which will be compensated for within the proposed enhanced corridor/greenway on the southeastern boundary of the Subject Lands; • No development will occur within the habitat of a Threatened or Endangered species without *Endangered Species Act* permitting (refer to *Endangered Species Act* above); • No development will occur within a Core Fishery Resource Area, and the potential indirect impacts to fish habitat will be mitigated by implementing a range of measures provided by this CEISMP (see **Table 18**); • Unevaluated Wildlife Habitat shall be studied and evaluated through site specific studies at the Draft Plan stage; • No development will occur within a Valley and Stream Corridor with the exception of the enhancement of HDF reach WHT6-A, and the development design will ensure that the quality and quantity of the water entering these areas, as well as riparian buffers, are protected, maintained and enhanced and restored where appropriate as provided in this CEISMP; • The development design will ensure that the quality and quantity of groundwater recharge and discharge and the flow distribution of ground water are protected, maintained and enhanced and restored where appropriate as provided in this CEISMP; and • The proposed development will strive to retain all native soils on site.

APPLICABLE POLICY / LEGISLATION	RELEVANT CEISMP FINDINGS	COMPLIANCE
	quality and quantity of water entering these areas, and well as riparian buffers, shall be maintained and enhanced where appropriate. <u>Policy 3.2.5.13 - Groundwater</u> New Development needs to ensure that the quality and quantity of groundwater recharge and discharge and the flow distribution are protected and maintained, and where appropriate, enhanced and restored. Restoration of degraded groundwater discharge and recharge zone may be a condition of development approval. <u>Policy 3.2.5.13 - Soils</u> The Town encourages the conservation and protection of productive soils and native soils vulnerable to erosion. Establishment of ecosystem linkages through the revegetation of erosion prone soils is encouraged and may be a condition of development.	
Toronto and Region Conservation Authority (TRCA) Regulations	The Subject Lands include drainage features, floodplains and fish habitat, all subject to TRCA policies and regulations.	Regulated natural heritage features (wetlands and HDF's) have been integrated within the proposed natural heritage system. These features and their functions protected, restored, or enhanced. Natural hazards will be contained within the proposed enhanced corridor/greenway for Tributary WHT6. Permits will be applied for as required.

11. Summary and Conclusions

This CEISMP report and the companion FSR (Urbantech Consulting 2021) and Hydrogeolocial Investigation (DS Consultants 2021) have been prepared in support of the proposed LOPA and Macville Community Land Use Plan and Preliminary Framework Plan.

This CEISMP was prepared in accordance with Terms of Reference (TOR) that were previously developed as part of the Bolton Residential Expansion Study (BRES) planning process. This CEISMP builds upon and integrated the findings of the various technical studies previously completed for the Study Area by the Town of Caledon between 2013 and 2016.

As per the CEISMP TOR, the objective of the study is to: *conduct an impact assessment and develop a management plan for the natural environment potentially affected by urban development associated with the expansion of the Bolton Rural Service Centre to accommodate future residential growth to 2031.* Also, the goal CEISMP is to provide a sufficient level of detail and clear direction for the development in accordance with the environmental protection policies of the PPS, Region of Peel Official Plan and Town of Caledon Official Plan, and TRCA regulations and policies.

The CEISMP summarizes the findings of detailed biophysical investigations and analyses that have been undertaken to date for the Subject Lands. This information was used to characterize the environment, identify constraints and opportunities to future development, as well as the environmental management systems that will be required to support future development while enhancing the environment and local natural heritage system.

The Land Use Plan for the Macville Community Secondary Plan as well as a Preliminary Framework Plan were developed by having consideration to the constraints and opportunities identified in this CEISMP. An iterative approach was used to ensure that key components of the natural heritage system are protected, restored, and enhanced in accordance with the Town's ecosystem framework and environmental performance measures. As the proposed Land Use Plan and Preliminary Framework plans have been developed to integrate most of the existing natural heritage features, impacts to natural features and their functions have generally be avoided. The proposed natural heritage system has been developed to include clusters of wetland features, certain headwater drainages features, as well as fish and wildlife habitat. Isolated wetland features are however proposed to be consolidated into a single enhanced corridor/greenway block that has been sized to ensure no wetland habitat or headwater functions are lost.

This CEISMP assesses the potential impact impacts of the proposed Land Use Plan and Preliminary Framework Plan on the environment and provides recommendations for mitigation that will be implemented through the various environmental management plans that have been identified in the CEISMP, FSR (Urbantech Consulting 2021) and other technical studies. To ensure that the environmental protection and management measures outlined in these plans are performing as intended, the CEISMP includes Long-Term Monitoring Plan (LTEMP) and a Comprehensive Adaptive Management Plan (CAMP) to address refinements to the proposed environmental management systems.

This CEISMP demonstrates the Macville Community Land Use Plan can be implemented which satisfying applicable environmental protection legislation, regulations, and policies, including the Town's environmental performance measures. Additionally, the goals of this CEISMP are in line with Section 3.2.4.15 of the Town of Caledon's Official Plan, which lists ways in which the Town assist's in implementing ecosystem principle, goal and objectives, such as identifying groundwater resources and participating in environmental studies.

This CEISMP has been prepared to be comprehensive and offer site-level detail to minimize the extent of future study during the draft plan stage. While some information gaps remain in the CEISMP that will be filled through future work, these gaps are relatively minor in scale and are not anticipated to affect the proposed Land Use Plan or Preliminary Framework Plan or the Limits of Development that have been established through this CEISMP. This future work is summarized and described in the CEISMP and it is anticipated that most can be completed at the detailed design stage and provided to the Town and agencies in the form of a Compliance Letter.

In conclusion, it is the opinion of the project study team that the proposed Land Use Plan and Preliminary Framework Plan will not adversely impact existing natural heritage features and functions associated with the Subject Lands, provided that the recommended environmental management plans are implemented.

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Appendix A

Terms of Reference for BRES CEISMP

APPENDIX 1

Bolton Residential Expansion Study

Recommended Terms of Reference for Phase 3 Comprehensive Environmental Impact Study and Management Plan (CEISMP)

Prepared by TRCA and Region of Peel Staff

August 20, 2013

1.0 STUDY PURPOSE AND OBJECTIVE

The purpose of the Comprehensive Environmental Impact Study and Management Plan (CEISMP) is to conduct an impact assessment and develop a management plan for the natural environment potentially affected by urban development associated with the expansion of the Bolton Rural Service Centre to accommodate future residential growth to 2031. The management plan will inform planning and decision making so that changes in land use are compatible with natural systems and consistent with the Provincial Policy Statement (PPS) and applicable Region of Peel and Town of Caledon Official Plan policies.

The CEISMP shall include the completion of impact modeling based on land use scenario(s) developed and refined in the first phases of the Study (Parts A and B). The CEISMP will provide a sufficient level of detail and give clear direction for the implementation of development in accordance with the PPS, the Region of Peel Official Plan and the Town of Caledon Official Plan. The CEISMP study may be completed in a phased manner that will provide appropriate documentation of the municipal comprehensive review requirements for both the Regional and Town of Caledon Official Plan Amendments. The study will be completed in accordance with applicable Provincial, Conservation Authority, Regional and Municipal requirements.

1.1 Addressing Regional MCR Requirements in 7.9.2.12 e) and p)

The policy in 7.9.2.12 e) and p) requiring the demonstration of environmental protection shall be addressed through the completion of a CEISMP as outlined below. This study will address environmental and resource protection and enhancement including the identification of a conceptual natural heritage system, at a Regional scale, in accordance with the ROP policies. Requirements to enable a Regional Official Plan Amendment to proceed will be satisfied through:

1. Completion of all of the Part A Existing Conditions and Characterization;

2. Substantial completion of the Part B Impact Assessment and Detailed Studies components of the CEISMP terms of reference;
3. Identification of Core Areas of the Greenlands System, if any; and
4. Identification of a conceptual natural heritage system to the satisfaction of the Region and Town of Caledon, in consultation with the TRCA and other agency staff (e.g. Ministry of Natural Resources).

The substantial completion of the Part B component must **at a minimum** include setting the detailed targets for each discipline (e.g. ecology, surface water, groundwater, etc.) based on the detailed existing characterization of conditions completed in Part A; and establishing the conceptual plans/measures to meet those targets. For example, establishing a conceptual Low Impact Development (LID) plan that demonstrates mitigation measures that would be appropriate for meeting the site water balance targets would be required; and the detailed plan would be finalized through the completion of the CEISMP. Finalization of the CEISMP to the end of Part C and detailed refinement and finalization of natural heritage system boundaries will not be necessary for the purposes of satisfying Regional level approvals for a ROPA.

Additional direction to address Regional MCR requirements are outlined below:

- The CEISMP study component will identify a conceptual natural heritage system utilizing existing available inventories of natural features and areas supplemented by additional information collected through the completion of Parts A and B as outlined above. The identification of the conceptual natural heritage system will consider the natural heritage system policies contained in the Regional Official Plan and the Town of Caledon Official Plan.
- This study will apply the criteria for identification of the Core Areas of the Greenlands System and confirm, as appropriate, if any Core Areas exist in the recommended boundary expansion area. Spatial data and mapping of refined Core Areas of the Greenlands System boundaries shall be provided in a format satisfactory to the Region. Criteria for identifying Core Areas of the Greenlands System in Policy 2.3.2.2 of the Regional Official Plan should be applied for this purpose.
- The consultant should also utilize existing and ongoing studies and inventories and supplementary field work if necessary and appropriate.
- The Regional MCR environmental study results for the Regional ROPA shall be documented and submitted in a separate report in a format acceptable to the Region.

1.2 Preparation of a Detailed Workplan

These terms of reference provide overall guidance and a framework for carrying out a Comprehensive EIS and MP (CEISMP). It is intended that the Consultant(s) will prepare a detailed workplan with a proposed starting date of September 2013. The workplan should describe, in a more specific technical manner, how the Consultant(s) will fulfill the requirements of the terms of reference. The detailed workplan shall identify all necessary tasks, including but not limited to: a preliminary listing of all literature and background data to be relied upon; a detailed methodology for carrying out environmental characterization; monitoring and technical studies, including required technical expertise; the proposed approach to modeling urban land use scenarios and related impact assessments; the identification of anticipated deliverables; the methods of consulting with relevant agencies, stakeholders and the public; and, the timelines related to all key steps in the process. The detailed workplan is to be approved by the Town of Caledon, Region of Peel and TRCA.

TRCA will provide background data and information to the Town and consultant to inform the CEISMP. However, further consultation with the TRCA will be required to verify the extent and usability of the models/datasets, as well as to gather any additional data not initially provided.

1.3 Study Approach and Structure

To meet the objectives of Phase 1 of the Bolton Residential Expansion Study (BRES), TRCA will compile their existing environmental data (terrestrial and aquatic) related to the potential expansion area and produce screening mapping and GIS data. This will include a review of secondary sources, such as the South Albion-Bolton Boundary Expansion CEISMP. The consultant will be responsible for reviewing the mapping and data provided by the TRCA and provide a memorandum to the principle consultant setting out what known environmental features exists within the expansion areas and what constraints these features and their location may have on the potential for development.

To meet the objectives of Phase 3 and 4 of the BRES, a CEIMP will be required, which consists of fifteen (15) steps generally structured into three parts as outlined in Table 1 (these steps are described in more detail later in the terms of reference).

Part A characterizes the environmental resources of the study area. Background and supplemental field data is assessed within each discipline (hydrology/hydraulics, hydrogeology, water quality, stream morphology, aquatics and terrestrial and wildlife) and integrated across disciplines. Key deliverables of Part A include the identification of data gaps and resultant detailed studies required in Part B, and the establishment of initial goals and objectives.

Part B identifies and evaluates the potential impacts of urban land use scenarios within the study area. Required detailed studies identified in Part A will be carried out to fill data gaps. Goals and objectives will be finalized and key targets and strategies for meeting the finalized goals and objectives will be developed.

Based on the results of Parts A and B, Part C identifies all necessary components of an implementation strategy which will ensure that all goals, objectives, targets and other related recommendations and management measures are implemented. This will include the establishment of guidelines for the preparation of required site specific environmental studies, including but not limited to site specific Environmental Impact Study & Management Plans (EIS & MPs).

Table 1: Contents of a Comprehensive Environmental Impact Study and Management Plan

Part A **Existing Conditions and Characterization**	1. Introduction to the Study Area 2. Background Information 3. Baseline Monitoring 4. Existing Conditions Characterization and Initial Constraints and Opportunities Mapping 5. Part A Report
Part B **Impact Assessment and Detailed Studies**	6. Detailed Studies 7. Land Use Evaluation and Impact Assessment 8. Part B Report
Part C **Implementation**	9. Conclusions, Recommendations, Strategies and Management Measures 10. Long Term Monitoring Plan 11. Comprehensive Adaptive Management Plan 12. Policy Conformity Assessment and Recommendations 13. Guidelines for Site Specific Environmental Studies 14. Executive Summary 15. Final Report and Reporting Format

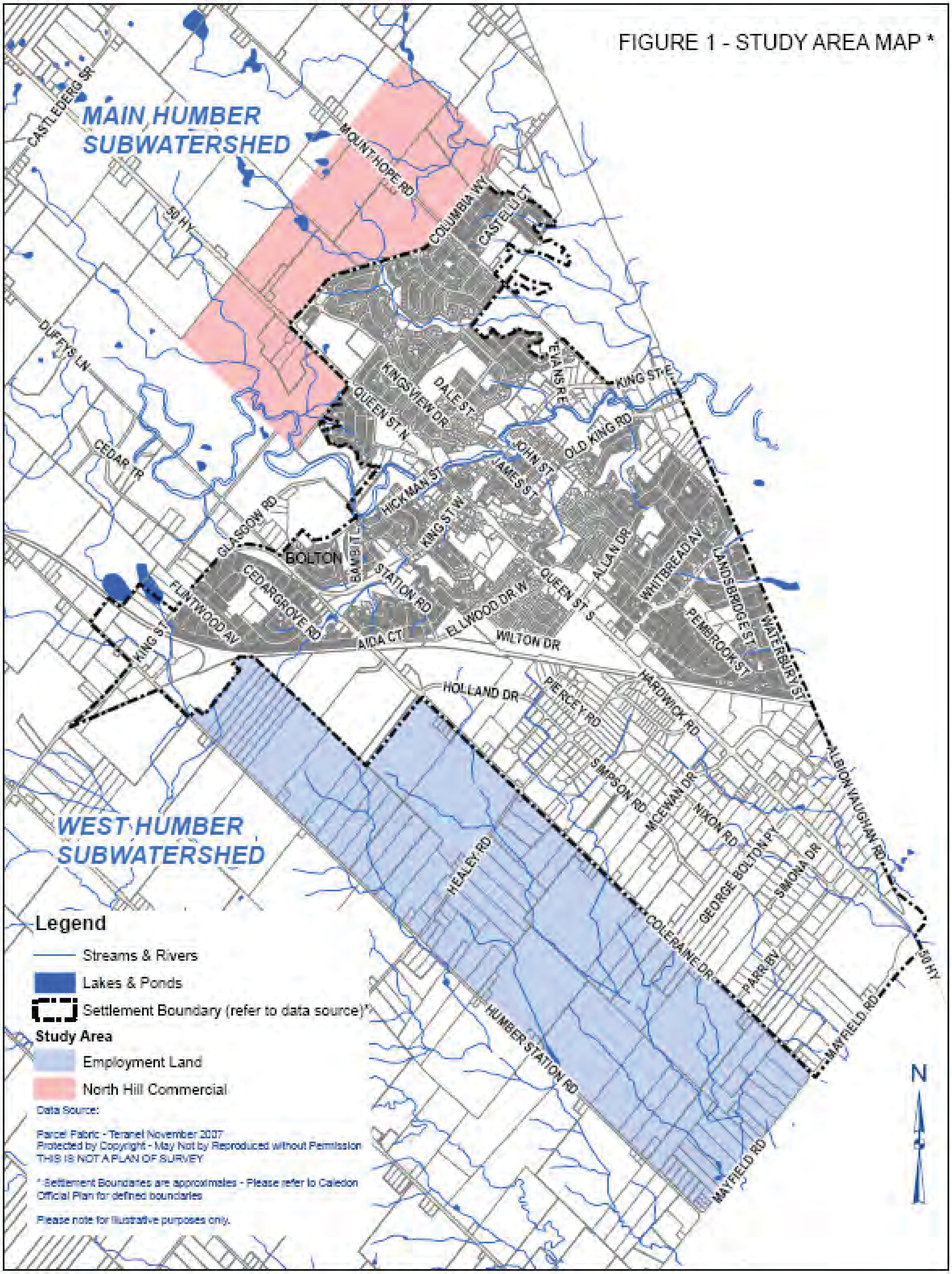

FIGURE 1 - STUDY AREA MAP *

Data Source:

Parcel Fabric - Teranet November 2007
Protected by Copyright - May Not by Reproduced without Permission
THIS IS NOT A PLAN OF SURVEY

* Settlement Boundaries are approximates - Please refer to Caledon Official Plan for defined boundaries

Please note for illustrative purposes only.

*Note: The study area boundary may be refined through the detailed workplan to incorporate other lands determined to be functionally connected to the study area through Parts A and B of the study.

2.0 PART A – EXISTING CONDITIONS AND CHARACTERIZATION

2.1 Introduction to the Study Area

The purpose of this section is to provide a general introduction and overview of the study area to provide context for readers of the document. This shall include but not be limited to textual description and relevant base mapping. Examining the impacts of the residential boundary expansion on the natural environment will require a sub-watershed approach, rather than only focusing on the boundaries of the preferred expansion options. Therefore, the broader study area must be defined and the assessment of impacts will apply to the full study area. The Town of Caledon, Region of Peel and TRCA will provide further guidance to the consultant regarding the delineation of the broader study area. If through the study process, other expansion area options are identified, the scope of the CEISMP may need to be revised to include any additional work.

2.2 Background Information

This section shall list all literature, background reports, mapping, technical data and all other information sources to be relied upon in the study.

2.3 Baseline Monitoring

The purpose of the baseline monitoring is to establish the baseline conditions within the study area and existing environmental trends against which future monitoring results will be compared. This will allow the projected impacts of future land uses to be monitored as land uses change over time and will link to the Adaptive Management Plan.

Information to be collected shall include but not be limited to:
(a) Surface water quality and quantity;
(b) Aquatic resources;
(c) Hydrology;
(d) Surface water - groundwater interconnections;
(e) Groundwater quality, quantity and flow patterns;
(f) Feature and Site Water budget/balance;
(g) Stream morphology; and

(h) Terrestrial resources – woodlots, wetlands, wildlife, Environmentally Sensitive Areas, Areas of Natural or Scientific Interest.

When preparing a baseline monitoring plan, it is important to ensure that many different disciplines are being monitored at the same sampling site where possible and appropriate. For example, fisheries and water quality monitoring should take place at the same site.
The monitoring plan should include an explanation of how the indicator parameters were established, e.g. what criteria were used when deciding what to monitor.

2.4 Existing Conditions Characterization and Initial Constraint & Opportunities Mapping

Field work should be carried out to better define the existing ecosystem forms, functions, and linkages within the study areas shown on Figure 1. Any areas identified as having potential functional connections that are outside the limits of the study areas shown on Figure 1 shall be addressed, as appropriate. Detailed constraint mapping (1:5,000 min. specified in step 15) will be prepared which highlights the environmental resources within the study area, as well as agency and municipal constraints (i.e. Fisheries Act, Official Plan designations, valley land setbacks). Initial objectives, which complement and build upon the subwatershed and related studies, will be developed based on the information and data inferences.

The mapping shall include but not be limited to:

(a) All hydrologic features including watercourses, swales, ponds, depression areas, springs, seepage areas and existing stormwater management facilities. Headwater features should be classified and mapped according to the CA's headwater drainage feature assessment guidelines;

(b) Existing hydrology, hydraulics, floodlines and floodline estimates as per TRCA Flood Plain Management Policies;

(c) Present day land use;

(d) Vegetation communities using Ecological Land Classification (ELC) mapping;

(e) Wildlife species locations and relative abundance (including amphibian and bird breeding);

(f) Terrestrial corridors (existing and potential), taking into consideration lands that have been targeted for the restoration of natural cover using TRCA's Terrestrial Natural Heritage System Strategy methodology and relevant subwatershed studies;

(g) Aquatic habitat, including water quality;

(h) Feature and Site Water balance/water budget assessment;

(i) Aquatic communities and habitat (with inventory sites), reach delineation, and appropriate setbacks;
(j) Valley slopes, top of bank, ecological considerations, geomorphic and geotechnical hazard areas, including stable slope lines, as per the CA's technical guidelines;
(k) Groundwater recharge and discharge areas, the linkages between them and existing condition groundwater recharge rates determined through a water budget assessment;
(l) Aquifer vulnerability to surface sources of contamination;
(m) Groundwatersheds (extending outside the study area – if applicable);
(n) Stream morphology, channel sensitivity and setbacks required to allow natural channel functions (migration, flooding, erosion);
(o) Preliminary channel classifications based on CA's technical guidelines;
(p) Refined municipal constraint limits (Town of Caledon EPA and Supportive Natural Systems and Linkages);
(q) Existing soils and geology;
(r) Significant landforms;
(s) Flora and Fauna species (based upon assessments using accepted protocols and seasonal sensitivities);
(t) Restoration or enhancement opportunity areas; and
(u) Ecological buffers.

Data deficiencies and information gaps need to be summarized and a workplan developed for filling gaps through detailed studies to be carried out in Part B. It is anticipated that this will include the review of regional groundwater models for the area (that will be provided by the TRCA), and extrapolate data from the models in combination with monitoring data to explain the groundwater conditions in the study area.

2.5 Part A Report

Once the requirements of steps 1 to 4 have been fulfilled, a Part A Report will be submitted in draft form to the Town of Caledon, Region of Peel and TRCA for review and approval prior to proceeding to Part B of the CEISMP.

3.0 PART B – IMPACT ASSESSMENT AND DETAILED STUDIES

3.1 Detailed Studies

It is anticipated that certain detailed studies will be required to complete the constraint mapping, confirm the areas functionally connected to the study area, carry out required detailed impact assessments and/or develop protection, restoration and enhancement plans for the area. In addition, the evaluation and refinement of land use options and impact assessment described in step 6 above may provide direction regarding detailed study requirements. A number of watershed and sub-watershed scale studies that are relevant to the study areas have been completed or are in progress. These studies provide strategies, guidance, targets and recommended actions to guide land use decisions and new development and should be considered when completing the detailed study components of the Comprehensive EIS and MP.

The EIS and MP must be completed in a manner such that the findings of each component study and analysis are integrated throughout the document. In addition, each aspect of the component studies must recognize the principle of adaptive management and incorporate an appropriate level of flexibility into the design. In doing this, interrelationships between components will be more fully considered and a proactive management approach may result. For example, the potential impacts of modifications to surface and/or groundwater on natural features and systems must be considered to determine the feasibility of the proposed land use changes and if/what mitigation and adaptive design measures may be required. In this regard, natural and built systems should not be considered in isolation but as integrated and adaptive units.

The need for, and scope of, the detailed studies are to be confirmed with the Town of Caledon, in consultation with the Region of Peel and TRCA, and they may include but are not limited to:

(a) Surface Water and Groundwater Resources studies;
(b) Aquatic Resources and Water Quality Study;
(c) Stream Morphology Study;
(d) Natural Heritage Study;
(e) Stormwater Management Study;
(f) Water Budget / Balance Study; and
(g) Geotechnical and Slope Stability Assessment.

The following subsections outline the potential contents of the above-referenced detailed studies, if it is determined they are required.

a) Surface Water and Groundwater Resources

The initial constraint mapping will have identified known hydrologic features within and adjacent to the study area, however, the overall hydrologic system must be described and features/functions confirmed. The components of the system to be addressed by the detailed studies include but are not limited to:

(i) Identification of flow characteristics of watercourses and swales, and a description of the feature and site water balance within the study area;
(ii) Characterization of all hydrologic features (watercourse, swales, natural areas providing flood storage/attenuation, depression storage, recharge areas, seepage areas and springs). Particular emphasis should be placed upon headwater tributaries and the functions that they perform within the system;
(iii) Identification of volume and distribution patterns of the major discharge areas and a representative location used for monitoring; and
(iv) Description of the relationship and dependencies between these features and the surrounding terrestrial, wetland and aquatic resources.

Since the study areas may include wetlands, watercourses, fishery resources and other features of potential sensitivity to changes to groundwater resources, a detailed hydrogeological impact assessment will likely be required. This may include but not be limited to:

(i) The general groundwater setting and linkages between the local and surrounding groundwater system;
(ii) Sensitivity of the natural environment and the function of the groundwater related to natural features such as the fishery, aquatic system, terrestrial resources, geomorphology, surface water, water quality and water quantity etc.;
(iii) Approximate high water table location;
(iv) Regional groundwater flow and direction and the general geologic setting;
(v) Potential recharge and discharge areas within the study areas;
(vi) Local groundwater resource usage within the study areas;
(vii) Projected post-development groundwater recharge rates including any anticipated deficits;

(viii) Location and usage of water wells within 1 km of the study areas;

(ix) Detailed description of the local geologic conditions and the function of the geologic units from a hydrogeologic perspective;

(x) Detailed assessment of the groundwater flow system, local flow direction, linkages to surface water and the regional groundwater flow system;

(xi) Delineate major and local aquifers in the area and interpret the connection to the study area;

(xii) Studies on springs, surface water courses or discharge to surface water that focus on groundwater/surface water interaction, determining linkages to recharge and discharge areas through baseflow assessment, vertical gradients, and water table location. This information should be incorporated into the water balance;

(xiii) Contamination risk assessment that considers aquifer vulnerability and proposed land use changes and identification of a risk management strategy; and,

(xiv) Assessment of potential impacts on groundwater flow and volume from required servicing.

b) Aquatic Resources and Water Quality

The initial constraint mapping will have identified fish habitat and water quality classification for the tributaries. The detailed study is to provide the following information in support of the habitat classifications and planned land use change conditions:

(i) Confirm the fish habitat and water quality classifications of all watercourses and fish habitat within the study area;

(ii) The direct and indirect physical and bio-physical impacts of the land use scenarios on water bodies, water quality and quantity;

(iii) The fish species present, and the direct and indirect biological impacts of the physical impacts;

(iv) The life stages of aquatic organisms supported by the impacted habitat; and

(v) Opportunities for maintaining and enhancing aquatic habitat and species through the land use scenarios.

c) Stream Morphology

The study will describe the physical form of the watercourse. The following information will be included:

(i) Characterization of geomorphic features including sensitive reaches, areas of erosion and aggradation, channel migration, etc;
(ii) Determine the relationship between hydrology of the stream and geomorphology, aquatic resources and water quality, using a continuous simulation modeling approach;
(iii) A meander belt width analysis and delineation of the 100 year erosion limit; and
(iv) Assessment of stream bank erosion and the potential for such erosion within the 100 year timeframe, with consideration for potential impacts on the morphology of the valley or stream corridor.

d) Natural Heritage

The study will describe the physical form and function of the ecological systems and features within the study area, and identify any functional relationships to broader systems (e.g. regional wildlife corridors), define what additional issues must be examined (i.e. opportunities for linkages) and demonstrate how the land use scenarios will affect the ecological features and functions of the study area. This shall include but not be limited to:

(i) Identification and design of a natural heritage system that enhances the form, function and integrity of ecological features within and surrounding the study area and maintains or enhances connectivity amongst ecological features. This will also include ecological buffers as well as enhancement and restoration opportunity areas;
(ii) Strategies to avoid and/or mitigate anticipated impacts of land use changes on the form and function of ecological features; and
(iii) Consideration of conservation authority ‘target’ natural heritage systems, and opportunities to (re)establish linkages between natural features and systems. This may include enhancing the form and maintaining the function of linkages that currently exist prior to development.

e) Stormwater Management

This study will address stormwater management considerations, including but not limited to:

(i) Evaluation of stormwater management options and selection of a preferred stormwater management strategy that includes lot level, conveyance, and end-of-pipe solutions, with emphasis placed on at source controls, and as per TRCA’s Stormwater Management Criteria;

(ii) Identification of preliminary locations of stormwater management ponds and infrastructure outside of the natural system (including ecological buffers);
(iii) Identification of major and minor system flow routes;
(iv) Identification of proposed road crossing locations and criteria;
(v) Implementation strategy for inclusion on the overall Study Environmental Management Plan (e.g. phasing, interim works, roles, etc.);
(vi) Identification of erosion and sediment control requirements to be implemented, integrating conservation authority guidelines;
(vii) Methods for mitigating any projected groundwater recharge deficits associated with proposed land use changes;
(viii) Updating the CA's relevant hydrology models, based on the preferred stormwater management strategy and proposed land uses;
(ix) Methods for maintaining the seasonal water budget of hydrologically sensitive terrestrial features (i.e. wetlands and wet forests) affected by proposed land use changes; and,
(x) Updated floodplain mapping within the study area, as well as the surrounding area, if affected.

f) Water Budget / Balance

One component of achieving the sustainability and adaptive management objectives for the community is the integration of best management practices pertaining to maintaining as closely as possible, pre-development ground water conditions post-development. With changes in impervious areas, and potential changes to surface and ground water quality and quantity, best management practices which serve to promote post-development groundwater infiltration/recharge, and maintain pre-development water balance conditions to the greatest feasible extent are required. This report (to be completed by a Professional Engineer or Professional Geoscientist with expertise in this area of practice) should include the development of a detailed water balance on a catchment area basis under existing and post-development conditions.

The investigation should provide definitive, factual information that verifies the final recommendations and should include the components listed below:

1. Introduction.

(i) Background;

(ii) Hydrogeological setting, geological setting; and

(iii) Site location and proposed land use.

2. Methodology.

(i) Report and water balance objectives;

(ii) Background data studies and information utilized and considered; and

(iii) Data and considerations.

3. Water Balance Methodology.

(i) Provided on a catchment basis (existing and proposed);

(ii) Appropriate long-term water budget assessment (e.g. AES Thormewaite, minimum monthly); and

(iii) Groundwater recharge contributions to natural features must be quantified.

For preparing the Feature Based Water Balance study methodology, please refer to TRCA's Water Balance Guidelines for the Protection of Natural Features, which can be downloaded at: http://www.sustainabletechnologies.ca/Portals/_Rainbow/Documents/Water%20Balance%20for%20the%20Protection%20of%20Natural%20Features%20Guideline%20.pdf

4. Predevelopment water balance analysis.

5. Post-development water balance analysis.

(i) Land use considerations.

6. Comparison of pre- and post-development water balances.

(i) Proposed mitigation measures (if required);

(ii) Potential measures (above and beyond traditional lot level controls) that may be considered in the analysis include:

- Rain water harvesting from roof-top water collection on commercial or employment lands, which may be used for irrigation purposes;
- Infiltration galleries;
- Exfiltration galleries;
- Biofiltration measures;

- Green roofs;
- Porous pavement;
- Additional non-compacted topsoil;
- ‘third pipe’ systems; and
- Additional evapotranspiration measures.

(iii) Preliminary assessment based upon hydrogeological assessment of areas in which enhanced ground water recharge measures may be employed;
(iv) Establish specific targets, thresholds, and objectives for water balance in these areas;
(v) Provide alternative measures that may be employed to meet these objectives – utilizing best management practices;
(vi) Design (may consider interflow, baseflow contributions, downstream erosion and thermal impacts mitigation);
(vii) Provide locations in which these measures would be optimized;
(viii) Implementation (including funding, fiscal implications, technical feasibility, long-term maintenance, cost sharing and landownership considerations if applicable);
(ix) Maintenance; and
(x) Monitoring of water balance enhancement measures.

7. Conclusions and Recommendations.

g) Geotechnical and Slope Stability

A geotechnical investigation will be required to identify areas in which potential slope instability exists. Existing Top-of-Slope (ETOS) and the Long-Term-Stable Top-of-Slope (LTSTOS) should be assessed in areas where they are not coincident with the physical crest of slope. Because of the complexities of site development and soil conditions, comprehensive assessments are required for development projects close to major features, while less detail may be required for minor works near shallower slopes. The assessment of the LTSTOS is to be completed following the MNR’s Technical Guide on River and Stream Systems: Erosion Hazard Limit (2002) and should be accompanied by a detailed slope stability analysis.

Where required, a solution based on sound technical data should be recommended to minimize or eliminate the impact of the development and associated activity, and at the same time ensure that the development will be safe for a design period of 100 years. Alternatives should be considered, and a final solution recommended and justified by comparing it to the alternatives. The basic requirements are as follows (more specific components should be discussed with conservation authority and Town staff):

(i) Determine the existing subsoil conditions and pertinent geotechnical parameters for the entire height of the slope;
(ii) Model the slope conditions and assess its stability. Determine the stable slope inclination corresponding to a minimum Factor of Safety of 1.5; and
(iii) Provide and assess mitigation strategies, where required.

The TRCA will provide specific guidelines for the required structure of the assessment giving a general guide for the documentation and calculations required. The level of detail required for a specific submission will depend on factors such as:

(i) Slope characteristics (e.g., height, angle, and distance from watercourse);
(ii) Distance of development from the slope;
(iii) Local soil conditions; and
(iv) The type of development proposed.

3.2 Land Use Evaluation and Impact Assessment

Through an analysis of the dynamics and interrelationships of the ecosystem, the study will assess the potential environmental impacts of locating residential uses and the associated infrastructure within the respective study areas, and their compatibility with the Town's ecosystem goals, objectives, policies and performance measures.

The study will recommend environmental protection and enhancement measures for use in assessing the environmental impacts and enhancement opportunities of the residential land use options. The study will consider the impacts of development adjacent to the natural system and identified enhancement opportunities, and will discuss approaches to avoiding or minimizing impacts of adjacent land uses. The location of infrastructure, including roads adjacent to the natural system, will need to be considered with the design eliminating or minimizing any proposed crossings of the natural system.

The study will outline an environmental management strategy for the preferred development locations which will recommend measures for the management, enhancement, restoration and monitoring of the ecosystem.

It is expected that an iterative relationship will exist between steps 6 and 7.

3.3 Part B Report

Once the requirements of steps 6 and 7 have been fulfilled, a report on Part B will be submitted in draft form to the Town of Caledon, Region of Peel and TRCA for review and approval prior to proceeding to Part C of the CEISMP. Based on the results of Steps 6 and 7, the Part B report will recommend finalized goals and objectives and key targets and strategies for meeting the finalized goals and objectives.

4.0 PART C – IMPLEMENTATION

4.1 Conclusions, Recommendations, Strategies and Management Measures

This section will synthesize the results of Parts A and B of the study and provide all related conclusions, recommendations, and management/mitigation strategies. This shall include but not be limited to:

(a) A comparative evaluation of alternative management options leading to the selection of the preferred option;
(b) Conclusions and recommendations; and
(c) Strategies and Management Measures – if impacts are expected or may occur, what plans are in place to maintain ecosystem features and functions?

It is expected that key components of Part C will include a long term monitoring program, an adaptive management plan, policy recommendations and guidelines for site specific environmental studies, as generally outlined in Steps 10 to 13 below.

4.2 Long Term Monitoring plan

Monitoring is to continue after baseline conditions are established. The monitoring plan should be designed in such a way that impacts can be distinguished from natural trends at an early stage. If impacts are detected:

(a) A more aggressive type of monitoring should take place that determines where, why and how fast the change is occurring;
(b) Establish cause-effect relationships between environmental resources and land use change;
(c) Be able to deal with change by proposing appropriate mitigative measures (as per adaptive management plan); and
(d) Focus on evaluating ongoing or proposed management practices.

Items that should be monitored over the long term include but are not limited to:

(i) Water quality and quantity, including stormwater system performance (including any best management practice measures and/or designs used);
(ii) Fisheries and aquatic resources;
(iii) Hydrology and hydraulics;
(iv) Groundwater quality and quantity;
(v) Stream morphology and slope stability;
(vi) Terrestrial resources – woodlots, wetlands, flora and fauna, Environmentally Sensitive Areas, Areas of Natural or Scientific Interest, terrestrial linkages, buffer areas, invasive species, natural system encroachments, natural system edge management, and vernal pools; and
(vii) Feature Based and Site Water balance and the effectiveness of groundwater recharge enhancement measures.

It is essential that long term monitoring be included in the final study report, and that the costs and responsibilities for long term monitoring be addressed. The length of time for monitoring will be determined during the study, and may depend upon the feature to be monitored (i.e. different features may need different lengths of time).

4.3 Comprehensive Adaptive Management Plan

The broad objective of the Comprehensive Adaptive Management Plan (CAMP) is to provide direction for monitoring the performance of the recommended aquatic and terrestrial resource mitigation strategies, and to provide a flexible mitigation system that can be adjusted in response to monitoring results. For the CAMP to be effective, flexible measures must be accommodated at the initial stages of all aspects of the community design (e.g. stormwater management infrastructure, open space system, transportation network, landscaping etc.) to allow for an adaptive system that can react to required change. The CAMP is a management framework that encompasses and provides for the following:

(a) Identify key Study Area features and functions and associated protection goals and objectives;
(b) Management targets required to meet goals and objectives;
(c) Mitigation measures to address the performance targets;
(d) Monitoring requirements to monitor the success of the mitigation measures in relation to the targets;
(e) Evaluation of the monitoring results in relation to the management targets; and
(f) Long term adjustment of the overall Plan/CAMP as needed.

Specifically, the CAMP will include a framework for long-term environmental monitoring to measure the performance of the recommended mitigation/management strategies. Recommendations for long-term monitoring of surface water, groundwater, water quality, fisheries, stream morphology and terrestrial/wetland resources will be provided. The data collected as part of the Study will form a baseline for monitoring change over time and for evaluating proposed management practices. Monitoring frequency, parameters and responsibility will also be addressed. The monitoring program will be designed in a way that will help to distinguish between natural variation in ecosystem function and potential land use development impacts.

In keeping with the adaptive management plan approach, the CAMP will discuss responses to changing conditions or anticipated impacts. This might include more aggressive monitoring necessary to determine the cause and effect relationship associated with the change or anticipated impact as well as providing general directions for consideration of impact contingency measures that might be considered as adjustments to the plan where necessary after taking into account monitoring results.

The CAMP will provide the framework linking the site specific studies and CAMPs into the broad management plan or CAMP for the study area management, to ensure mitigation and monitoring plans, as well as enhancement and restoration, are consistent and integrated and address the identified resource protection targets, within the context of the broader ecological and water resources context as documented through the Study.

In areas of widespread development, the conservation authority may undertake long-term environmental monitoring (should funding be provided) to reduce overall costs and to achieve better consistency.

4.4 Policy Conformity Assessment and Recommendations

As previously stated, the CEISMP is required to not only address the policy requirements of the Caledon Official Plan, but also the applicable policies and requirements of other relevant agencies, including the Provincial Policy Statement, Provincial Acts, the Region of Peel and TRCA. Step 12 of the CEISMP is intended to clearly reference relevant policy, legislative and technical requirements and describe how the CEISMP meets or exceeds these requirements.

4.5 Guidelines for Site Specific Environmental Studies

It is anticipated that one of the products of the CEISMP will be guidelines for carrying out future site specific environmental studies, including site specific Environmental Impact Study & Adaptive Management Plans to be prepared by individual applicants in support of development proposals in the study area. These site specific studies will assess the merits of the application and will apply findings, recommendations and strategies contained in the CEISMP. Establishing guidelines for the preparation of site specific environmental studies will assist future applicants in determining the scope and content of such studies.

4.6 Executive Summary

Include a summary at the front of the final report (step 15 below) that summarizes the results of Parts A, B and C, highlighting key findings, recommendations and strategies.

4.7 Final Report and Reporting Format

A complete description of all the work and conclusions involved in the Comprehensive EIS & MP (Parts A, B, and C) is to be included in the final report.

Reports should be submitted in hard copy along with an electronic copy in Word for Windows 2007 Office and Portable Document Format (PDF) on a CD. Ten copies of all draft and final reports, each with a full set of graphics, artwork and maps shall be submitted to the Town of Caledon.

<u>Graphics</u>

Graphics should be submitted in Microsoft PowerPoint format on a CD separately from the main report as well as incorporated into the main report.

<u>Artwork</u>

Artwork should be submitted in JPG format on a CD separately from the main report as well as incorporated into the main report.

<u>Mapping</u>

Mapping should be in a scale of 1:5000 or less. It should be noted that Arc GIS 9.x is the GIS software currently used in the Town of Caledon, and as such, ArcView shape files are required. In general, digital graphic data:

(a) **must** be georeferenced in UTM using NAD 83;
(b) **must** be clean, i.e. polygons should be closed, dangles eliminated, polygons with common borders should not overlap, etc.;
(c) should be packaged/organized into logical layers, for example, a soils layer, a wetlands layer, etc.; and
(d) **must** be in vector as opposed to raster format, unless otherwise specified.

<u>Tabular Attribute Data</u>

Attribute data should be provided in Excel format files (preferred), dBase IV format files, or in formatted (i.e. with defined columns) ASCII files.

Textual Data for Graphics

Text should be provided in Word for Windows 2003 Office. Please be aware that any tabular data to be referenced to actual map features should **not** be provided as tables in a Word document.

Digital Photos

Digital photos, whether they are scanned photographs or computer-generated artwork, should be provided in JPG format.

Spatial Data Requirements

Spatial data provided by the Vendor to the Agency will be in ESRI Shapefile format. All spatial data will be geo-referenced and projected in 6 Degree Universal Transverse Mercator (UTM), Zone 17, North American Datum 1983 (NAD83). Mapping (cartographic) templates may be provided to the Vendor upon request.

Spatial data will be topologically correct. Polygon features will not overlap and gaps (slivers) will not be present (areas of no data accepted). Linear features will not have dangles, self intersects or self overlaps. Sample data may be provided to the Vendor upon request.

Metadata will be provided with all data. The metadata will include an abstract, purpose and process steps used to create the data. Attribute field definitions will also be provided. Metadata will be attached to the GIS data through a metadata record and/or as a Readme file. Sample metadata may be provided to the Vendor upon request.

The successful Vendor will be responsible for entering into a Digital Data Use Agreement (DDUA) with the Agency. A template of the DDUA is attached.

All data created by the Vendor will become the property of the Agency. Data may become available to the Public through open data initiatives.

Appendix B

Hydrogeological Investigation

REPORT ON
PRELIMINARY HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
MACVILLE COMMUNITY
IN CONNECTION WITH LOPA APPLICATION TO ESTABLISH THE MACVILLE COMMUNITY SECONDARY PLAN AREA
BOLTON, ONTARIO

PREPARED FOR:
Bolton Option 3 Landowners Group

DS CONSULTANTS LTD.
6221 Highway 7, Unit 16
Vaughan, Ontario, L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project No: 20-169-100
Date: February 3, 2021

20-169-100 **Feb 3rd, 2021**

Karen Bennett
Bolton Option 3 Landowners Group c/o Glen Schnarr & Associates
700 - 10 Kingsbridge Garden Circle
Mississauga, ON L5R 3K6

Via email: karenb@gsai.ca

RE: Hydrogeological Investigation – Macville Community, Caledon (Bolton), ON

DS Consultants Limited (DS) was retained by Option 3 Landowners Group to complete a hydrogeological investigation in support of a proposed Secondary Plan for the Macville Community in Bolton, Ontario (Site). The Site includes approximate 182.1 hectares of land bounded by King Street to the south, The Gore Road to the west and Humber Station Road and the CP Rail to the east. The area is primarily agricultural with some single detached residential lots. The Secondary Plan involves development of these lands for residential and mixed-use land uses, open spaces, parks, trails, commercial uses, the Bolton GO Station, Environmental Policy Area (EPA) and areas designated for stormwater management (SWM Ponds). The development will also include the construction of roadways including storm and sanitary sewer and water distribution infrastructure.

This Hydrogeological Investigation is undertaken in support of the Local Official Plan Amendment (LOPA) application to establish the Macville Community Secondary Plan Area. It includes an overview of the existing geological and hydrogeological conditions at the Site and surrounding area and provides an assessment of hydrogeological constraints and potential impacts of the proposed development on local groundwater resources. A significant aim of the study is to provide mitigation measures to reduce or eliminate the impacts of development on local water resources, groundwater users, and the natural environment. It also includes an estimation of construction dewatering requirements and groundwater permanent drainage conditions.

If needed, the results of this investigation can be used in support of an application for a Category 3 Permit to Take Water (PTTW) or an Environmental Activity Sector Registry (EASR) for construction dewatering from the Ministry of the Environment, Conservation and Parks (MECP) and discharge permitting from the Town of Caledon.

Based on the results of our investigation, the following conclusions and recommendations are presented:

1. The Site is located within the Main Humber subwatershed part of the larger Humber River watershed. The surface water and drainage setting at the Site comprises a total of eight (8) wetlands, which are incorporated into the tributaries of the Humber River and ultimately flow into Lake Ontario. Relief across the Site ranges from approximately 281 masl in the northwest corner of the Site to 262.0 masl in the southwest corner of the Site. The study area is characterized as having moderate drainage, which is directed overland into various streams on the Site.

2. The Site is situated within the South Slope Physiographic Region of Southern Ontario (Chapman and Putnam, 1984), and lies within a Drumlinized Till Plain Physiographic Landform. Surficial geology mapping made available by the Ontario Geological Survey (2010) indicates that the study area is covered entirely by Halton till. There are some glacial deposits of sand and gravel to the west of the site and modern alluvial deposits of silt, sand, and gravel to the east along tributaries to the Humber River. The overburden in the vicinity of the site is clayey silt to sandy silt till deposits (Halton till).

3. Based on the MECP water well records search, there are seventy-three (73) water wells within 500 meters of the Site. Forty-seven (47) water wells are noted as domestic supply wells and six (6) wells are noted as commercial or industrial supply wells. Eight (8) wells are noted as test holes or monitoring wells. The remaining twenty-three (23) wells are either abandoned or unknown use. Private domestic and commercial water supply wells are drilled into sandy aquifers confined under clay till. The depths of these wells range from 5.5 m to 65.2 mbgs. It is recommended that a private door-to-door water well survey be completed within a 500 m radius of the Site to confirm private use of groundwater in the study area.

4. To assess groundwater conditions at the Site, DS carried out a drilling program in July 2020 to advance a total of sixteen (16) exploratory boreholes and installing monitoring wells (MW) in thirteen (13) strategic locations across the study area as shown in **Figure 4**. MWs were constructed with two (2) inch PVC casing and a 1.5 m length of screen installed at varying depths ranging from 3.0 to 9.1 meters below ground surface (mbgs).

5. Based on the subsurface investigation, the stratigraphic setting of the Site comprises of topsoil/fill /disturbed native materials underlain by native soil deposits. The native soil deposits at the Site includes clayey silt till to silty clay till (Halton till) to depths ranging from 1.5 m to 11.3 mbgs, which in turn is underlain by silt/sandy silt/silty sand (Newmarket till) extending to the maximum depth of investigation. Modern alluvium deposits consisting of sand and gravel were encountered in the southeast corner of the Site in Borehole/Monitoring Well BH20-16. Bedrock was encountered during the subsurface investigation.

6. **DS** implemented a manual groundwater monitoring program at the site in May 2018 on a monthly basis to assess long-term groundwater fluctuations for a one (1) year. Groundwater was found in monitoring wells at depths ranging from 254.11 to 274.76 mbgs. The The groundwater flow direction within the Site area is inferred to be in a southeasterly direction with some flow in the southwestern quadrant of the Site to be directed in a southwesterly direction. Continuous groundwater monitoring at the Site indicated that the groundwater levels at the Site had a gradual decline during the August to October ongoing monitoring period.

7. Single Well Response Tests (SWRTs) were completed by **DS** in all monitoring wells on August 6th and 7th, 2020 to estimate hydraulic conductivity (K) for the representative geological units in which the wells were completed. The hydraulic conductivity values ranged from 7.4x 10^{-9} m/sec to 3.2 x 10^{-6} m/sec for clayey silt till and sandy silt till / silt unit.

8. Non-filtered groundwater samples were collected from Monitoring Well BH20-4 on Oct September 4, 2020 to assess the groundwater quality. Groundwater quality results were compared to parameters listed in the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to nearby surface water features as part of the hydrogeological investigation. Based on the results of the analytical testing, the sample quality met the permissible limit of all analyzed parameters, however exceeded for Total Cobalt against the PWQO standards. Pre-treatment of the pumped water will be required prior to discharging into a natural surface water feature.

9. Non-filtered surface water samples were collected from surface stations SG W2-1 and SG W8-1 to compare the baseline water quality against the PWQO. Based on the results of the analytical testing, the water quality exceeded the PWQO criteria for various metal parameters.

10. **DS** commenced continuous pre-construction monitoring at the Site including the onsite wetlands to determine the interaction between surface and groundwater. The monitoring program is currently ongoing and will commence for a period of 1-year. Based on the preliminary results of the monitoring during the August to October period in 2020, all wetlands at the Site appear to be ephemeral features. The monitoring program to-date indicated upward shallow groundwater gradient in two (2) surface water monitoring stations, including for Wetland 3 (SG-W3, W3-PZS and W3-PZD) and Wetland 8 (SG-W8, W8-PZS and W8-PZD). Based on the preliminary data collected during the current monitoring period, there is a potential for the baseflow of Wetland 8 to be maintained by groundwater following precipitation events and/or during the wet season; however further monitoring will be required to confirm the surface and groundwater dynamic at the location of Wetland 8 and the remainder of the Site.

11. In-situ infiltration testing was conducted by **DS** field personnel on September 2nd, 2020. The testing was completed at a depth of 0.5m and 1.5 m bgs at ten monitoring well locations (BH20-1, BH20-2 and BH20-5 through BH20-16). Based on the test results, the site primarily consists of a low permeable silty clay till with a measured infiltration rate ranging from about 16 to 38 mm/hr with an average of 26 mm/hr. One test location at (BH20-16 - southeast corner of the Site) with sand and gravel deposits, produced an infiltration rate of 108 mm/hr. Soils with infiltration rates over 15 mm/hr are considered suitable for Soakaways, infiltration trenches and chambers (TRCA, 2010). Continued water level monitoring at all locations is recommended to ensure a minimum of 1 m clearance between the top of the seasonally high water table and the bottom of any infiltration measure.

12. The Site-specific water balance indicates a reduction in the annual infiltration rates at the Site following the proposed plans for development due to an increase in the impervious area. Designing of Low Impact Development (LID) measures to mitigate this post-development infiltration deficit will be required to ensure that pre-development infiltration rates are maintained.

13. Changes to wetland catchment size directly effects the volume and timing of stormwater contributions to downgradient features. A Wetland Water Balance Risk Evaluation following TRCA guidelines (TRCA, Nov 2017) showed there is high risk to wetlands W1 to W6 as a result of reduced catchment size. In order to understand the effects of the reduced catchment area and evaluate the

magnitude of actual hydrological changes, a wetland water balance is currently being completed by Urbantech using a continuous model. The results of the ongoing pre-construction wetland monitoring program undertaken by **DS** will be used in conjunction with the continuous model to assess the actual risks to the wetlands. Based on the findings of the water balance results, a wetland mitigation plan will be developed.

14. It is understood that the provided site grading plan and the design of the two (2) storm water management plans are currently preliminary and the proposed site servicing plan and the architectural drawings with the final basement floor slab elevations of all structures to be constructed below grade have not been finalized at this stage. **DS** made numerous assumptions, as outlined in Section 6.0 of this report, in support of the groundwater seepage assessment during the construction period. The requirements for dewatering/control during the construction period is as follows:

    14.0 Low-Rise Residential Block – 62,000 L/day (incl. 50% safety factor on anticipated seepage rates and contribution from a 2-year storm) **per unit block**;

    14.1 Mid-Rise Residential Block – 102,500 L/day (incl. 50% safety factor on anticipated seepage rates and contribution from a 2-year storm) **per unit block;**

    14.2 Site Servicing (Developmental Site area / Newmarket Till) – 15,500 L/day (incl. 50% safety factor on anticipated seepage rate and contribution from a 2-year storm) **per unit trench segment**;

    14.3 Storm Water Management Pond 1 – 205,000 L/day (incl. 50% safety factor on anticipated rate; does not include contribution from a 2-year storm);

    14.4 Storm Water Management Pond 2 (Anticipated Case/Halton Till) – 230,500 L/day (incl. 50% safety factor on anticipated rate; does not include contribution from a 2-year storm); and

15. It is expected that permanent drainage control will be required for the proposed mid-rise residential blocks should detailed designs corroborate assumptions made during this assessment. The total permanent drainage rates for one (1) block of a mid-rise residential is estimated to be on the order of 55,000 L/day. Control of permanent private water drainage in the low-rise residential blocks, institutional and commercial zones is not anticipated.

16. During the construction period, the requirements to obtain any water taking permits (EASR/PTTW) will depend on the ownership structure of the Site and the staging for development. During the post-construction period, PTTW registration with the MECP will be required for the permanent drainage anticipated for proposed mid-rise residential blocks.

17. A discharge permit may be required from the Toronto and Region Conservation Authority (TRCA), Region of Peel and/or Town of Caledon if the water is to be discharged to a nearby/on-site surface water body as a result of construction dewatering. A discharge and monitoring plan will need to be prepared prior to obtaining a discharge approval from the TRCA, Peel Region and/or Town of Caledon.

Based on the results of the groundwater analytical testing, the quality of the groundwater exceeded the PWQO for Total Cobalt. Pre-treatment of the pumped water will be required to ensure compliance with the PWQO criteria prior to discharging into a natural surface water feature.

18. During the post-construction period, a sewer discharge agreement with the local upper and/or lower tier municipality may be required prior to any discharging operations into the municipal sewer system.

19. Dewatering activities adjacent to the on-site wetland features has the potential to lower the groundwater and/or surface water levels in the wetlands. Once a groundwater dewatering system is set up at the Site, daily and weekly monitoring should be implemented to assess the groundwater conditions such as water levels, measurement of discharge flow, discharge water quality and any adverse impacts as a result of dewatering, if any. At this stage, pre-construction monitoring for a period of 1-year has not been completed and baseline conditions in the wetlands have yet to be established. On the onset of completing the pre-construction monitoring, DS will prepare a monitoring, mitigation and contingency plan, which will outline a pre-defined "*review*" and "*response*" levels for all surface water stations in the wetlands to ensure a mitigation plan is in place should impacts to the wetland features be noted.

20. In conformance with Regulation 903 of the Ontario Water Resources Act, the decommissioning of any dewatering system and monitoring wells should be carried out by a licensed contractor under the supervision of a licensed water well technician.

Should you have any questions regarding these findings, please do not hesitate to contact the undersigned.

DS Consultants Ltd.

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APPENDICES

1.0 INTRODUCTION

DS Consultants Limited (DS) was retained by Option 3 Landowners Group to complete a Hydrogeological Investigation in support of a proposed Secondary Plan for the Macville Community in Bolton, Ontario (Plan). The investigation was completed as part of the Comprehensive Environmental Impact Study and Management Plan (CEISMP) in collaboration with Beacon Environmental Limited (Beacon) and Urbantech Consulting (Urbantech).

The Macville Community Secondary Plan includes the development of approximate 182.1 hectares of land bounded by King Street to the south, The Gore Road to the west and Humber Station Road and the CP Rail to the east (Site). The Site location is shown in **Figure 1**. The area is primarily agricultural with some single detached residential lots. The proposed development of these lands includes residential and mixed-use land uses, open spaces, parks, trails, commercial uses, the Bolton GO Station, natural heritage features and areas designated for stormwater management (SWM Ponds). The development will also include the construction of roadways including storm and sanitary sewer and water distribution infrastructure.

This hydrogeological investigation includes characterization of existing geological, hydrogeological and hydrologic conditions of the Site and local features including 8 wetland units. The investigation provides an assessment of opportunities and constraints including potential impacts on local groundwater resources. A significant aim of the study is to provide mitigation measures to reduce or eliminate the impacts of development on local water resources, groundwater users, and the natural environment. The study also provides an estimation of construction dewatering requirements and groundwater permanent drainage conditions.

1.1 Purpose

The purpose of this investigation is to characterize groundwater conditions over the study area and provide construction dewatering estimates and recommendations for design and mitigation measures to reduce or eliminate impacts of development on local water resources. The investigation will inform a water balance study to help define potential risks to the wetlands features within the Site. This investigation also includes an asassessment of dewatering requirements and provides recommendations for the obtaining the necessary permits prior to construction such as a Permit to Take Water (PTTW) or registry on the Environmental Activity Sector Registry (EASR) from the Ministry of Environment and Conservation and Parks (MECP).

1.2 Scope of Work

The scope of work for this investigation includes:

(i) Drilling and installation of monitoring wells, piezometers, and stream flow monitoring instrumentation;
(ii) Collecting and interpreting available reports and data including the MECP Water Well Records (WWR), geotechnical, hydrogeological and environmental studies completed at the Site;
(iii) In-situ hydraulic conductivity testing
(iv) Stream water level and flow monitoring including seasonal fluctuation;

(v) Water quality assessment for surface water and groundwater;
(vi) Site water balance assessment;
(vii) Data analyses and report preparation, and;
(viii) Review and response to agency comments.

2.0 PREVIOUS STUDIES

DS reviewed the following previous studies during our background review:

- *"Headwater Drainage Feature Assessment: In Support of the Bolton Residential Expansion Study"*, by Aquafor Beech Ltd., dated June 16. 2013, File No.: 65473
- *"Preliminary Geotechnical Investigation, Proposed Residential Subdivision, Bolton Option 3 Lands, Bolton, Ontario"*, by DS Consultants Ltd., dated September 4, 2020, File No.: 20-169-100

A brief summary of the findings from each investigation/report is provided in the following sections.

2.1 Headwater Drainage Feature Assessment: In Support of the Bolton Residential Expansion Study (Aquafor Beech Ltd., 2014)

Aquafor Beech Limited (Aquafor) completed a *Headwater Drainage Feature Assessment* (2014) in support of the BRES Study being carried out by the Town of Caledon. The objectives of the investigation included delineation of Headwater Drainage Features (HDF) within the Option 3 Lands (Site). The study identified and classified a total of four (4) HDFs as summarized below:

- Headwater Drainage Feature-1 (HDF-1) is located in the eastern portion of the Site and consists of fifteen (15) stream reaches (1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1l, 1m, 1n and 1-o);
- Headwater Drainage Feature-2 (HDF-2) is located along the eastern boundary of the Site and consists of two (2) stream reaches (2a and 2b);
- Headwater Drainage Feature-3 (HDF-3) is located in the western portion of the Site and consists of seven (7) stream reaches (3a, 3b, 3c, 3d, 3e, 3f and 3g) ; and,
- Headwater Drainage Feature-4 (HDF-4) is located along the western property boundary of the Site and consists of three (3) stream reaches (4a, 4b and 4c). Stream reach 4b is noted to be an existing pond.

The Headwater Drainage Map by Aquafor (2014) is provided in **Appendix A**.

2.2 Preliminary Geotechnical Investigation, Proposed Residential Subdivision, Bolton Option 3 Lands, Bolton, Ontario (DS Consultants Limited, 2020)

A Preliminary Geotechnical Investigation was completed by DS Consultants Ltd., for the Site. The investigation involved advancing a total of sixteen (16) boreholes to depths ranging from 6.7 m to 11.3 m bgs. Groundwater monitoring wells were installed in thirteen (13) borehole locations (BH20-1, BH20-2,

BH20-3, BH20-4, BH20-5, BH20-6, BH20-7, BH20-9, BH20-11, BH20-12, BH20-14, BH20-15 and BH20-16) to permit monitoring of groundwater levels at the Site.

Based on the subsurface investigation completed at the Site, the Site was underlain by a surficial layer of topsoil, fill and/or disturbed native materials to depths of 0.8 m bgs, which in turn was underlain by native soils extending to the full depth of investigation. The native soils at the Site comprised of clayey silt/silty clay till material underlain by a lower cohesionless silt to sandy silt and silty sand deposits. Bedrock was not encountered to the full depth of investigation.

The clayey silt till was encountered under the fill layer in all borehole locations except BH20-4 and extended to depths ranging from 1.5 m to 7.7 m bgs and to the termination depth in Boreholes BH20-6, BH20-7, BH20-10, BH20-14 and BH20-15. The clayey silt to silty clay layer contained sand seams and trace to some amounts of sand, gravel and cobbles. The unit was noted to be moist to very moist and wet at the bottom of some borehole locations. The soil was generally found to be brown to grey in colour.

The lower cohesionless silt to sandy silt and silty sand deposits was found underlying the clayey silt to silty clay deposits in Boreholes BH20-1 to BH20-3, BH20-5, BH20-8, BH20-9, BH20-11 to BH20-13 and BH20-16 and extended to the full depth of investigation. This unit contained layers of sand and gravel/gravelly sand materials in the location of Borehole BH20-16 at various depths ranging from 1.5 m to 6.2 m bgs. The unit was noted to be moist to wet and brown to grey in colour.

The investigation involved equipping thirteen (13) borehole locations with 51 mm diameter monitoring wells to permit the monitoring of groundwater levels at the Site. On-completion groundwater levels were collected and noted to range from 2.3 m to 9.1 m bgs. Groundwater levels in the monitoring wells were measured in August 2020 and ranged from 0.2 m to 6.8 m bgs (Elev. 260.4 masl to 275.7 masl). Monitoring Well BH20-7 was found to be dry.

3.0 FIELD INVESTIGATION

To assess soil and groundwater conditions at the Site, DS used monitoring wells installed during the geotechnical investigation carried out in July 2020 which included thirteen (13) monitoring wells (MWs) installed in at borehole locations BH20-1 through BH20-7, BH20-9, BH20-11, BH20-12 and BH20-14 to BH20-16. The borehole and monitoring well locations are as shown in **Figure 4**. The detailed subsurface conditions are provided in the boreholes logs in **Appendix B**. MWs were constructed in accordance with O.Reg. 903, with 2-inch PVC casing and a 3.0 m length of screen (10 slot) in BHs 20-2, 20-3, and 20-4 and 1.5m length screen in the remainder of BHs. Screens were installed at varying depths ranging from 3.0 to 9.1 meters below ground surface (mbgs).

Monitoring wells were developed before use to allow for groundwater level monitoring, hydraulic conductivity testing, and to assess groundwater quality. Nine (9) single well response tests (SWRTs) were completed by performing a rising head test to estimate hydraulic conductivity values of the overburden at the Site.

Two (2) unfiltered groundwater samples were collected and analyzed against parameters listed in the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to nearby surface water features as part of the hydrogeological investigation.

Water quality testing at the Site consisted of collecting one (1) non-filtered groundwater sample and two (2) non-filtered surface water samples for comparison of water quality against the Provincial Water Quality Objectives (PWQO) to assess baseline water quality conditions at the Site prior to commencing construction activities.

4.0 PHYSICAL SETTING

Available topographic maps, environmental, geotechnical, and hydrogeological reports were used to develop an understanding of the physical setting of the study area. The borehole logs from all investigations at the site as well as the Ministry of the Environment, Conservation and Parks Water Wells Records (MECP WWRs) used to interpret the geological and hydrogeological conditions at the Site.

4.1 Physiography and Drainage

The Site is located within a physiographic region of southern Ontario known as the South Slope and within a physiographic landform feature known as the Drumlinized Till Plain (Chapman and Putnam, 1984). The South Slope physiographic region lies between the Oak Ridges Moraine in the north and the Peel Plain in the south. Much of the land surface topography and geology in southern Ontario was formed during the most recent glaciation period, known as the Wisconsin Glaciation, which was accompanied by various meltwater lakes and channels. The Pleistocene deposits present in the Caledon and Brampton area are associated with the advancing and retreating of this ice sheet. The South Slope consists of low-lying till plains, with undulating to gently rolling terrain and incised valleys around larger creeks and rivers. The South Slope has a gently, but steady slope to the southeast towards Lake Ontario, which results in overall good drainage. A regional physiography map for the Site and surrounding area is provided in **Figure 2A**.

The Site is located within the Main Humber subwatershed, part of the larger Humber River Watershed. There are numerous headwater drainage features located within the Site (Section 4.3.5). The closest surface watercourse to the Site is the Humber River, located approximately 1 km east of the Site. The topography within the Site is gently rolling with a general slope towards the south/southeast. The study area is characterized as having a moderate drainage and is directed overland into various streams on the Site.

4.2 Geology

The following presents a brief description of regional and site geology based on the review of available information and site-specific soil investigations.

4.2.1 Quaternary Geology

The surficial geology at the Site and in the surrounding area is predominantly comprised of clay to silt-textured silt (Ontario Geological Survey, 2010). A pocket of surficial ice-contact stratified deposits consisting of sand and gravel with minor amounts of clay, silt and till are present west of the Site. There are modern alluvial deposits consisting of clay, silt, sand and gravel deposits present along the Humber River and its tributaries in the east. An illustration of surficial geology for the Site and surrounding area is provided in **Figure 2B.**

4.2.2 Bedrock Geology

Available published mapping indicates that bedrock in the area predominantly comprises of shale and minor limestone part of the Queenston Formation (MNDM Map 2544 Bedrock Geology of Ontario). As part of the borehole drilling program within the Macville Community Site area, bedrock was not encountered to 11.3 mbgs (Elev. 250.4 masl), which was the maximum depth of investigation. Based on the MECP water well records, there are ten (10) water well records which were reportedly completed into bedrock. The thickness of the overburden generally ranged from 29.9 mbgs to 76.2 mbgs, based on nine (9) well records (MECP WWR No. 4908193, 1908194, 1907399, 1906470, 4905615, 7275497, 4903854, 7267796 and 4904216). There is one (1) well record (MECP WWR No. 4905839) located approximately 490 northeast of the Site with a reported depth to bedrock of 11.6 mbgs. This well record is located within the valley lands of the Humber River, and for this reason the ground surface elevation of the well is likely significantly lower than surface elevations across the Site.

A bedrock geology map for the Site and the surrounding area is provided in **Figure 2C**.

4.2.3 Site Geology

The stratigraphic setting of the Site was interpreted from the soil encountered during the current subsurface investigation. In summary, the Site is underlain by a surficial layer of topsoil / fill / disturbed native material, which in turn was underlain by native soil deposits extending to the full depth of investigation. The native soil deposits at the Site comprised of clayey silt till to silty clay till (Halton Till), which in turn was underlain by silt to sandy silt/sandy silt deposits. Sand and gravel alluvium deposits were encountered in the southeast corner of the Site (BH20-16). Bedrock was not encountered during the subsurface investigation.

The stratigraphic conditions encountered at the Site during the current subsurface investigations were generally consistent with the findings from the previously completed Preliminary Geotechnical Investigations at the 14275 The Gore Road and the Cook Property by SPL Consultants Ltd (Sections 2.4 and 2.5).

The stratigraphic conditions encountered in the boreholes are in detail summarized below.

Topsoil/Fill/Disturbed Native:

Topsoil was encountered at grade in all borehole locations with the exception of Borehole BH20-05. The depths of the topsoil varied from 200 mm to 550 mm, with an average thickness of 340 mm. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative of the Site and should not be relied on to estimate the quantity of topsoil at the Site.

A layer of earth fill / disturbed native material was encountered at all borehole locations and extended to a maximum depth of 0.8 m below the ground surface. The fill / disturbed native material generally consisted of sandy silt to clayey silt with trace gravel and trace amounts of topsoil/organics.

Halton Till Deposits (Clayey Silt Till to Silty Clay Till):

Glacial till deposits consisting of clayey silt to silty clay with trace amounts of sand and gravel was predominantly encountered underlying the surficial topsoil / fill / disturbed native soils in all borehole locations except for Borehole BH20-4. The till deposits consisted of occasional wet silt or sand seams/layers. The glacial till layer extended to depths ranging from 1.5 m to 11.3 mbgs and to the borehole termination depth in BH20-6, BH20-7, BH20-10, BH20-14 and BH20-15. The Standard Penetration Test (“N”) counts ranged from 8 to 72 blows for a penetration of 300 mm.

Newmarket Till (Silt / Sandy Silt / Silty Sand):

Silt/sandy silt/silty sand was encountered in all BHs but BH20-6, 20-7, 20-10, 20-14, and 20-15 extending to the limits of excavation wherever it is present. A massive layer of silty sand to sandy silt Newmarket till likely underlies the Halton till and modern alluvial deposits throughout the site, even where clayey silt is found to the extent of boreholes. “N” values ranged from 7 to greater than 100 blows for 300mm penetration.

Modern Alluvium (Sand and Gravel):

Sand and gravel deposits are not common throughout the site however they are present at the southeast corner of the site near the watercourse in BH 20-16. The sand and gravel layer extends from 1.5 to 6.2mbgs and is split by a sandy silt layer from 3.3 to 4.5mbgs

The location of the boreholes and monitoring wells is provided in **Figure 4**. The borehole logs are provided in **Appendix B**. Geological Cross-Sections A-A’ to F-F’, which depict the stratigraphic setting at the Site are provided in **Figure 5A to 5F**.

4.3 Hydrogeology

The hydrogeology at the Site was evaluated using the on-site monitoring wells, piezometers, and staff gauges installed by DS, local domestic wells and existing hydrogeological and environmental reports for the area.

4.3.1 Local Groundwater Use

As part of the hydrogeological study, DS completed a search of the Ministry of the Environment, Conservation and Parks (MECP) Water Well Record (WWR) database. Based on the MECP water well records search, there are seventy-three (73) water wells within 500 meters of the Site. Forty-seven (47) water wells are noted as domestic supply wells and six (6) wells are noted as commercial or industrial supply wells. Eight (8) wells are noted as test holes or monitoring wells. The remaining twenty-three (23) wells are either abandoned or unknown use. Private domestic and commercial water supply wells are drilled into sandy aquifers confined under clay till. The depths of these wells range from 5.5 to 65.2 mbgs. Domestic water supply records exist for wells drilled between the dates of January 15th, 1957 to June 13th, 2016. The water well record summary is included **in Appendix C. Figure 3** shows the MECP water well location plan.

It is recommended that a door-to-door private water well survey be completed within a 500 m radius of the Site to confirm the use of groundwater for private servicing in the study area.

There are zero (0) records of permit to take water (PTTW) within 500m of the site.

4.3.2 Groundwater Conditions

DS implemented a groundwater monitoring program at the Site in August 2020, with a Site visit to collect groundwater levels on a monthly basis for one (1) year to assess long-term groundwater fluctuations. Currently, the monitoring has been conducted from August 2020 to October 2020, and will ongoing until August 2021. **Figure 4** shows the monitoring well locations. **Table 1** presents a summary of the measured groundwater level elevations in all monitoring wells and piezometers.

Throughout the study area, groundwater levels were found to range between 255.2 masl (BH20-7) and 275.7 masl (BH20-1) in the proposed developmental area, which represent the groundwater levels within the overburden at the Site. Based on the groundwater elevation contours, the direction of groundwater flow is generally expected to be in a southeasterly direction with some flow in the southwestern quadrant of the Site to be directed in a southwesterly direction towards Monitoring Well BH20-7. The average hydraulic gradient in the northern portion of the Site is estimated to be 0.009 m/m from the west to the east. The average hydraulic gradient from the north to the south in the northern portion of the Site is estimated to be approximately 0.001 m/m. The average hydraulic gradient from the north to south in the southern portion of the Site is estimated to be approximately 0.008 m/m. Groundwater outlets to surface streams at the southwest and southeast limits of the site. A groundwater elevation contour and flow map is provided in **Figure 6**.

Continuous water level monitoring was conducted on four (4) select monitoring wells at BH20-5, BH20-7, BH20-12 and BH-20-16. Continuous monitoring was completed using a fixed interval pressure and temperature data recording device (Levelogger^{TM}) which was corrected for atmospheric pressure from a central location on the site. Based on the findings of the continuous monitoring to-date (August to October), the following is summarized:

- **Monitoring Well BH20-5 –** There was a decline in the groundwater level from 270.2 m to 269.7 m above sea level;
- **Monitoring Well BH20-7 –** The recovery in this monitoring well is noted to be significantly slow following development of the monitoring well. The water level has gradually risen to the currently measured level of 258.3 m above sea level, which is considered to not have been stabilized yet;
- **Monitoring Well BH20-12 –** The water level has stagnated at an approximate elevation of 264.8 m above sea level; and
- **Monitoring Well BH20-16 –** The water level has fluctuated between 263.0 m to 263.5 m above sea level.

Based on the above, the water levels in the monitoring wells have not varied significantly during the current monitoring period. The groundwater levels in the monitoring wells, with the exception of Monitoring Well BH20-7, have gradually declined during the late summer to the fall monitoring period. The water level recovery in Monitoring Well BH20-7 is noted to be significantly slow and has yet to stabilize at its static water level. For this reason, the water level Monitoring Well BH20-7 is not considered representative of actual groundwater conditions at this stage.

The hydrographs for the continuous groundwater monitoring are provided in **Appendix F**.

4.3.3 Hydraulic Conductivity

Single Well Response Tests (SWRTs) were completed by DS in nine (9) monitoring wells on August 6th and 7th, 2020 to estimate hydraulic conductivity (K) for the representative geological units in which the wells were screened. SWRTs were completed by performing a rising head test (slug test) using a bailer to remove water from the well. A data logger was placed at the bottom of the wells to monitor recovery. Hydraulic conductivity (k) values were calculated using the Bouwer and Rice method. **Table 2** presents a summary of the hydraulic conductivity (K) results for the representative geological units. The hydraulic conductivity values ranged from 7.4×10^{-9} m/sec to 3.2×10^{-6} m/sec for the clayey silt till and sandy silt till / silt unit. The hydraulic testing results are provided in **Appendix D.**

Table 2: Summary of Hydraulic Conductivity (K) Test Results

Well ID	Screen Interval (masl)	Screened Formation	K- Value(m/s)
BH20-1	272.2 m to 273.7 m	Silt	7.3×10^{-7}
BH20-5	264.0 m to 275.5 m	Silty sand	5.3×10^{-7}
BH20-6	262.5 m to 264.0 m	Clayey silt till, sand seams	1.4×10^{-7}
BH20-9	266.5 m to 268.0 m	Silty clay till, some sand	3.2×10^{-6}
BH20-11	261.0 m to 262.5 m	Silt, some sand	5.2×10^{-8}
BH20-12	257.3 m to 258.8 m	Silt	7.3×10^{-7}
BH20-14	257.1 m to 258.6 m	Silty clay till, some sand	6.0×10^{-7}
BH20-15	255.0 m to 256.5 m	Clayey silt till, some sand	7.4×10^{-9}
BH20-16	251.8 m to 259.4 m	Silty sand, some clay	1.5×10^{-8}

4.3.4 In-Situ Infiltration Testing

In-situ infiltration testing was conducted by DS field personnel on September 2nd, 2020. The testing was completed in the location of monitoring wells (BH20-1, BH20-2 and BH20-5 through BH20-16) as shown below in **Table 3**, to provide a preliminary field assessment of infiltration rates of surficial soils across the Site. Testing was completed following the guidelines outlined in the Low Impact Development (LID) Stormwater Management Planning and Design Guide for Stormwater Infiltration, 2010 (Appendix C Site Evaluation and Soil Testing Protocol).

To estimate the infiltration rate of soils in the test locations, **DS** completed in-situ infiltration testing at a depth of 0.5m and 1.5 m bgs. The testing included the use of a constant head infiltrometer which operates using the Marriott Bottle principal, whereby a shallow ponded head of water is maintained at a constant depth within an augured borehole. The steady-state flow of water into the subsurface soil following saturated conditions is regarded as the field saturated hydraulic conductivity (K_{fs}) rate respective of the depth of the head utilized. The results of the infiltration testing is summarized below in **Table 3**.

Table 3: Summary of Test Pits and Estimated Soil Infiltration Rates

Test Location	Test Depth (mbgs)	Soil Type	Water Head	Steady State Rate of Water Level Change (cm/min)	K_{fs} (cm/sec)	Infiltration Rate (mm/hr)
BH20-1	0.5	Sandy Silt	0.05 m	0.34	3.20E-05	34.1
	1.5	Silty Clay	0.05 m	0.03	2.82E-06	17.8
BH20-2	0.5	Sandy Silt	0.05 m	0.28	2.63E-05	32.4
	1.5	Silty Clay	0.05 m	0.02	1.88E-06	16.0
BH20-5	0.5	Sandy Silt	0.05 m	0.20	1.88E-05	29.6
	1.5	Silty Clay	0.05 m	0.04	3.76E-06	19.2
BH20-6	0.5	Silty Clay	0.05 m	0.11	1.03E-05	25.2
	1.5	Silty Clay	0.05 m	0.02	1.88E-06	16.0
BH20-9	0.5	Silty Clay	0.05 m	0.08	7.52E-06	23.1
	1.5	Silty Clay	0.05 m	0.03	2.82E-06	17.8
BH20-11	0.5	Silty Clay	0.05 m	0.48	4.51E-05	37.4
	1.5	Silty Clay	0.05 m	0.04	3.76E-06	19.2
BH20-12	0.5	Silty Clay	0.05 m	0.14	1.32E-05	26.9
	1.5	Silty Clay	0.05 m	0	No Infiltration - wet Soil Conditions	
BH20-14	0.5	Silty Clay	0.05 m	0.25	2.35E-05	31.4
	1.5	Silty Clay	0.05 m	0.05	4.70E-06	20.4
BH20-15	0.5	Silty Clay	0.05 m	0.40	3.76E-05	35.6
	1.5	Silty Clay	0.05 m	0.06	5.64E-06	21.4
BH20-16	0.5	Sandy Silt	0.05 m	0.44	4.14E-05	36.5
	1.5	Sand and Gravel	0.05 m	24.94	2.34E-03	107.6

Notes:
-m bgs– meters below ground surface
-Infiltration Rate approximated from Kfs using calculations provided in Figure C1 of Appendix C - Site Evaluation and Soil Testing Protocol (Low Impact Development (LID) Stormwater Management Planning and Design Guide for Stormwater Infiltration, 2010)

Based on the results of the infiltration testing, the site primarily consists of a low permeable silty clay till with a measured infiltration rate ranging from about 16 to 38 mm/hr with an average of 26 mm/hr. Soils with infiltration rates over 15 mm/hr are considered suitable for Soakaways, infiltration trenches and chambers (TRCA, 2010).

One test location at BH20-16 on the southeast corner of the Site contains sand and gravel deposits which extend from 1.5 to 6.2mbgs. The deep test (1.5 mbgs) was completed within the sand and gravel layer and produced an infiltration rate of about 108 mm/hr. The area is in the location of a proposed Storm water Management (SWM) pond. Based on test results there appears to be a good opportunity for infiltration measures in areas surrounding the SWM pond assuming there is a minimum of 1 m clearance between the top of the seasonally high water table and the bottom of any infiltration measure.

For the purpose of calculating design infiltration rates for on-site LID measures, Table C2 in the "Low Impact Development Stormwater Management Planning and Design Guide" (Appendix C), was used to determined safety correction factors for each of the test pit locations. The safety factors are applied to the measured infiltration rates of soils for each location to address heterogeneity of the soils. The calculated safety correction factors and the design infiltration rates for each location was determined to be 2.5. As a result of applying the safety correction factors, an infiltration rate ranging from about 6 to 15 mm/hr (average 10 mm/hr), can be considered for design purposes at the tested locations within the silty clay soils. A design infiltration rate of 43 mm/hr was calculated for the tested location within the sand and gravel deposits. Shallow groundwater levels in the vicinity of BH20-12 interfered with in-situ test results at this location. Buried infiltration facilities in this location are not recommended. Continued water level monitoring at all locations is recommended to ensure a minimum of 1 m clearance between the top of the seasonally high water table and the bottom of any infiltration measure.

4.3.5 Groundwater Quality

Unfiltered groundwater samples were collected from the selected monitoring well location (BH 20-4) on September 4th, 2020 to assess groundwater quality. The collected samples were submitted to SGS Laboratory in Lakefield, Ontario. SGS Laboratory is a Canadian Association of Laboratory Accreditation Inc. (CALA) and Canadian Standard Association (CSA) certified. Groundwater quality results were compared to parameters listed in the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to nearby surface water features as part of the hydrogeological investigation. Analytical results indicate that the concentration of Cobalt exceeded PWQO standards at least at one monitoring well location. **Table 4** presents a summary of exceeded parameters.

Table 4: Parameters in Groundwater Exceeding MECP Guidelines

Parameter Exceeded	Guideline	Unit	Borehole #	Guideline limit	Concentration
Cobalt	MECP O.Reg. 153/04 Table 2	μg/L	20-4	**3.8**	**5.16**

4.3.6 Surface Water Conditions

The surface water and drainage setting at the Site comprises a total of eight (8) wetlands (Wetland 1, 2, 3, 4, 5, 6, 7 and 8), which are incorporated into the tributaries of the Humber River and ultimately flow into Lake Ontario. All accessible wetlands at the Site were instrumented with surface stations consisting of staff gauges and associated nested piezometer set.

A 1-year pre-construction surface water and groundwater monitoring program of the Site is currently underway, and this report includes the findings from the data collected to-date during the August to October of 2020 monitoring period. All staff gauges installed within the wetlands at the Site have been instrumented with a Levelogger^{TM} to allow for continuous monitoring at every 15-minute interval. The monitoring program includes a Site visit on an every 1-month basis to retrieve the water level data from the Levelogger^{TM} and to collect manual readings within all surface stations and monitoring wells at the Site.

As discussed in Section 2.1, Aquafor (2014) completed a *Headwater Drainage Feature Assessment* of the Site and delineated the four (4) Headwater Drainage Features (HDFs) and their associated reaches at the Site. The surface stations are installed within the delineated drainage reaches at the Site.

The location of the wetlands is provided in **Figure 4**.

A discussion on the surface water conditions at all surface stations is provided below.

Wetland 1 and 2

Wetland 1 and 2 are located within the southwestern corner of the Site along The Gore Road and within the Headwater Drainage Feature HDF-4. Due to accessibility constraints, Wetland 1 could not be instrumented with a surface station to permit monitoring within the wetland. Wetland 2 was equipped with a staff gauge, SG W2-1, and a nested piezometer set, W2-PZS and W2-PZD within Reach 4a. The shallow and deep nested piezometers were installed to depths of 1.1 m (Elev. 260.5 masl) and 2.0 m (259.5 masl) below existing ground surface, respectively. Staff gauge SG W2-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W2-1 is approximately 261.3 masl.

During the continuous monitoring of staff gauge SG W2-1 in Wetland 2, the Reach 4a channel has generally remained dry during the August to October monitoring period, with some flow observed following precipitation events. This flow was noted to diminish into dry conditions within 1-2 days after the cessation of the storm event. The manual groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels are slightly above the base of the Reach 4a channel during the current monitoring period. The water level in the shallow piezometer was found to be approximately 0.1 m to 0.2 m above the base of the Reach 4a channel. The water level in the deep piezometer was found to be approximately 0.08 m to 0.16 m above the base of the Reach 4a channel. The shallow groundwater gradient at the location of Reach 4a was found to be downward during the current monitoring period; with a decline in the gradient from 0.04 m/m to 0.03 m/m between September and October 2020.

The flow observed in the monitoring data for the Reach 4a channel after precipitation events may potentially be as a result of the low permeability surficial silty clay till soils precluding the free infiltration of storm water into the ground. This allows for the saturation of the near surficial soils creating perched groundwater conditions, which in turn further reduces the soil infiltration rates and allows for increased surface runoff along the Reach 4a channel. Nearby Monitoring Well BH20-7 indicates the deep groundwater level to be measured at 4.5 m below existing grade (Elev. 257.2 masl) during highest point in the current monitoring period. For this reason, groundwater is not considered to be recharging the Reach 4a channel. There is also a potential for recharging of the surface water in the Reach 4a channel from the up-gradient Reach 4b (pond) and 4c of HDF-4. Given that the primary source of flow in the Reach 4a channel during the current monitoring period is determined to be from precipitation events, this channel is considered an ephemeral feature. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrographs for Wetland 1 and 2 are provided in **Appendix F**.

Wetland 3

Wetland 3 is located within the southwestern portion of the Site and within the Headwater Drainage Feature HDF-3. The wetland was equipped with a staff gauge, SG W3-1 and a nested piezometer set, W3-PZS and W3-PZD within Reach 3c of HDF-3. The shallow and deep nested piezometers were installed to depths of 1.0 m (Elev. 269.9 masl) and 1.9 m (269.1 masl) below existing ground surface, respectively. Staff gauge SG W3-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland at approximate ground surface elevation of 270.7 masl. Wetland 4 is located downstream of this wetland location with respect to surface water flow.

During the continuous monitoring of staff gauge SG W3-1 in Wetland 3, Reach 3c has generally remained dry during the August to October monitoring period, with very minimal response to precipitation events. Flow in the Reach 3c was rare, however diminished into dry conditions within the same day from appearing in the data. The manual groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels are below the base of Reach 3c. The water level in the shallow piezometer was found to be approximately 0.25 m to 0.44 m below the base of Reach 3c. The water level in the deep piezometer was found to be approximately 0.33 m to 0.64 m below the base of Reach 3c. The shallow groundwater gradient at the location of Reach 3c was found to be upward during the current monitoring period; with a decline in the gradient from 0.25 m/m to 0.10 m/m between September and October 2020.

Reach 3c is located within tiled agricultural cropland without a discernable channel (Aquafor, 2014). The short-lived flow observed in the monitoring data for Reach 3c following precipitation is not considered to be a prevalent flow due to the absence of a defined channelized morphology at this location. Further, given that the shallow groundwater levels recorded in the nested piezometers during the current monitoring period are below the base of Reach 3c, there is no contributions to the feature from groundwater during the late summer and fall period. Given that Reach 3c had some minor response to precipitation events, the feature is considered ephemeral. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrographs for Wetland 3 is provided in **Appendix F**.

Wetland 4

Wetland 4 is located within the southwestern corner of the Site, east of Wetland 2 within the Headwater Drainage Feature HDF-3. Wetland 4 was equipped with a staff gauge, SG W4-1, and a nested piezometer set, W4-PZS and W4-PZD within the Reach 3a channel. The shallow and deep nested piezometers were installed to depths of 0.6 m (Elev. 260.7 masl) and 1.6 m (259.5 masl) below existing ground surface, respectively. Staff gauge SG W4-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W4-1 is approximately 261.0 masl.

During the continuous monitoring of staff gauge SG W4-1 in Wetland 4, the Reach 3a channel has generally remained dry during the August to October monitoring period, with very minimal response to precipitation events. Flow in the Reach 3a was rare, however diminished into dry conditions within the same day from appearing in the data. The manual groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels are below the base of Reach 3a. The water level in the shallow piezometer was found to range from 0.1 m to more than 0.3 m below the base of Reach 3a. The water level in the deep piezometer was found to be approximately 0.3 m to 1.3 m below the base of Reach 3a. The shallow groundwater gradient at the location of Reach 3a was found to be downward during the current monitoring period; with a magnitude of 0.17 m/m.

All up-gradient reaches (3b, 3c, 3d, 3e, 3f and 3g) in HDF-3 are located within tile agricultural cropland without discernible channels (Aquafor, 2014). For this reason, based on the current data, recharge of surface flows for Reach 3a from up-gradient reaches in HDF-3 is not considered to be likely. Given that the shallow groundwater levels recorded in the nested piezometers during the current monitoring period are below the base of Reach 3a, there is no contribution to the feature from groundwater during the late summer and fall period. Given that Reach 3a had some minor response to precipitation events, it is considered an ephemeral feature. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrograph for Wetland 4 is provided in **Appendix F**.

Wetland 5 and 6

Wetland 5 and 6 are located near the southern boundary of the Site along King Street, east of Wetland 4 within the Headwater Drainage Feature HDF-3. Both wetlands are equipped with a single staff gauge, SG W5-1, and a nested piezometer set, W5-PZS and W5-PZD within Reach 3g. The shallow and deep nested piezometers were installed to depths of 0.8 m (Elev. 260.5 masl) and 1.8 m (259.4 masl) below existing ground surface, respectively. Staff gauge SG W5-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W5-1 is approximately 261.1 masl.

During the continuous monitoring of staff gauge SG W5-1, the Reach 3g channel has generally remained dry during the August to October monitoring period, with some flow observed following precipitation events. This flow was noted to diminish into dry conditions within 1-2 days after the cessation of the storm event. The manual groundwater monitoring in the nested piezometers indicate the following:

- The water level in the shallow piezometer was 0.02 m above the base of Reach 3g channel during the September measurement, and 0.013 m below the base of Reach 3g channel during the October measurement

- The water level in the deep piezometer was 0.003 m below the base of the Reach 3g channel during the September measurement, and 1.2 m below the base of the Reach 3g channel during the October measurement.

The shallow groundwater gradient at the location of Reach 3g was found to be downward during the current monitoring period; with a rise in the gradient from 0.019 m/m to 1.1 m/m between September and October 2020.

The flow observed in the monitoring data for the Reach 3g channel after precipitation events may potentially be as a result of the low permeability surficial silty clay till soils precluding the free infiltration of storm water into the ground. This allows for the saturation of the near surficial soils creating perched groundwater conditions, which in turn further reduces the soil infiltration rates and allows for increased surface runoff along the Reach 3g channel. Based on the monitoring of Wetland 5 and 6 during the late summer and fall monitoring period, groundwater was not considered a source for contributions to surface water flow in Reach 3g. Groundwater levels observed in the shallow piezometer at the elevation of the Reach 3g streambed is considered to be perched groundwater conditions. All up-gradient reaches (3f and 3g) in HDF-3 are located within tile agricultural cropland without discernible channels (Aquafor, 2014). For this reason, based on the current data, recharge of surface water flows for Reach 3g from up-gradient reaches in HDF-3 is not considered to be likely. Given that the primary source of flow in the Reach 3g channel during the current monitoring period is determined to be from precipitation events, this channel is considered an ephemeral feature. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrographs for Wetland 5 and 6 are provided in **Appendix F**.

Wetland 7

Wetland 7 is located within the southeastern portion of the Site, north Wetland 8 and within the Headwater Drainage Feature HDF-1. The wetland was equipped with a staff gauge, SG W7-1 and a nested piezometer set, W7-PZS and W7-PZD within Reach 1d of HDF-1. The shallow and deep nested piezometers were installed to depths of 1.1 m (Elev. 269.9 masl) and 1.8 m (269.1 masl) below existing ground surface, respectively. An additional staff gauge SG W7-2 was installed on the upstream end of the wetland within Reach 1e. Staff gauge SG W7-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the local low point of the wetland at its upstream location. The ground surface elevation at the location of staff gauge SG W7-1 is approximately 261.3 masl.

During the continuous monitoring of staff gauge SG W7-1 and manual monitoring of SG W7-2 in Wetland 7, both Reach 1d and Reach 1e have consistently remained dry during the entire August to October monitoring period. Staff gauge SG W7-1 did not display any response to precipitation events. The manual groundwater monitoring in the nested piezometer (W7-PZS and W7-PZD) were noted to be dry during this monitoring period.

All up-gradient reaches (1e, 1f, 1k, 1l, 1m and 1n) are located in tiled agricultural croplands without discernable channels. For this reason, there is likely no surface water recharge from any upstream reaches in HDF-1. Further, the dry conditions indicate that there is no surface water and groundwater interaction during the August to October monitoring period. At this stage, Reach 1d is considered a non-perennial surface water feature. Further monitoring will be required to confirm seasonal fluctuations and to confirm the surface/groundwater dynamics.

The hydrograph for Wetland 7 is provided in **Appendix F**.

Wetland 8

Wetland 8 is located in the southeastern portion of the Site along Humber Station Road and within the Headwater Drainage Feature HDF-1. Wetland 8 was equipped with a staff gauge, SG W8-1, and a nested piezometer set, W8-PZS and W8-PZD within the Reach 1a channel. The shallow and deep nested piezometers were installed to depths of 0.8 m (Elev. 262.8 masl) and 1.7 m (261.9 masl) below existing ground surface, respectively. Staff gauge SG W8-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W8-1 is approximately 263.4 masl.

During the continuous monitoring of staff gauge SG W8-1 in Wetland 8, the Reach 1a channel has sustained flow for the majority of September with increased response to precipitation events during this period. The flow in the Reach 1a channel was noted to become dry at the end of September and transitioning into the October period. During the dry period, the Reach 1a channel did not display any response to any storm events. The manual groundwater monitoring in the nested piezometers indicate the following:

- The water level in the shallow piezometer was 0.02 m above the base of Reach 1a channel during the September measurement, and was found dry during the October measurement

- The water level in the deep piezometer was 0.08 m below the base of the Reach 1a channel during the September measurement, and was found dry during the October measurement.

The shallow groundwater gradient at the location of Reach 1a was found to be upward during the September monitoring period with a magnitude of 0.036 m/m.

Up-gradient Reaches 1d, 1e, 1f, 1g, 1i, 1j, 1k, 1l, 1m and 1n are located within tile agricultural cropland without discernable channels (Aquafor, 2014). Further, upstream Reaches 1b and 1c comprise of a well-defined channel, which may allow for flow of surface water downgradient into Reach 1a. Reach 1h also has a reported well-defined channel, however connectivity with Reach 1a is lost as a result of the absence of a channel along the intermediary Reach 1g (Aquafor, 2014). It is likely that surface water flows carried from Reach 1b and 1c allows for recharge to Reach 1a following precipitation events and/or at times of high groundwater tables. Based on the groundwater elevation contours (**Figure 6**), the deeper groundwater level in the area of Reach 1a during the current monitoring period is expected to be approximately 262.0 masl to 263.0 masl. Given that monitoring from the nested piezometer indicated an upward shallow groundwater gradient, it is possible that surface water flows in Reach 1a may receive contribution from groundwater. For this reason, Reach 8 is likely an intermittent surface water feature, however further monitoring will be required to confirm seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrograph for Wetland 8 is provided in **Appendix F**.

4.3.7 Surface Water Quality

DS collected two (2) surface water samples on October 24, 2020; one (1) from the surface water stream in the southwest corner of the Site (Surface Station: SG W2-1); and one (1) sample from the surface water stream in the southeast corner of the Site (Surface Station: SG W8-1). The collected samples were submitted to ALS Laboratory in Richmond Hill, Ontario. ALS Laboratory is a Canadian Association of Laboratory

Accreditation Inc. (CALA) and Canadian Standard Association (CSA) certified. The samples were analyzed for general chemistry parameters, total suspended solids and dissolve oxygen against the Provincial Water Quality Objectives (PWQO) for surface water to assess suitability of discharge to nearby surface water features as part of the Hydrogeological Investigation. **Table 5** presents a summary of exceeded parameters**.**

Table 5: Parameters in Surface Water Exceeding the PWQO

Parameter Exceeded	Unit	Sample Location	Guideline limit	Concentration (SG W2-1)	Concentration (SG W8-1)
Aluminum	ug/L	Surface stream	**75**	**2,610**	**2,400**
Aluminum	mg/L	Surface stream	**0.015**	**0.034**	**0.096**
Arsenic	ug/L	Surface stream	**5**	**12.0**	1.0
Cobalt	ug/L	Surface stream	**0.9**	**1.86**	**1.87**
Copper	ug/L	Surface stream	**5**	**6.9**	3.2
Iron	ug/L	Surface stream	**300**	**36,800**	**4,300**
Phosphorus	mg/L	Surface stream	**0.01**	**1.93**	**0.358**
Zinc	ug/L	Surface stream	**20**	**24**	**19**

Bold – parameter exceeds the PWQO standards.

Based on the analytical testing results, both surface water samples exceeded the PWQO for various parameters.

The certificate of analysis report is provided in **Appendix E.**

5.0 SITE WATER BALANCE

To understand and compare existing hydrologic conditions, a Thornthwaite site water balance was completed. The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. Inputs to the model are monthly temperature, Site latitude, precipitation, and stormwater run-on. Outputs include monthly potential and actual evapotranspiration, evaporation, water surplus, total infiltration, and total runoff. For ease of calculation, a spreadsheet model was used for the computation.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table, or evaporate/evapotranspiration (ET) from the earth's surface and vegetation. The sum of R and I is termed as the water surplus (S). When long-term averages of P, R, I and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for small changes in ST. The annual water budget can be stated as **P = ET + R + I + ST** and the components are discussed below.

Precipitation (P)

Based on the 30-year average for the Toronto Pearson Airport Climate Station in Ontario, the average precipitation for the area is about 786 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in **Table G-1, Appendix G.**

Storage (St)

Groundwater storage (ST) of native soils for the existing Site was estimated using values of Water Holding Capacity (mm) of respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning & Design Manual (MOE, March 2003). The land uses, soil types and respective water holding capacities chosen to represent existing conditions at the Site include the following with their respective water holding capacity applied to March for monthly calculations:

- Pasture/Shrubs, Silty Clay Soils – 200 mm
- Moderately Rooted Crop, Silty Clay Soils – 150 mm
- Urban Lawns, Pervious Development – 75 mm

Using the procedures outlined in the SWM Planning & Design Manual for the above land use and soil type, the annual change in storage is zero (0).

Evapotranspiration (Et)

Monthly Potential Evapotranspiration (PET) is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite,1948; Mather, 1978). In the Thornthwaite water balance model, PET is calculated using the Hamon equation (Hamon, 1061);

PET Hamon = 13.97 * d * D2 * Wt

Where:
d = the number of days in the month
D = the mean monthly hours of daylight in units of 12 hours
Wt = a saturated water vapour density term = 4.95 * e0.627/100
T = the monthly mean temperature in degrees Celsius

The calculated Actual Evapotranspiration (AET) is based on PET and changes in ST (Δ ST). Where there is not enough P to satisfy PET, a reduction in ST occurs. As a result, volumes of AET are less than PET. Also, it is assumed that evaporation will occur and will amount to approximately 15% of the total precipitation for an impervious cover.

Precipitation Surplus (S)

Precipitation surplus is calculated as P–ET. For pervious areas, ET is considered AET and for impervious areas, ET is evaporation.

Infiltration (I) and Runoff (R)

For pervious areas, precipitation surplus has two components in the Thornthwaite model: a runoff component (overland flow that occurs when soil moisture capacity is exceeded) and an infiltration component. The accumulation of infiltration factors for topography, soil types and cover as prescribed in Table 3.1 of the SWM Planning & Design Manual give infiltration factors for existing conditions on the Site as shown below in **Table 6**. The runoff component calculated in the pre-development model is the remaining volume of precipitation surplus following AET, ET, and infiltration.

Table 6 - Existing Conditions – Infiltration Factor

Land uses / soil types	Topography	Soil	Cover	Total Infiltration Factor
Pasture & Shrubs / Clay Loam	0.1	0.15	0.15	0.4
Moderately Rooted Crop / Clay Loam	0.1	0.15	0.1	0.35
Urban Lawns / Clay Loam	0.1	0.15	0.05	0.3

5.1 Pre-development Water Balance

The Site has a total area of 181.7 ha and is predominantly comprised of landscaped/vegetated areas with only 1.7% of the total Site area comprising of existing buildings and asphalt/paved hard surfaces. **Figure 7** shows the pre-development conceptual model considered for establishing current hydrologic conditions. To predict outputs of the pre-development water balance, various inputs were entered into the Thornthwaite model including monthly precipitation and temperature, site latitude, water holding capacity values for native soils and factors of infiltration. Various inputs and outputs of the model are summarised below.

The average annual precipitation rate for the area is approximately 786 mm/year. In the pervious area of the Site, the PET is estimated to be 605 mm/year, which is approximately 77% of the total annual precipitation rate. Based on the monthly distribution of soil storage for all pervious areas of the Site characteristic of silty clay soils, the resulting annual AET rate for each pervious area will be as follows:

- Pasture/Shrubs – 551.6 mm/year
- Moderately Rooted Crop – 533.9 mm/year
- Urban Lawn – 501.8 mm/year

There will not be any evapotranspiration from the existing impervious area of the Site however a loss of 15% from all incoming precipitation and surface runoff due to evaporation is accounted for in the water balance model. All water surplus in the existing impervious area of the Site will convert into surface runoff.

Based on the above, the resulting annual evapotranspiration, infiltration and runoff volumes for each area of the Site during the pre-development period is summarized in **Table 7** below.

Table 7 – Summary of Pre-Development Water Balance

Land Uses / Soil Types	ET Volume (m^3/year)	AET Volume (m^3/year)	Infiltration Volume (m^3/year)	Runoff Volume (m^3/year)
Pasture & Shrubs / Clay Loam	NIL	115,750	19,505	29,257
Moderately Rooted Crop / Clay Loam	NIL	789,624	130,527	242,407
Urban Lawns / Clay Loam	NIL	49,398	8,394	19,585
Impervious Areas	3,708	-	-	21,010
Total	***3,708***	***953,773***	***158,426***	***312,260***

The detailed calculations are provided in **Table G-2, Appendix G**.

5.2 Post-development Water Balance

To predict outputs of the post-development water balance, the same elements of the 30-year average weather data and site latitude inputs were used. Various inputs and outputs of the post-development model are described in detail below. **Figure 8** shows the post-development conceptual model considered for establishing current hydrologic conditions. The detailed calculations are presented in **Table G-3, Appendix G**.

PRECIPITATION (P)

Based on the 30-year average for the Toronto Pearson Airport Climate Station, the average precipitation for the area is about 786 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in **Table 1, Appendix G.**

STORAGE (ST)

Groundwater storage (ST) of native soils for the post-development scenario was estimated using the values of soil moisture holding capacity or respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning and Design Manual (MOE, March 2003). The land uses, soil types and respective water holding capacities chosen to represent existing conditions at the Site including the following with their respective water holding capacity applied to March for monthly calculations:

- Pasture/Shrubs, Silty Clay Soils – 200 mm
- Urban Lawns/Landscaped, Previous Development – 75 mm

Similar to the pre-development conditions, using the procedures outlined in the SWM Planning & Design Manual for each land use, the annual change in storage is 0. The monthly distribution of ST for each of the land use/soil types is presented in **Table G-1, Appendix G**.

EVAPORATION / EVAPOTRANSPIRATION (ET)

The proposed plans for development during the post-construction period will result in an increase in the total impervious hard surfaces across the Site. The total area of impervious surfaces following the proposed plans for construction is approximately 1,277,392 m^2. In the impervious areas, it is assumed that only evaporation will occur and will amount to approximately 15% of the total precipitation. Considering a total annual precipitation of 786 mm/year, evaporation is estimated at 118 mm. On this basis, the total annual volume of evaporation is estimated at 150,604 m^3/year. The detailed calculations for evaporation are included in **Table G-3, Appendix G**.

For post-development pervious areas, monthly PET is estimated using the same inputs and calculations described in the pre-development model respective of land use and soil moisture holding capacity. In the post-development scenario, annual AET is 62,780 m^3/year for the pasture/shrubs area and 213,660 m^3/year for the pervious landscape/developmental area of the Site. The monthly distribution of Post-development AET and detailed calculations are presented in **Table G-3, Appendix G**.

PRECIPITATION SURPLUS (S)

For post-development pervious surfaces at the site, precipitation surplus is calculated as the difference between precipitation and actual evapotranspiration (P–AET), which is summarized below for each of the post-development pervious catchment areas:

- Pasture/Shrubs – 234.4 mm/year
- Pervious Landscaped – 284.2 mm/year

For Impervious surfaces at the site, surplus is P-ET where ET is estimated at 15% of P. The resulting precipitation surplus is about 853,426 mm/yr. The more detailed calculations are included in **Table 3, Appendix G**.

INFILTRATION (I)

The same accumulation of infiltration factors for topography, soil types and cover as prescribed in Table 3.1 of the SWM Planning & Design Manual were used give infiltration factors for post-development conditions.

Considering the infiltration factors used, the total volume of Infiltration (I) estimated for post-development conditions of each pervious areas of the Site is summarized below:

- Pasture/Shrubs – 10,671 mm/year
- Previous Landscaped – 36,305 mm/year

The more detailed calculations are presented in **Table G-3, Appendix G**.

RUNOFF (R)

The runoff component calculated in the post-development model is a combination of the remaining volume of precipitation surplus for both pervious and impervious areas. The total volume of runoff (R) estimated for the post-development conditions of the pervious areas is summarized below:

- Pasture/Shrubs – 16,007 m^3/year
- Pervious Landscaped – 84,712 m^3/year

All precipitation water over impervious hard surfaces will convert into surface runoff after accounting for evaporative losses. On this basis, the resulting surface runoff over the impervious lands during the post-construction period is estimated to be 853,426 m^3/year.

The more detailed calculations are presented in **Table G-3, Appendix G**.

5.3 Post-development Water Balance (With Mitigation)

A summary of the results from the pre- and post-development water balance without mitigation is provided in **Table 8** below:

Table 8 – Summary of Pre- and Post-Development Site Water Balance (without Mitigation)

	Pre-Development	Post-Development	Change
ET (m^3/year)	3,708	150,605	-146,897
AET (m^3/year)	953,772	276,441	677,331
Infiltration (m^3/year)	158,426	46,976	111,450
Runoff (m^3/year)	312,260	954,144	-641,884

During the post-construction period, there is an increase in the area of hard surface paving/imperviousness, which in turn resulted in an overall increase in surface runoff. The decrease in the available pervious/landscaped area during the post-construction period resulted in a decreased in the annual AET and infiltration volumes. There has been an increase in the volume of evapotranspiration during the post-construction period as a result of increased volume of surface runoff over impervious surfaces which is subjected to evaporation. A summary of the results of the water balance is provided in **Table G-6 and G-7, Appendix G**.

To minimize the effects of increased impervious area, Low Impact Development (LID) measures which promote onsite infiltration should be incorporated into the development plan. Based on the *"Functional Servicing Report, Macville Secondary Plan, Macville, Town of Caledon, Region of Peel, 1st Submission"*, by Urbantech, Prepared for Bolton Option 3 Landowners Group, dated January 2021, File No.: 15-458, the following LID measures are currently under consideration to meet the water balance deficit:

- Downspout Disconnection
- Additional Topsoil Depth
- Swales
- Infiltration Facilities
- Rain Gardens
- Rainwater Harvesting

Stormwater management practices at the Site following the construction period should involve directing all roof and surface runoff towards the above considered LID facilities to allow for gradual re-infiltration of collected storm water into the ground. It should be noted that if any stormwater is collected from surface runoff over paved impervious lands, then pre-treatment of the collected water will be required prior to permitting infiltration into the ground through any LID facilities.

It should be noted that the detailed design of the LID facilities at the Site during the post-construction period have not been finalized. For this reason, a post-development water balance to account for the effectiveness of the proposed LID mitigation measures to meet the water balance deficit of the post-development Site could not be completed at this time. During the detailed design stage, **DS** should be consulted to estimate the water balance, which accounts for the actual considered mitigation measures.

Please refer to the above-referenced Functional Service Report (FSR) by Urbantech (2021) for further information regarding the LID's under consideration.

6.0 FEATURE BASED WATER BALANCE

6.1 Pre-development Subcatchments

Pre-development catchment mapping showing topographical drainage divides and wetland catchments were provided by Urbantech (2021) to document existing drainage patterns across the site and determine which areas are within the catchments of wetlands W1 through W9. The mapping was completed to inform the proposed functional servicing for the development. Wetland and constraints mapping was provided by Beacon. The Pre-Development catchment map is presented in **Figure 9**.

The pre-development mapping shows catchments for 9 wetland units including W1 through W9. Catchments for wetlands W1 to W6 includes west areas of the Site which drain south across King Rd. Each of these catchments are limited to within the Site boundaries with exception to some ditch and road runoff from the east side of The Gore Rd. The largest subcatchment is mapped draining directly into W7 and includes approximately 75.9 ha of upgradient area which runs onto the Site via HDF WHT6-E. The drainage feature appears to be captured within a collector pipe which is observed to transect the Site from the north boundary to somewhere between wetland W7 and W8. The entire catchment area within the Site is currently tile drained. Flow exists the Site at wetland W8 via a culvert across Humber Station Road approximately 30m north of the southeast corner of the Site. Wetland catchment W9 is located east of the Site and the CP Rail. The wetland is not within the Sites boundaries however there is a small portion of the catchment within the proposed development area.

6.2 Post-Development Subcatchments

Post-development wetland catchments were provided by Urbantech to document proposed changes to existing drainage patterns for wetland catchments W1 to W6. The Post-Development Catchment Map is provided in Drawings 501 to 503 in Functional Servicing Report (Urbantech 2021). Based on the post-development wetland catchments provided, changes to catchment boundaries for Wetland 1 to 6 include area reductions of about 48 to 87%. The post development boundaries are limited to the wetland / constraints boundaries with exception to about 90 residential lots which are proposed to drain uncontrolled into the wetland features. The uncontrolled drainage includes runoff from pervious back yards and half of the roof area which includes roof leaders discharging to backyards. A summary of changes to catchment size and imperviousness is provided in **Appendix G, Table G-6**.

Wetlands W7 and W8 are proposed to be relocated and so were not included in the post-development water balance assessment. It should be noted that the external run-on from HDF WHT6-E which is currently conveyed to wetlands W7/W8 via a drainage pipe is proposed it be redirected toward the relocated features to provide runoff contributions as required. Wetland W9 was also not included in the water balance assessment as it is located off Site and was not accounted for in the post-development catchment mapping.

6.3 Wetland Water Balance Risk Evaluation

To aid in determining the level of risk and evaluation requirements for the study, an assessment was completed using the Wetland Water Balance Risk Evaluation guidelines provided by the Toronto and Region Conservation Authority (TRCA, Nov 2017). The guideline provides criteria used to evaluate the magnitude of potential hydrological impact on a wetland. The criteria include:

i) The proportion of impervious cover in the catchment of the wetland that would result from the proposal;
ii) The degree of change in the size of the wetland catchment;
iii) Water taking from, or discharge to, surface water bodies or aquifers directly connected to the wetland, and;
iv) The impact on locally significant recharge areas.

Considering the above criteria, increases to impervious cover and changes to wetland catchment size were evaluated.

6.3.1 Impervious Cover Score

An increase in the percent of impervious cover within a wetland catchment has the effect of reducing infiltration and potentially decreasing baseflow and/or interflow contributions to the wetland. It further increases runoff contributions and risks of flooding and potentially increases stormwater sediment and contaminant loading. To assess the risk of the proposed impervious surfaces on sensitive features including Wetlands 1, 2, 3 and 5/6, the Impervious Cover Score (S) was calculated for each of the catchments. The equation defining S is as follows:

$$S = \frac{IC \cdot Cdev}{C}$$

where,

IC is the proportion of impervious cover proposed within the specific catchment (as a percentage between 0 and 100)
C dev is the total proposed development area within the catchment (in ha)
C is the size of the wetland's catchment (in ha).

Results of the calculation are provided in **Table 9** and show that wetland catchment W1 to W6 are presented with low risk based on the calculated S.

Table 9 –Impervious Cover Score - Probability and Magnitude of Hydrological Change

Subcatchment Area Name	Pre-development Catchment Size (m^2)	Proposed Impervious Cover (m^2)	Impervious Cover Score (S) (%)	Sensitive Feature	magnitude of hydrological change
Wetland 1 (W1)	13,402	85	0. 6	Wetland	Low
Wetland 2 (W2)	50,784	1,615	3.2	Wetland	Low
Wetland 3 (W3)	225,600	1,785	0.8	Wetland	Low
Wetland 4 (W4)	62,040	2,083	3.4	Wetland	Low
Wetland 5 (W5)	74,225	1,062	1.4	Wetland	Low
Wetland 6 (W6)	47,447	1,020	2.1	Wetland	Low

Note: * Impervious Cover Score (S) calculated using equation 1 (TRCA - Wetland Water Balance Risk Evaluation, Nov 2017)

6.3.2 Change in Catchment Size

Changes to catchment size directly effects the volume and timing of stormwater contributions to downgradient features. To evaluate the magnitude of hydrological change these effects can have, pre-development and post-development catchments were compared. **Table 10** provides the area breakdown for pre and post-development conditions. The same magnitude thresholds used for impervious cover (10% and 25 %) are used as thresholds to define catchment size alteration. As a result, changes to catchment size for W1 to W6 is considered high risk.

Table 10 –Changes to Catchment Size - Probability and Magnitude of Hydrological Change

Subcatchment Area Name	Pre-development catchment area (m²)	Post-Development Catchment Area (m²)	% Change in Catchment Area	Sensitive Feature	Magnitude of Hydrological Change *
W1	13,402	2,200	84 % decrease	Wetland	High
W2	50,784	26,500	48 % decrease	Wetland	High
W3	225,600	30,399	87 % decrease	Wetland	High
W4	62,040	14,915	76% decrease	Wetland	High
W5	74,225	17,101	77% decrease	Wetland	High
W6	47,447	11,600	76% decrease	Wetland	High

Note: * Based on Table 2: Criteria used to evaluate the probability and magnitude of hydrological change (TRCA - Wetland Water Balance Risk Evaluation, Nov 2017)

6.4 Wetland Water Balance

To estimate potential hydrologic changes to the wetland catchments as a result of the proposed development, a Thornthwaite Water Balance was completed for all retained onsite wetlands with catchments identified as intersecting the site. The model was developed using the same input as the site water balance with the exception of including only those areas which fall within the Wetland catchments.

6.4.1 Existing Conditions

The existing conditions across the wetland catchments W1 to W6 include a silty clay loam soil type on a rolling terrain with pervious cover consisting of cultivated agricultural areas, pasture and shrub (NHS areas) and urban lawn and impervious surfaces associated with existing developed areas of the Site. **Table 11** shows the pre-development catchment breakdown of land uses for each subcatchment.

Table 11 – Pre-Development Conditions

Subcatchment Area Name	Pre-development catchment area (m²)	Mature Forest (m²)	Pasture and Shrub (m²)	Moderately Rooted Crop (m²)	Landscaped (m²)	Impervious Surface (m²)
W1	13,402	0	5,161	4,003	1,881	2,357
W2	50,784	0	26,743	18,870	1,486	3,685

Subcatchment Area Name	Pre-development catchment area (m^2)	Mature Forest (m^2)	Pasture and Shrub (m^2)	Moderately Rooted Crop (m^2)	Landscaped (m^2)	Impervious Surface (m^2)
W3	225,600	0	35,599	163,350	21,470	5,181
W4	62,040	0	8,313	52,371	0	1,356
W5	74,225	0	19,471	50,398	3,331	1,025
W6	47,447	0	16,702	27,448	1,989	1,307

6.4.2 Proposed Development

It is expected that the proposed plans for development will result in a decrease in the total catchment area size for Wetlands 1 to 6 during the post-development conditions. In order to understand the effects of the reduced catchment area and evaluate the magnitude of actual hydrological changes, a wetland water balance is currently being completed by Urbantech, which includes the use of a continuous model. A pre-construction wetland monitoring program by **DS** is currently underway and will be ongoing for a minimum of a 1-year period to establish baseline conditions throughout the hydroperiods for Wetlands 1 to 6. The results of the baseline wetland monitoring will be used in combination with the continuous modeling to assess the actual risk to the wetlands. Based on the findings of the water balance results, a wetland mitigation plan will be developed.

7.0 CONSTRUCTION DEWATERING

Based on the preliminary designs, the proposed plans for development will consist of low-rise and mid-rise residential blocks, commercial and institutional zones, storm water management (SWM) ponds and greenspace. The development will also include the construction of roadways and associated storm, sanitary sewer and water distribution infrastructure. Given that the detailed design of the proposed plans for development is not currently finalized, it is assumed that the proposed residential blocks will comprise of one (1) to two (2) level of underground basement and/or parking. Further, the institutional and mixed commercial use blocks and the GO station block will be constructed slab-on-grade.

Based on the findings of the subsurface drilling investigation, there are significant variations noted in the subsurface stratigraphic and groundwater conditions across the Site. The construction of the low-rise residential blocks and the site servicing will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. The following preliminary grading plans for the Site were provided to **DS** for review in estimating the requirements for groundwater control and dewatering during the construction period:

- *"Drawing No. 301 - Preliminary Grading Plan (1 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458

- *“Drawing No. 302 - Preliminary Grading Plan (2 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)”*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *“Drawing No. 303 - Preliminary Grading Plan (3 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)”*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *“Drawing No. 304 - Preliminary Grading Plan (4 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)”*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *“Drawing No. 601 – Preliminary SWM Pond 1 Plan View and Sections, Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)”*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *“Drawing No. 602 – Preliminary SWM Pond 2 Plan View and Sections, Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)”*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458

Based on the review of the proposed preliminary grading plans, it is understood that the site grades will generally range from approximately 280.0 masl in the northwestern corner to an approximate elevation of 262.2 masl in the southwest and 265.1 masl in the southeastern corner of the Site. For the purpose of assessing the requirements for groundwater control and dewatering during the construction period, a conceptual model of the Site has been prepared based on the proposed site grading and the worst-case subsurface conditions, which can be encountered during the trenching/excavation for the low-rise residential blocks and site servicing. Conceptual models for the mid-rise residential development and the two (2) storm water management ponds are prepared based on inference from nearby boreholes and monitoring wells in the locality of these proposed structures.

It is expected that the trenching and excavation earthwork during the construction period will extend below the groundwater table in certain areas of the Site and groundwater control and dewatering will be required to ensure the excavation area remains dry and safe. Generally, the excavations will be completed into the cohesive clayey silt till, however will extend into the underlying silty sand till / silt unit in certain locations. The site services trenching and the excavation for the storm water management pond in the southeastern corner of the Site has the potential to encounter modern alluvium deposits, which may provide higher flows of groundwater seepage. The geometric mean hydraulic conductivity for the overburden at the Site is estimated to be 2.0 x 10^{-7} m/sec.

The dewatering estimates also includes provision for controlling storm water in the excavation area from an incidental 2-year storm event. As per the Ministry of Transportation (MTO) Intensity-Distribution-Frequency (IDF) curves for the Town of Caledon, a 2-Year storm that is 2-hours in duration would result in a 13.5 mm/hr of rainfall intensity.

This section calculates the estimated dewatering required during the construction of the proposed residential buildings, private services, and SWM ponds.

7.1 Estimation of Flow Rate – Residential Blocks, Low-Rise Development

It is understood that the architectural designs for the proposed structures at the Site are not finalized at this time. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- An excavation for one (1) residential block within the larger Site development will comprise of six (6) low-rise units. This will result in an excavation that will be approximately 60 m x 20 m in area for one block.

- The low-rise residential development will comprise of one (1) level of underground basement extending to approximately 2 m below ground surface. The excavation will extend an additional 0.5 m below the finished floor basement slab for the foundation. On this basis, the base of excavation for each low-rise residential block will be advanced to 2.5 m below ground surface.

As previously indicated, the excavations for the proposed residential blocks will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. Generally, it is expected that the excavations for the low-rise residential blocks will be completed above the groundwater table and construction dewatering/control will be minimal for the majority of the Site, and particularly during the summer period. To assess the requirements for groundwater control and dewatering during the construction period, a conceptual site model was prepared assuming the worst-case scenario with respect to the depth of excavation below the ground water table at the Site. Based on the proposed preliminary grading plan, it is anticipated that these conditions will likely be present in the central portion of the Site. For the purpose of estimating the requirements for groundwater control and dewatering during the construction period, the groundwater table in the conceptual site model was set to Elev. 269.7 masl (BH20-9, August 6, 2020). The elevation at the base of excavation will be Elev. 267.8 masl. On this basis, the excavation will be advanced to a depth of 1.9 m below the ground surface. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of excavation.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rates are estimated to be on the order of 19,702 L/day. An incidental 2-year storm event will result in a total of 32,400 L of water to be removed from the excavation. The total **unit** dewatering rate during the construction period for **one (1) residential low-rise block** development at the Site is estimated to be **62,000 L per day**, which includes a 50% safety factor on the anticipated rates and the contribution from an incidental precipitation event.

The maximum predicted theoretical radius of influence is estimated to be 1.2 m from the edge of the excavation.

It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed site grading and/or deviation from any assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.2 Estimation of Flow Rate – Residential Blocks, Mid-Rise Development

The proposed development will envisage the construction of mid-rise residential blocks in the east-central portion of the Site adjacent to the GO Station block. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- An excavation for one (1) mid-rise residential block within the larger Site development will be approximately 60 m x 20 m in area for one block; and,
- The mid-rise residential development will comprise of two (2) levels of underground basements extending to approximately 6 m below ground surface. The excavation will extend an additional 1.2 m below the lowest finished floor basement slab for the foundation. On this basis, the base of excavation for each mid-rise residential block will be advanced to 7.2 m (Elev. 262.3 masl) below ground surface.

Monitoring Wells BH20-10, BH20-11, BH20-14 and BH20-15 are located in close proximity to the proposed mid-rise residential blocks and are considered for estimating the requirements for construction dewatering/control. The highest groundwater level measured in the east-central portion of the Site is at Elev. 264.8 masl (BH20-11). On this basis, the excavation for the mid-rise residential development will extend approximately 2.5 m below the groundwater table. For this reason, groundwater control and dewatering during the construction period will be required to maintain a dry and safe excavation. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of excavation.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of an equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rate is estimated to be on the order of 46,703 L/day. An incidental 2-year storm event will result in a total of 32,400 L of water to be removed from the excavation. The total **unit** dewatering rate during the construction period for **one (1) residential mid-rise block** is estimated to be on the order of **102,500 L per day**, which includes a 50% safety factor on the anticipated rates and contribution from an incidental 2-year precipitation event.

The predicted theoretical radius of influence is estimated to range from 2.5 m from the edge of the excavation.

It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed site grading and/or deviation from any assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.3 Estimation of Flow Rate – Site Servicing

It is understood that the site servicing plans for the proposed development at the Site are not finalized at this stage. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- The trenching for the site servicing will be completed in segments of 30 m x 2 m per day; and
- The lowest invert level of the proposed trunk sewer and local servicing infrastructure will be limited to a depth of 4 m bgs.

As previously indicated, the trenching for the proposed site servicing will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. Generally, it is expected that the excavations for the site servicing will be completed above the groundwater table and construction dewatering/control will typically be minimal for the majority of the Site, and particularly during the summer period. To assess the requirements for groundwater control and dewatering during the construction period, a conceptual site model was prepared assuming the worst-case scenario with respect to the depth of excavation below the ground water table at the Site. Based on the proposed preliminary grading plan, it is anticipated that these conditions will likely be present in the central portion of the Site. For the purpose of estimating the requirements for groundwater control and dewatering during the construction period, the groundwater table in the conceptual site model was set to Elev. 269.7 masl (BH20-9, August 6, 2020). The elevation at the base of excavation will be Elev. 266.3 masl. On this basis, the excavation will be advanced to a depth of 3.4 m below the ground surface. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of the trench.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of an equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rates are estimated to be on the order of 9,006 L/day. An incidental 2-year storm event will result in a total of 1,620 L of water to be removed from the trench. The total **unit** dewatering rate during the construction period for **one (1) trench segment** at the Site is estimated to be **15,500 L per day**, which includes a 50% safety factor on the anticipated rates and contributions from an incidental precipitation event.

The maximum predicted theoretical radius of influence is estimated to be 2 m from the edge of the excavation.

It should be noted that the presence of modern alluvium deposits present in the southeastern corner of the Site has the potential to provide higher than anticipated groundwater flows into the trenching/excavation for the site servicing. It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Furthermore, the detailed design of the proposed site servicing has not been finalized at this stage. During the detailed design stage, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.4 Estimation of Flow Rate – Storm Water Management Ponds

The proposed plans for development will include two storm water management (SWM) ponds; one in the south-central portion of the Site (SWM Pond 1) and one in the southeast corner (SWM Pond 2). A discussion on the hydrogeological conditions and potential requirements for construction dewatering/control for each SWM pond is discussed below:

Storm Water Management (SWM) Pond 1

Monitoring Well BH20-12 is located within the footprint of the proposed SWM Pond 1. Based on the preliminary grading and storm water management plans provided to **DS** for review, it is understood that the lowest point of the excavation for the proposed SWM Pond 1 will be advanced to an elevation of Elev. 260.5 masl into the silty sand till / silt unit. Monitoring of BH20-12 indicates that the silty sand till / silt unit in this area of the Site is under pressurized hydrostatic conditions with potentiometric levels during the late summer and fall of 2020 to range from 0.1 m (Elev. 264.8 masl) to 0.2 m (Elev. 264.7 masl) below the existing ground surface.

It is expected that during the spring wet season, the potentiometric level of the underlying silty sand till / silt may observe a further rise. Assuming a 0.5 m rise in the potentiometric levels, the groundwater level at the location of SWM Pond 1 could be as high as 0.4 m (265.3 masl) above the existing ground surface. On this basis, the base of excavation would extend approximately 4.8 m below the highest assumed potentiometric surface of the underlying silty sand till / silt unit. There will be a requirement to lower the potentiometric level to an elevation of 0.5 m below the base of excavation during the construction period to maintain a stable and dry excavation. During periods of high groundwater tables, the total volume of groundwater into the excavation is estimated to be on the order of **205,000 L/day**. During periods of low groundwater tables, the total volume of groundwater into the excavation is estimated to be reduced to **202,000 L/day**. The above estimates both include a 50% safety factor on the anticipated volumes.

The maximum predicted theoretical radius of influence is estimated to be 16 m from the edge of the excavation or 126 m from the center of excavation.

It should be noted that the above calculations do not include provisions for controlling storm water from an incidental precipitation event during the construction period. Assuming an incidental 2-year storm event, 904,203 L of water could pool within the area of the proposed SWM Pond 1. It is understood that the pooled storm water would be pumped at a controlled rate over a period of a few weeks to ensure that the daily dewatering rates are within the limits of the approved water taking and discharging permits. Furthermore, the high potentiometric surface of 0.4 m (265.3 masl) above the existing ground surface was estimated at this stage for the purpose of assessing the approximate requirements for construction dewatering and control for the proposed SWM Pond 1. It should be noted that groundwater monitoring data for the spring period is not yet available and will need to be confirmed as part of the ongoing long-term groundwater monitoring program at the Site. The above estimates may need to be revised if the seasonal high groundwater levels or the final design of the storm water management pond differ from the assumptions made above.

The SWM pond must be constructed with a clay liner to prevent seepage of stormwater into the underlying groundwater regime. The existing silty clay till layer at the location of SWM Pond 1 extends to an approximate depth of 3.0 m (Elev. 261.9 masl) below existing grade or 1.4 m above the proposed base of the SWM Pond 1. The existing silty clay till must be tested for acceptability as a clay liner during construction. The safe excavation depth (SED) for the SWM Pond is estimated to be 2.5 m to 4 m.

It is understood that the provided site grading and storm water management plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed plans and/or any deviations to the assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

It is recommended that further subsurface investigation be completed within the footprint of the proposed SWM Pond to characterize the local soil and groundwater conditions and to confirm the above dewatering estimates.

Storm Water Management (SWM) Pond 2

Monitoring Well BH20-14, BH20-16 and Borehole BH20-13 are located in close proximity of the proposed SWM Pond 2 footprint. Based on the preliminary grading and storm water management plans provided to **DS** for review, it is understood that the lowest point of the excavation for the proposed SWM Pond 2 will be advanced to an elevation of Elev. 260.5 masl into the silty clay till. Based on monitoring of groundwater levels from BH20-14 and BH20-16, the highest groundwater levels in the silty clay till during the late summer and fall of 2020 was measured at elevation Elev. 264.3 masl.

It is expected that during the spring wet season, the groundwater level in the silty clay till may rise further. Assuming a 0.5 m fluctuation, the groundwater level at the location of SWM Pond 2 could be as high as elevation Elev. 264.8 masl. On this basis, the base of excavation would extend approximately 4.3 m below the assumed seasonal high groundwater level of silty clay till. There will be a requirement to lower the groundwater level to an elevation of 0.5 m below the base of excavation during the construction period to maintain a safe and dry excavation. During periods of high groundwater tables, the total volume of groundwater into the excavation is estimated to be on the order of **230,500 L/day**. During periods of low groundwater tables, the total volume of groundwater into the excavation is estimated to be reduced to **218,000 L/day**. The above estimates both include a 50% safety factor on the anticipated volumes.

The maximum predicted theoretical radius of influence is estimated to be 16 m from the edge of the excavation.

It should be noted that the above calculations do not include provisions for controlling storm water from an incidental precipitation event during the construction period. Assuming an incidental 2-year storm event, 1,112,643 L of water could pool within the area of the proposed SWM Pond 2. It is understood that the pooled storm water would be pumped at a controlled rate over a period of a few weeks to ensure that the daily dewatering rates are within the limits of the approved water taking permit. Furthermore, the assumed high groundwater table of elevation Elev. 264.8 masl was estimated at this stage for the purpose of assessing the approximate requirements for construction dewatering and control for the proposed SWM Pond 2. It should be noted that groundwater monitoring data for the spring period is not yet available and will need to be confirmed as part of the ongoing long-term groundwater monitoring program at the Site.

The SWM pond must be constructed with a clay liner to prevent seepage of stormwater into the underlying groundwater regime. The existing silty clay till layer at the location of SWM Pond 2 extends to an approximate depth of 7.5 m (Elev. 260.6 masl) below existing grade or 0.1 m above the proposed base of the SWM Pond 2. The existing silty clay till must be tested for acceptability as a clay liner during construction. The safe excavation depth (SED) for the SWM Pond is estimated to be 3.0 m to 4.5 m.

It should be noted that the provided site grading and storm water management plan are preliminary and subject to changes in the future. For this reason, the above requirements for groundwater control and dewatering during the construction period will need to be revisited if the finalized site grading and stormwater management pond design are revised during the detailed design stage or if the seasonal high groundwater level differs from the assumptions made above.

It is recommended that further subsurface investigation be completed within the footprint of the proposed SWM Pond to characterize the local soil and groundwater conditions and to confirm the above dewatering estimates.

7.5 Permanent Drainage (Long-term Discharge)

It is expected that the proposed mid-rise residential structures will comprise of underground basements/parking levels that will extend below the groundwater table at the Site. For this reason, control of permanent drainage within these structures will likely be required. It is understood that the proposed architectural and mechanical engineering design for the proposed mid-rise residential structures has not been finalized at this stage.

For the purpose of assessing permanent flows into the private water drainage system, the following design considerations relative to each type of structure and groundwater conditions are assumed:

- Monitoring Wells BH20-11, BH20-14, BH20-15 and Borehole BH20-10 are located in close proximity to the mid-rise residential blocks and are considered for estimating the construction dewatering/control requirements. The highest groundwater level measured in the east-central portion of the Site is at Elev. 264.8 masl (BH20-11).

- The mid-rise residential structures will comprise of two (2) levels of underground basement/parking (P2). The finished floor elevation (FFE) of the P2 level will extend to a depth of approximately 6 m (Elev. 263.5 masl) below ground surface. The sub-drains will be installed to a depth of approximately 0.3 m (~ 1 ft.) below P2 FFE slab to an approximate elevation of 263.2 masl. On this basis, the sub-drains will be situated approximately 1.6 m below the groundwater table and will be completed into the clayey silt till, however may extend into the silty sand till / silt unit in some areas.

The total flows into the permanent drainage system of the mid-rise residential structure during the long-term is estimated to be on the order of **55,000 L** of water to be removed over a 1-day period and includes a 50% safety factor on the anticipated permanent drainage flows.

It is understood that the low-rise residential block will include one (1) level of underground basement, which will likely be constructed above the water table and with a water-proofing membrane. A perimeter drainage system will be installed, however all collected percolating stormwater will be discharged to landscaped/vegetated areas of individual residential lots. Further, the institutional and commercial zones will be constructed slab-on-grade. For this reason, all low-rise residential blocks, institutional and commercial zones are not anticipated to require any permanent groundwater drainage control.

Given that the detailed design for the proposed plans for development were not finalized at this stage, various assumptions were made to assess the requirements for groundwater control and dewatering during the post-construction period. During the detailed design stage, if the assumptions made therein Section 6.0 of this report deviate from the finalized developmental designs, then **DS** should be consulted to revise the estimated groundwater seepage rates and permitting requirements.

7.6 Permit Requirements

7.6.1 Environmental Activity and Sector Registry (EASR) /Permit to Take Water (PTTW) Application

An Environmental Activity Sector Registration (EASR) Posting is required to be submitted to the Ministry of the Environment, Conservation and Parks (MECP) if the taking of groundwater and stormwater for a temporary construction project is between 50,000 L/day and 400,000 L/ day. The EASR application is an online registry and should be submitted to the MECP before commencing any construction dewatering operations. A PTTW is required to be submitted to the MECP if the taking of groundwater and stormwater for a temporary construction project is greater than 400,000 L/ day.

During the construction period, the requirements to obtain any water taking permitting (EASR/PTTW) will depend on the ownership structure of the Site and the staging for development. The estimates for groundwater control and dewatering provided in Section 7.1 through 7.4 of this report should be made use of each individual land parcel that comprise of the larger subject Site. It is anticipated that an EASR Posting will likely be required, however if the construction dewatering rates exceed 400 m^3 on any given day, a PTTW Registration with the MECP will be required.

During the post-construction period, the anticipated permanent drainage flows are anticipated to be about 55,000 L/day for a mid-rise residential block. Given that the estimated permanent drainage flows are expected to be greater than the MECP threshold of 50,000 L/day, a long-term PTTW will be required in support of permanent groundwater control for the mid-rise residential blocks should design details corroborate the assumptions made in this assessment.

7.6.2 Discharge Permits (Construction Dewatering and Permanent Drainage)

The Site is located within the Humber River watershed, which is located within the regulatory jurisdiction of the Toronto and Region Conservation Authority (TRCA). A discharge permit may be required from the TRCA, Peel Region and/or Town of Caledon if the water is to be discharged to a nearby/on-site surface water feature during the construction period. A discharge and monitoring plan will need to be prepared prior to obtaining a discharge approval from the TRCA, Peel Region and/or Town of Caledon.

If the private water during the post-construction period is anticipated to be discharged into the proposed municipal sewer system, a sewer discharge agreement with the Town of Caledon and/or Regional Municipality of Peel will be required prior to any discharging operations.

8.0 POTENTIAL IMPACTS

The following are the predicted potential impacts as a result of construction dewatering:

8.1 Local Groundwater Use

Based on the MECP WWRs, there are numerous well records listed within the boundary of the Site and the immediately adjacent area. The wells located within the Site boundary are expected to be decommissioned prior to commencing construction works for the proposed development. The predicted radius of influence from the dewatering activities is estimated to range from 1.2 m to 16.0 m from the edge of excavation. The majority of water supply wells in the area are noted to be installed at deeper depths. Given that the proposed construction is anticipated to extend to approximately 2.5 m to 7.6 m below existing ground surface, and the resulting radius of influence from the dewatering activities will be kept minimal, short and long-term impacts to private wells in the area during the construction period is not considered to be likely.

It is understood that the detailed design of the proposed plans for development have not been finalized at this stage. These specific details include, among other items, the maximum depth of excavation/trenching required in support of the proposed development, servicing and storm water management ponds. At this stage, the above-defined assumptions were considered in this assessment with regards to the deepest anticipated depth of excavation. It should be noted that if at the detailed design stage, the above assumptions do not hold true, then this assessment will need to be revisited based on the finalized design details.

8.2 Surface Water Features

Based on the proposed plans for development at the Site, the following may have the potential for impacts to natural surface water features:

(i) Groundwater control and dewatering operations during the construction period;
(ii) Reduction of groundwater recharge and possibly groundwater contributions to surface water features as a result of impervious surfaces following construction; and,
(iii) Reduction of runoff available to natural features as a result of changes to Site drainage.

A discussion on the potential for impacts (i to iii above) are provided below.

Groundwater Control and Dewatering:

All dewatering activities for the proposed development adjacent to the existing onsite wetlands have the potential to interfere and lower the groundwater table within the wetland features. During the construction period, monitoring of the wetlands must be continued to ensure the groundwater levels and surface water flows in the headwater drainage features are not being lowered. At this stage, pre-construction monitoring for a period of 1-year has not been completed and baseline conditions in the wetlands have yet to be established. On the onset of completing the pre-construction monitoring, **DS** will prepare a contingency plan, which will outline pre-defined *"review*" and "*response*" levels for all surface water stations in the wetlands, where impacts to the surface water features will have become apparent and mitigative measures as well as more frequent monitoring will need to be initiated promptly. Further preliminary details on the contingency plan are discussed in Section 8.0.

Pumped water from temporary construction dewatering activities should be managed to avoid direct discharge of potentially impacted water into sensitive features such as the wetland. To manage the potential risks to surface water quality, a discharge plan should be developed for proper discharge of private water during the construction period.

Reduction in Groundwater Recharge:

As discussed in Section 4.3.5, there are eight (8) wetlands at the Site. Wetlands W7 and W8 are being relocated with existing upgradient (offsite) contributions proposed to be redirected toward the new features. An adaptive management program for the newly constructed features will be required to ensure there is adequate contribution. For wetlands W1 to W6, a long-term pre-construction surface water and groundwater monitoring program is currently underway. Monitoring during the current period indicates that most wetlands are ephemeral surface water features, with minimal to some to response to precipitation events. Upward shallow groundwater gradient at wetland W3 is noted, however further monitoring will be required to establish seasonal baseline conditions and to confirm surface water and groundwater interaction dynamics for each of the wetlands.

There is a potential that groundwater levels may rise during the spring period and provide contribution to seasonal baseflow of the wetlands. A reduction in recharge over the Site as a result of the development may result in a lowering of the water table and thus a reduction in groundwater contribution. The water balance completed for the Site shows there is a total Site infiltration deficit of 111,450 m^3/yr. To prevent risk to the wetlands which may rely on contribution from groundwater, the post-development infiltration deficit should be reduced / eliminated through the designing and implementation of appropriate Low Impact Development (LID) servicing for storm water management at the Site. LID's which target areas surrounding upgradient portions of wetlands W1 through W6 would help maintain groundwater gradients toward the features without necessarily requiring a complete elimination of the infiltration deficit over the entire Site.

Reduction in Runoff Contribution:

Results of the wetland water balance shows there is reduced runoff within upgradient wetland catchments which is considered contribution for each of the wetlands W1 to W6. It is anticipated that the runoff deficits can be managed by introducing LIDs which collect and convey clean sources of runoff from residential lots. The system can outlet to infiltration trenches constructed around the wetland buffer to maintain groundwater gradients toward each of the wetland units. Runoff contribution can be maintained by sizing the trenches to allow larger precipitation/melt events to overflow to constructed outlets along the natural wetland inlets. Infiltration and runoff targets should be assessed using a continuous surface water model to compare changes in wetland storage for pre-development, post-development and post-development with mitigation conditions. It is anticipated that there is enough surplus and sufficient infiltration potential available in native soils based on in-situ infiltration testing results.

Discharged water from storm sewer outfalls should be designed to avoid direct discharge into the wetland where possible. Results of the wetland risk assessment (TRCA, Nov 2017) indicates that since the impervious cover was calculated to be under 15% of the total wetland catchment, that stormwater generated over the proposed development currently contributing to wetlands presently includes a low risk. should an outfall be considered with a direct discharge to the wetland, the risk to the wetland should be revaluated.

8.3 Point of Discharge and Groundwater Quality

A discharge plan will be required for the discharge of pumped groundwater from construction dewatering activities. The plan must identify the discharge location and ensure the discharge will not result in any adverse impacts by identifying the discharge measures to be installed and control measures to limit the turbidity of the discharge water.

Discharged water from temporary construction dewatering activities should be managed to avoid direct discharge of potentially impacted water into sensitive features such as the wetland. To manage the potential risks to surface water quality, a discharge plan should be developed for the discharge of pumped groundwater from the construction dewatering.

The results of the groundwater analytical testing indicate the quality of groundwater exceeded the Provincial Water Quality Objective (PWQO) for total cobalt. Therefore, pre-treatment of the pumped construction water will be required prior to discharging into any surface water bodies. Exceedances of metals can generally be treated through the use of a primarily filtration. The design and effectiveness of the pre-treatment system will be the responsibility of the pre-treatment system contractor. The quality of the discharge water must meet the guideline limits of the PWQO prior to discharging into any surface water features. If the pumped water is to be discharged into a surface water body, a monitoring plan will need to be prepared and submitted to the Toronto and Region Conservation Authority (TRCA), Peel Region and/or the Town of Caledon to obtain approval for a discharge permit.

8.4 Well Decommissioning

Following the completion of construction activities, all dewatering wells, well points, eductors, and monitoring wells installed at various stages of this project must be decommissioned. The installation and eventual decommissioning of the wells and the dewatering system must be carried out by a licenced water well contractor in accordance with Regulation 903 of the Ontario Water Resources Act.

9.0 MONITORING AND MITIGATION

Based on the hydrogeological investigation, **Table 13** below provides a recommended monitoring program, triggers for mitigation and recommended mitigation measures for groundwater levels and the discharge of water during construction.

Table 13: Monitoring and Mitigation Plan

PERIOD	MONITORING LOCATION	MONITORING FREQUENCY	METHOD	TRIGGERS FOR MITIGATION	COMMENTS / RECOMENDATIONS
WATER LEVELS					
Pre-Construction	Groundwater level monitoring (available on-site monitoring wells)	Continuously for one week	Dataloggers within the existing wells	None	Complete hydrographs to document baseline water levels
	Existing surface water stations (including staff gauages and nested piezometers)	Continuously for one week	Dataloggers within the existing staff gauges and manual measurements in nested piezometer	None	Complete hydrograph to document baseline water levels
During construction	Existing monitoring wells or replacements adjacent to dewatering area	Daily until target water level is reached	Dataloggers with weekly downloads	Target drawdown not reached or exceeded	Increased / reduced pumping; if pumping is approaching 400 m^3/day, a PTTW will be required
	Discharge volume	Daily at discharge location	Manual with totalizing flow meter in-line	Flow exceeds predicted volumes	Reduce to maximum allowed or obtain a PTTW
	Existing surface water stations (including staff gauages and nested piezometers)	Continuously until pre-defined *review* and/or *response* trigger levels are reached	Dataloggers and manual monitoring with weekly downloads	Drawdown of groundwater levels in wetlands to pre-defined *review* and/or *response* levels	The *review* and *response* levels will be finalized upon completion of the 1-year pre-construction monitoring
	Groundwater Contribution to Wetland (if any)	Continuously until pre-defined *review* and/or *response* trigger levels are reached	Dataloggers and manual monitoring with weekly downloads	Drawdown of surface water flows in wetlands below pre-defined *review* and/or *response* levels	The *review* and *response* levels will be finalized upon completion of the 1-year pre-construction monitoring
Post-Construction	Existing monitoring wells or replacements adjacent to dewatering area	Weekly for one month or until water levels reach 90% of original static level	Datalogger water level monitoring with weekly downloads	NA	NA
	Existing surface water stations (including staff gauages and nested piezometers)	Weekly for one month or until water levels reach 90% of original static level	Datalogger water level monitoring with weekly downloads	N/A	N/A

PERIOD	MONITORING LOCATION	MONITORING FREQUENCY	METHOD	TRIGGERS FOR MITIGATION	COMMENTS / RECOMENDATIONS
WATER QUALITY					
During construction (discharge to surface water feature)	Groundwater Discharge from dewatering	Sample for parameters against the PWQO criteria Field monitoring for turbidity and correlation with lab results	Once the start of dewatering at the point of discharge Weekly from the dewatering system for the first month of active dewatering Assuming water quality is compliant, monthly for the remainder of the dewatering period.	Discharge quality exceeds the PWQO criteria Field TSS/Turbidity exceed the PWQO criteria	More frequent monitoring will be considered Enhanced treatment of the discharge water will be considered, if needed
During Construction (surface water quality in wetlands)	Surface water flows at each surface water station	Sample for parameters against the PWQO criteria Field monitoring for turbidity and correlation with lab results	Sampling to be completed during construction monitoring on a monthly basis, until trigger level is reached	Exceedance in background turbidity concentration in water quality by more than 20 NTU or total suspended solids concentration above 25 mg/L	Conduct a site visit with the contractor; revisit the effectiveness of the pre-treatment system with the contractor and property owner to potentially alter construction phasing/methodology plan; revisit surface runoff at the Site and sediment and erosion control measures; and assess the need for clean up of the HDFs to minimize sediment transport

10.0 LIMITATIONS

This report was prepared for the sole use of the addressee to provide an assessment of the hydrogeological conditions on the property. The information presented in this report is based on information collected during the completion of the hydrogeological investigation. DS Consultants Limited was required to use and rely upon various information sources produced by other parties. The information provided in this report reflects DS' judgment in light of the information available at the time of report preparation. This report may not be relied upon by any other person or entity without the written authorization of DS Consultants Ltd. The scope of services performed in the execution of this investigation may not be appropriate to satisfy the needs of other users, and any use or reuse of this document or findings, conclusions, and recommendations represented herein, is at the sole risk of said users. The conclusions drawn from the Hydrogeological report were based on information at selected observation and sampling locations. Different conditions between and beyond these locations may become apparent during future investigations or on-site work, which could not be detected or anticipated at the time of this investigation. DS Consultants Ltd. cannot be held responsible for hydrogeological conditions at the site that was not apparent from the available information.

Should you have any questions regarding these findings, please do not hesitate to contact the undersigned.

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Tables

Macville Community (Option 3) Secondary Plan, Bolton ON

Hydrogoelogical Investigation

20-169-100

Staff Gauges (SGs)

SG ID	Top of Pipe Elevation (masl)	Depth (mbtop)	Ground Elev. (masl)	September 8, 2020		October 22, 2020	
				Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)
SG W2-1	262.62	1.35	261.27	1.25	261.37	1.35	261.27
SG W3-1	271.937	1.23	270.707	DRY		DRY	
SG W4-1	262.408	1.41	260.998	DRY		DRY	
SG W5-1	262.383	1.29	261.093	DRY		1.29	261.093
SG-W7-1	261.3	1.13	-	DRY		DRY	
SG W7-2	270.853	1.445	269.408	DRY		DRY	
SG W8-1	264.784	1.47	263.314	1.41	263.374	DRY	
Culvert	263.61	-	262.96	1.73	261.88	1.73	261.88

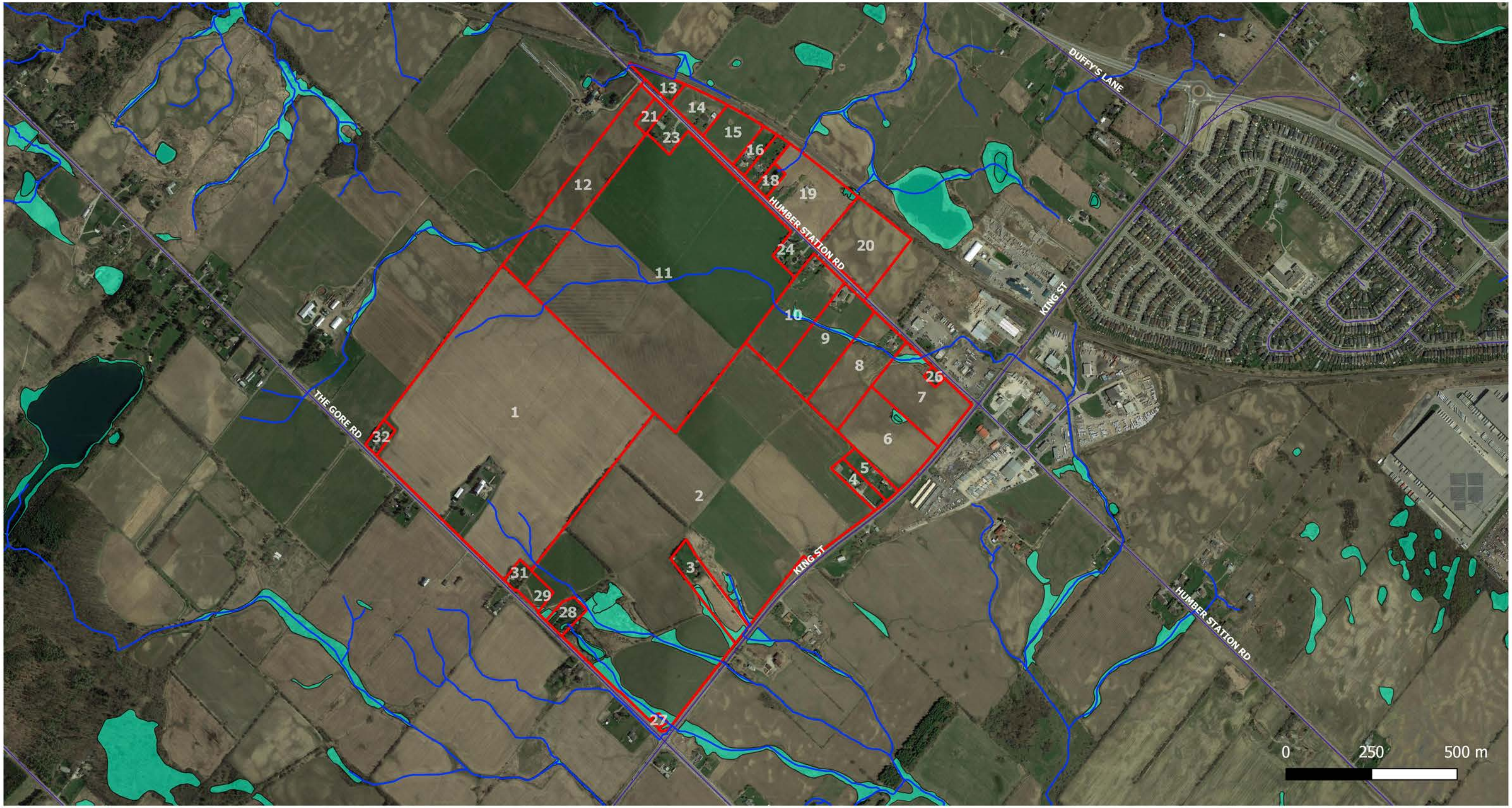
Piezometers (PZs)

Piezometer Location	Top of Pipe Elevation (masl)	Depth (top of pipe)	Stick-up (m)	Surface Elev. (masl)	September 8, 2020		October 22, 2020	
					Depth to Water (mbtop)	Depth to Water (masl)	Depth to Water (mbtop)	Depth to Water (masl)
W2-PZS	262.22	1.73	0.68	261.54	0.75	261.47	0.84	261.38
W2-PZD	262.38	2.92	0.90	261.48	0.95	261.43	1.03	261.35
W3-PZ2S	271.68	1.77	0.81	270.87	1.62	270.06	1.31	270.37
W3-PZ2D	271.77	2.65	0.78	270.99	1.51	270.26	1.32	270.45
W4-PZ1S	262.17	1.49	0.86	261.31	1.27	260.90	DRY	
W4-PZ1D	261.89	2.35	0.74	261.15	1.19	260.70	2.18	259.71
W5-PZS	262.17	1.71	0.90	261.27	1.06	261.11	1.09	261.08
W5-PZD	261.89	2.51	0.67	261.22	0.80	261.09	1.97	259.92
W7-PZS	271.50	1.63	0.53	-	DRY		DRY	
W7-PZD	271.50	2.37	0.56	-	DRY		2.23	269.27
W8-PZS	264.34	1.59	0.75	263.59	0.98	263.36	DRY	
W8-PZD	264.39	2.48	0.83	263.56	1.00	263.39	2.21	262.18
HD-F2 PZS	270.21	1.82	0.65	269.56	DRY		DRY	
HD-F2 PZD	270.25	3.29	0.75	269.50	2.18	268.07	2.11	268.14

Monitoring Wells (MWs)

MW ID	Surface Elevation (masl)	Depth (mbgs)	Stick-Up (m)	August 6, 2020		September 8, 2020		October 22, 2020	
				Depth to Water (mbtop)	Depth to Water (masl)	Depth to Water (mbtop)	Depth to Water (masl)	Depth to Water (mbtop)	Depth to Water (masl)
BH20-1	279.83	6.92	0.96	5.07	275.72	5.20	275.59	5.47	275.32
BH20-2	278.80	7.20	0.94	7.06	272.68	7.30	272.44	7.42	272.32
BH20-3	278.55	6.20	0.95	6.94	272.56	DRY		DRY	
BH20-4	277.07	5.54	0.85	4.62	273.30	4.75	273.17	NOT ACCESSIBLE	
BH20-5	273.07	9.33	0.97	3.75	270.29	4.06	269.98	4.35	269.69
BH20-6	270.95	7.64	0.86	7.63	264.18	2.01	269.80	NOT ACCESSIBLE	
BH20-7	261.71	7.65	1.08	DRY		7.60	255.19	4.48	258.31
BH20-9	274.11	7.37	0.88	5.31	269.68	5.60	269.39	5.85	269.14
BH20-11	270.10	9.07	1.00	6.42	264.68	6.37	264.73	6.33	264.77
BH20-12	264.94	4.60	0.77	0.97	264.74	0.87	264.84	0.91	264.80
BH20-14	267.65	11.04	0.88	4.20	264.33	4.31	264.22	4.47	264.06
BH20-15	264.14	9.38	0.95	3.36	261.73	3.28	261.81	3.36	261.73
BH20-16	265.54	7.79	0.88	3.00	263.42	3.15	263.27	3.37	263.05

Figures



Legend

— Watercourse
🟩 Wetland Areas
— Site Boundary
— Owner Parcels
Numbering Indicates Owners

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Telephone: (905) 264-9393
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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **Site Location Plan**

N

Client: Option 3 Landowners Group

Size: 11x17

Rev. 0

Approved By: S.W

Drawn By: M.Z

Date: December 2020

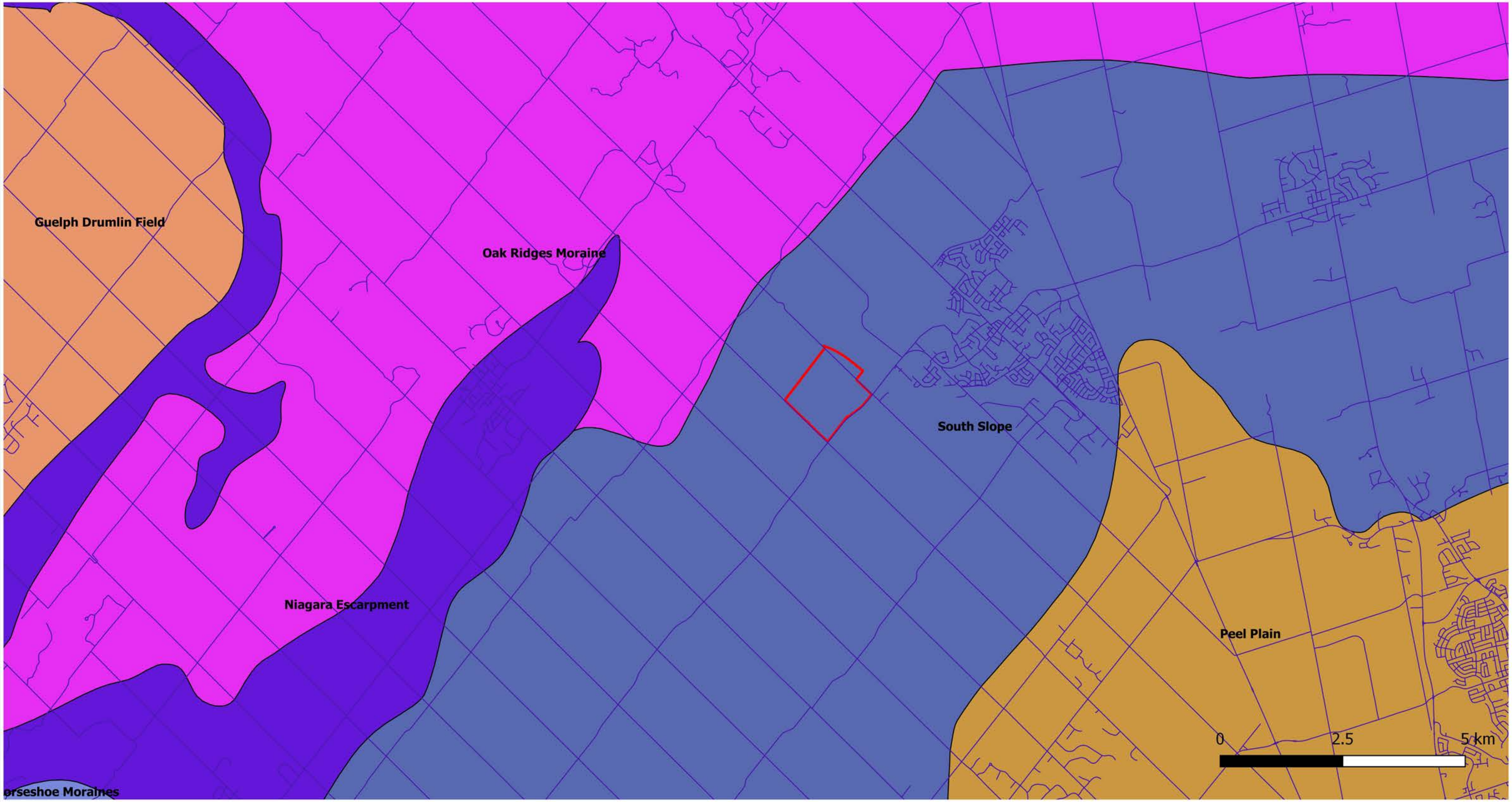
Scale: As Shown

Project No.: 20-169-100

Figure No.: 1

Image/Map Source: *Google Satellite Image*

F:\August 27,2020\Site Location Plan.qgs



Legend

— Roads
— Site Boundary
🟧 Guelph Drumlin Field
🟪 Niagara Escarpment
🟪 Oak Ridges Moraine
🟨 Peel Plain
🟦 South Slope

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **Regional Physiography Map**

N

Client: Option 3 Landowners Group

Size: 11x17

Rev. 0

Approved By: S.W

Drawn By: M.Z

Date: December 2020

Scale: As Shown

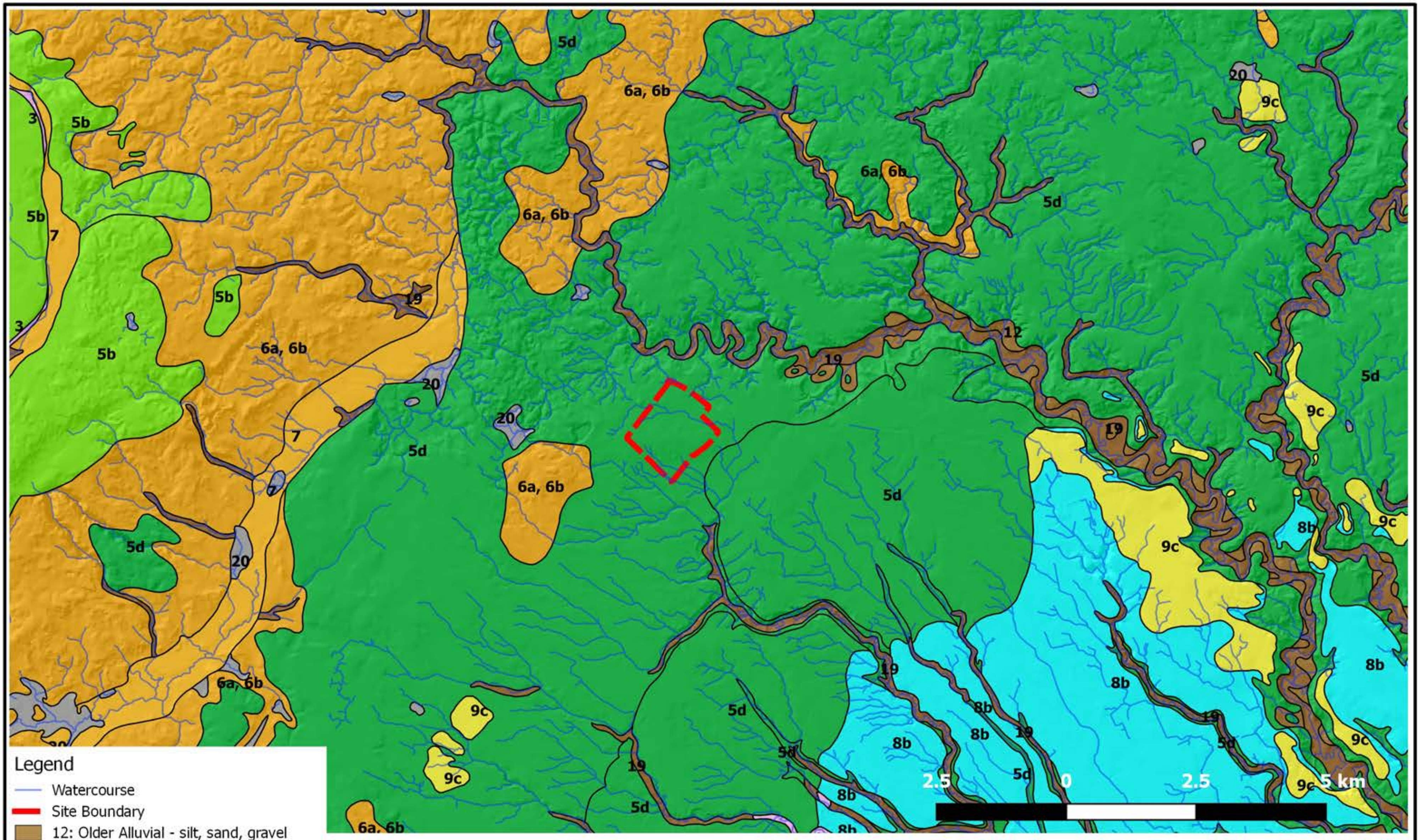
Project No.: 20-169-100

Figure No.: **2A**

Image/Map Source: *Google Satellite Image*

F:\August 27,2020\Regional Physiography Map.qgs

F:\August 27,2020\surfgeo map.qgs



Legend

— Watercourse

🟥 Site Boundary

🟫 12: Older Alluvial - silt, sand, gravel

🟫 19: Modern Alluvial - silt, sand, gravel

⬜ 20: Organic - peat, muck, marl

⬜ 3: Paleozoic Bedrock

🟩 5b: Till - sandy silt to silty sand

🟩 5d: Till - clayey silt to sandy silt

🟧 6a, 6b: Glacial Deposit - sand and gravel

🟧 7: Glaciofluvial - sand, gravel

🟦 8b: Fine Glaciolacustrine - clay, silt

🟨 9c: Coarse Glaciolacustrine - sand

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **Surficial Geology Map**

N

Client: Option 3 Landowners Group

Size: 8.5 x 11

Rev: 0

Approved By: S.W

Drawn By: M.Z

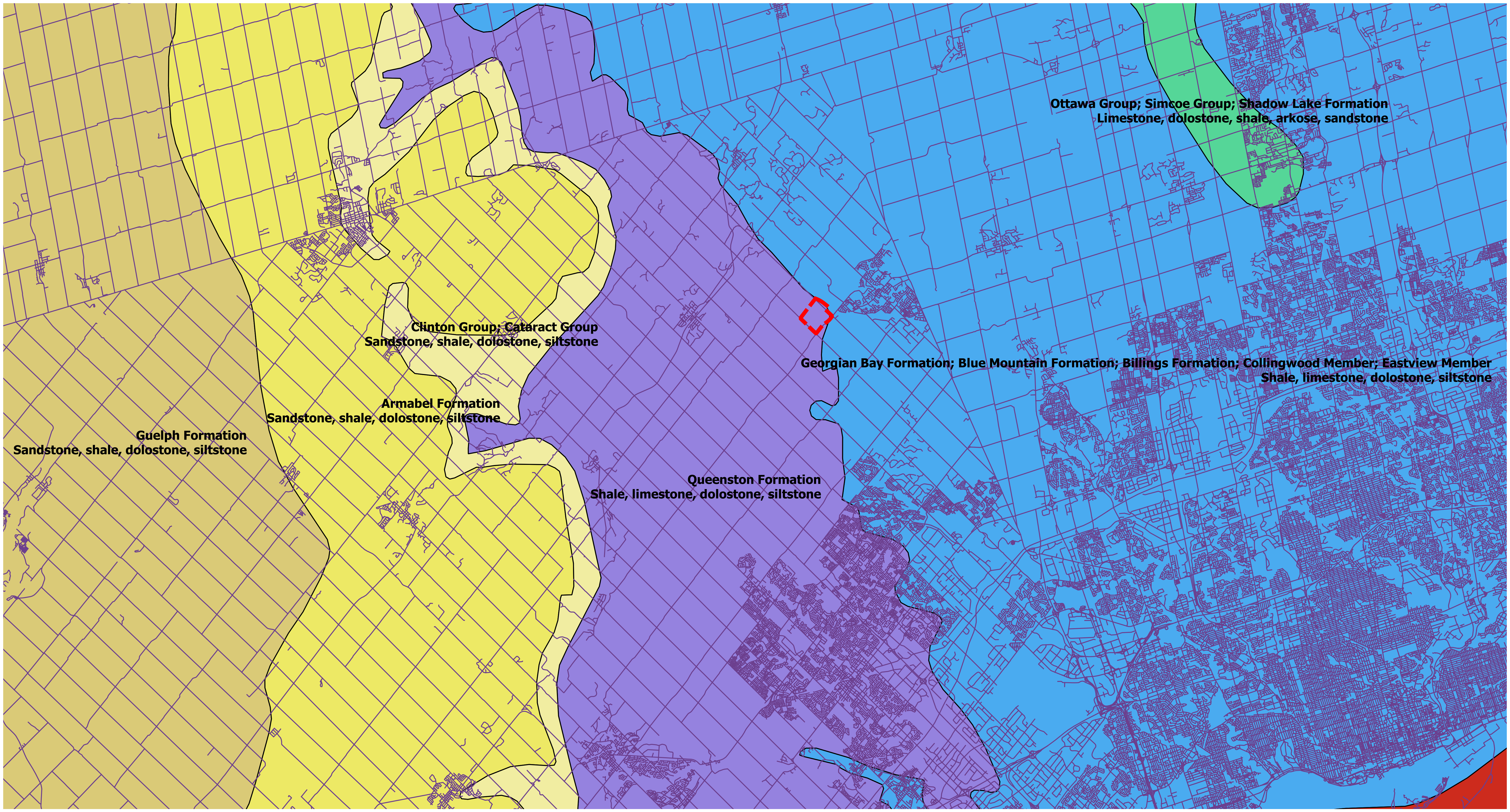
Date: August 2020

Scale: As Shown

Project No.: 20-169-100

Figure No.: **2B**

Image/Map Source: *Google Satellite Image*



Legend

- Site Boundary
- Roads
- 🟩 Ottawa Group, Simcoe Group
- 🟪 Queenston Formation
- 🟦 Georgian Bay Formation
- 🟫 Guelph Formation
- 🟨 Amabel Formation
- 🟨 Clinton-Cataract Group
- 🟥 LIMIT

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **Bedrock Geology Map**

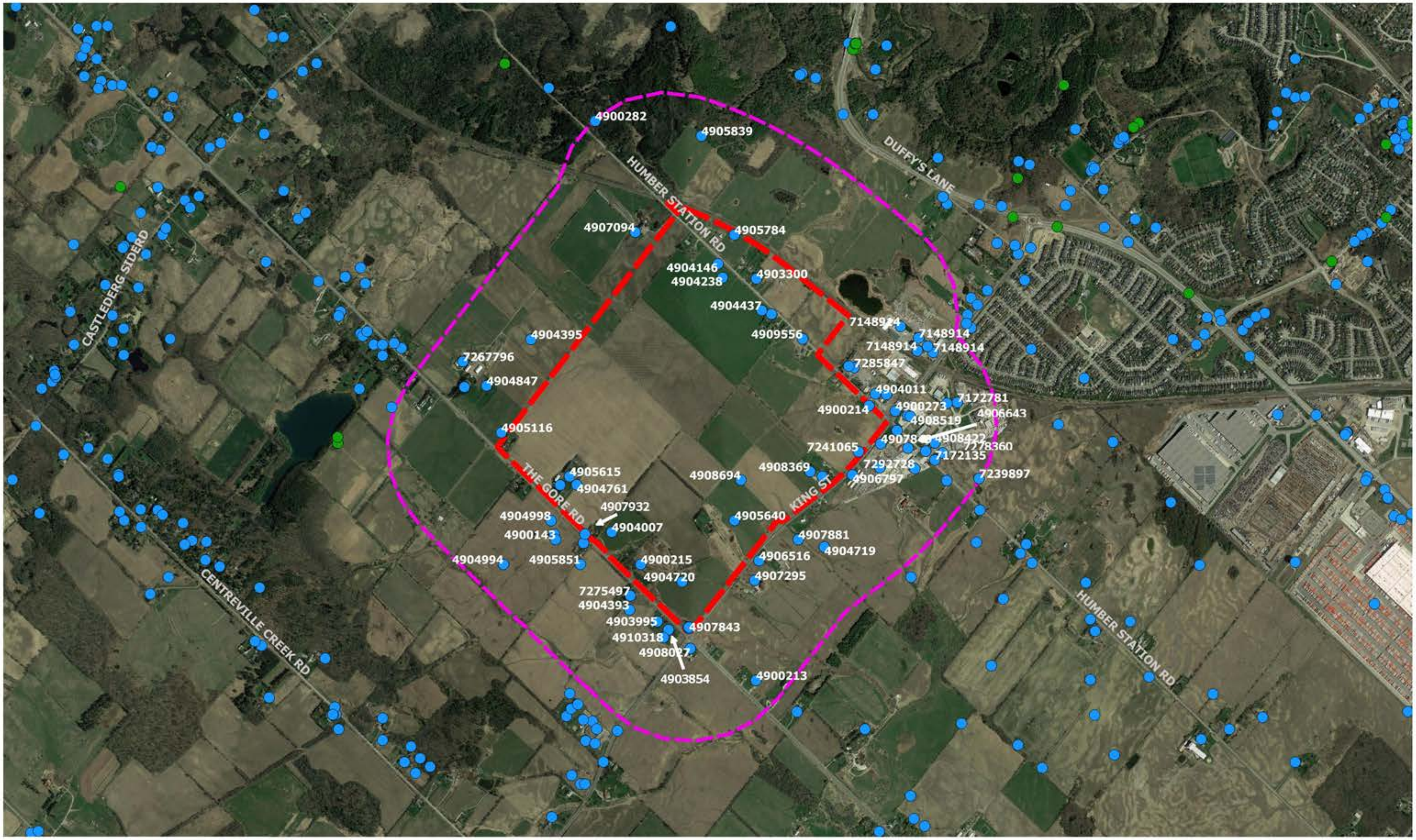
N

Client: Option 3 Landowners Group

Size: 11x17	Approved By: S.W.	Drawn By: M.Z	Date: December 2020
Rev. 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 2C

Image/Map Source: *Google Satellite Image*

F:\August 27,2020\Bedrock Geology map.qgs



Legend

- 🟥 Site Boundary
- ▭ 500m Buffer
- ● Permit To Take Water
- ● MECP Water Well Record

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Project:	Hydrogeological Investigation and Water Balance Study - Macville Community				
Title:	**MECP WWR and PTTW Map**				
Client: Option 3 Landowners Group	Size: 8.5 x 11	Approved By: S.W	Drawn By: M.Z	Date: December 2020	
	Rev: 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 3	
		Image/Map Source: *Google Satellite Image*			

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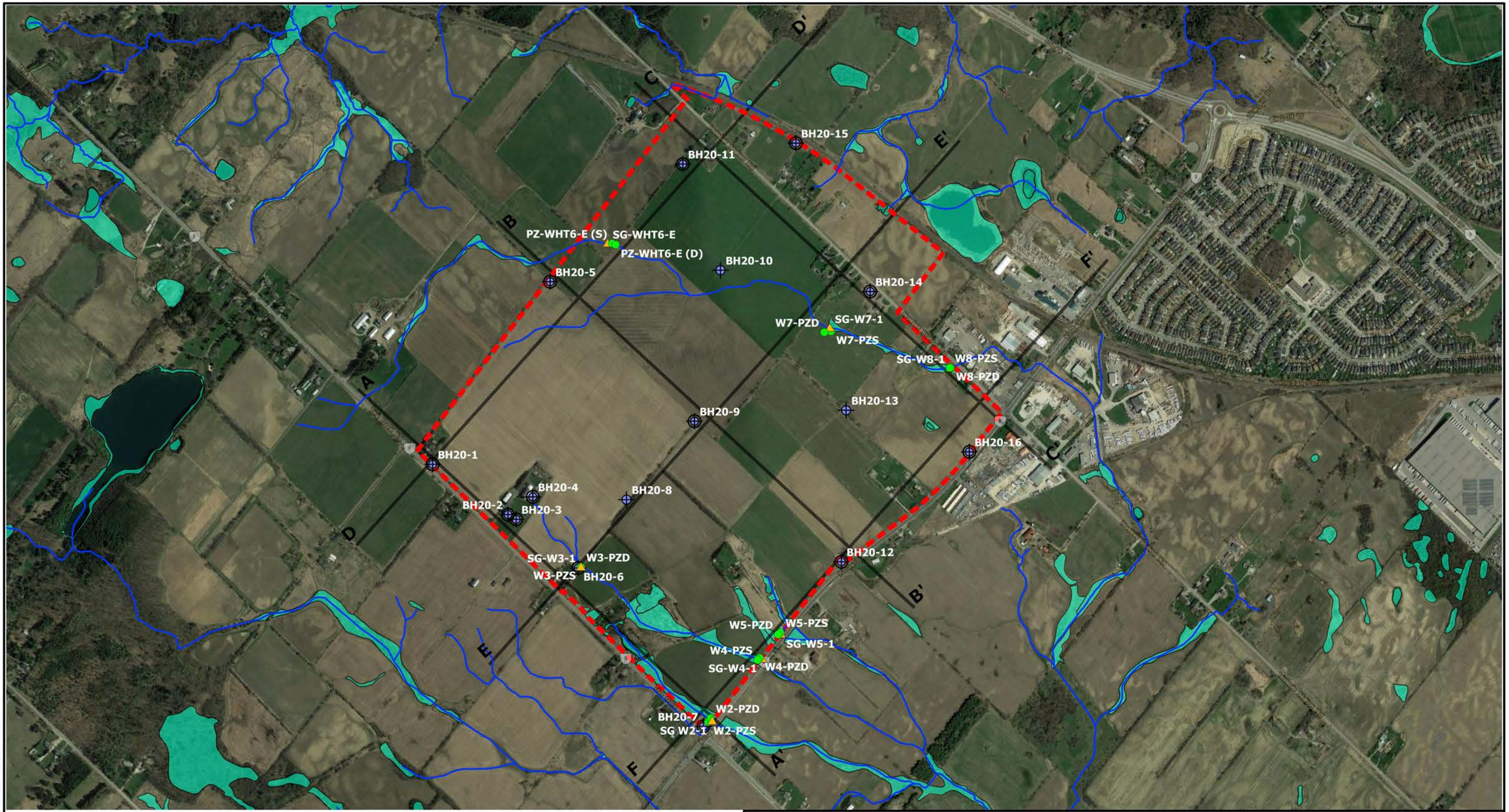

Legend

- 🟥 Site Boundary
- Parcels
- 🟩 Wetland Areas
- Watercourse
- A cross sections
- ⊕ Borehole
- ⊕ Monitoring Well
- ▲ Staff Guage
- ● Groundwater Piezometer

250 0 250 500 m

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Project: HYDROGEOLOGICAL INVESTIGATION - BOLTON OPTION 3 LANDS

Title: **BOREHOLE AND INSTRUMENTATION LOCATION MAP**

N

Client: Bolton Option 3 Landowners Group	Size: 11x17	Approved By:	S.W	Drawn By:	M.Z	Date:	December 2020
	Rev. 0	Scale:	As Shown	Project No.:	20-169-100	Figure No.:	4
		Image/Map Source: *Google Satellite Image*					

C:\Projects\Bolton LOPA\BH location map.qgs Feb-04 15:54

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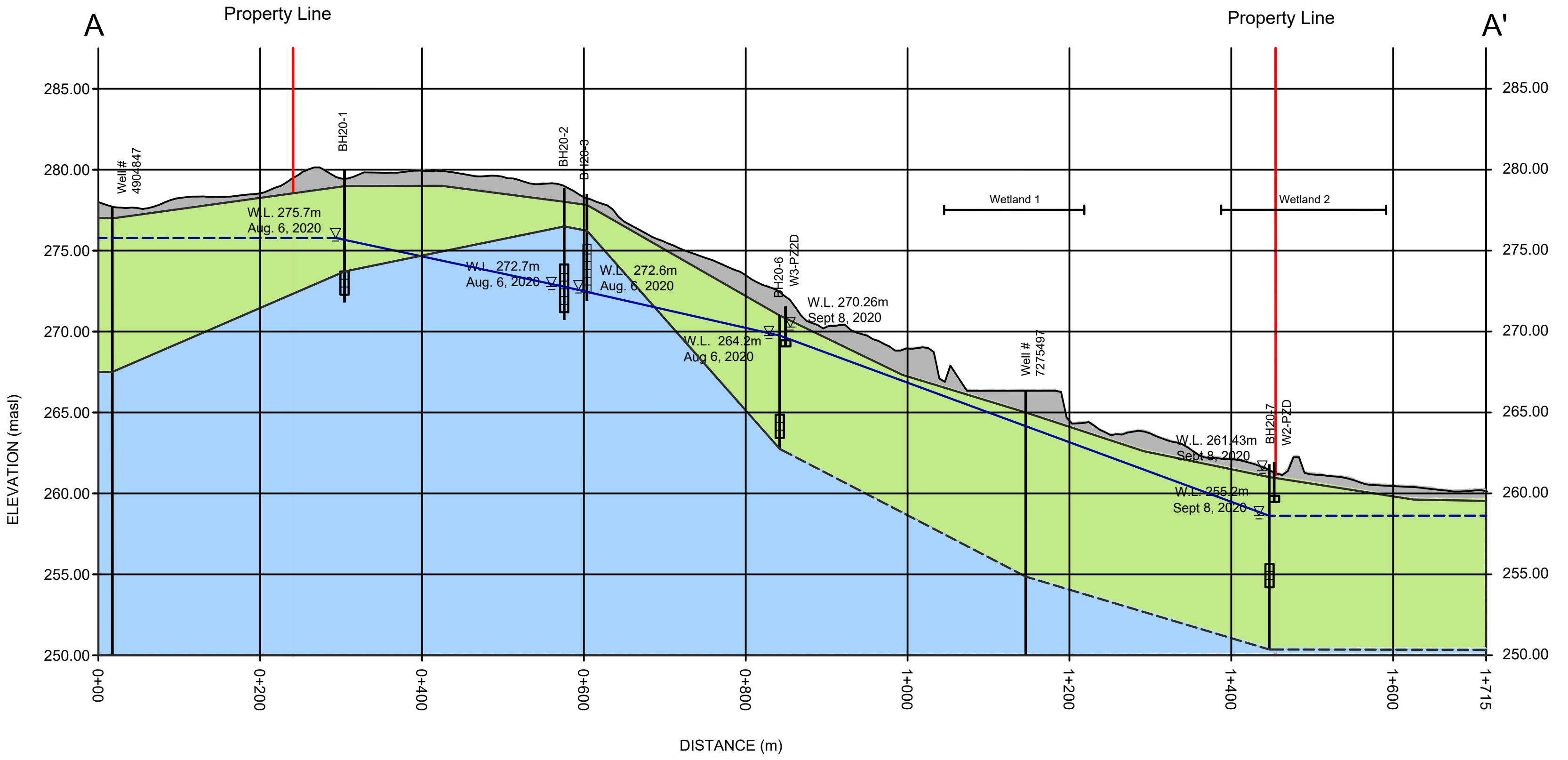

Horizontal Scale: 1:10,000
Vertical Scale: 1:400

- Groundwater Level
- 🟨 Sand
- ▨ Disturbed/Fill
- 🟩 Clayey Silt Till
- 🟦 Silty Sand Till/Silt

Well
Screen

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

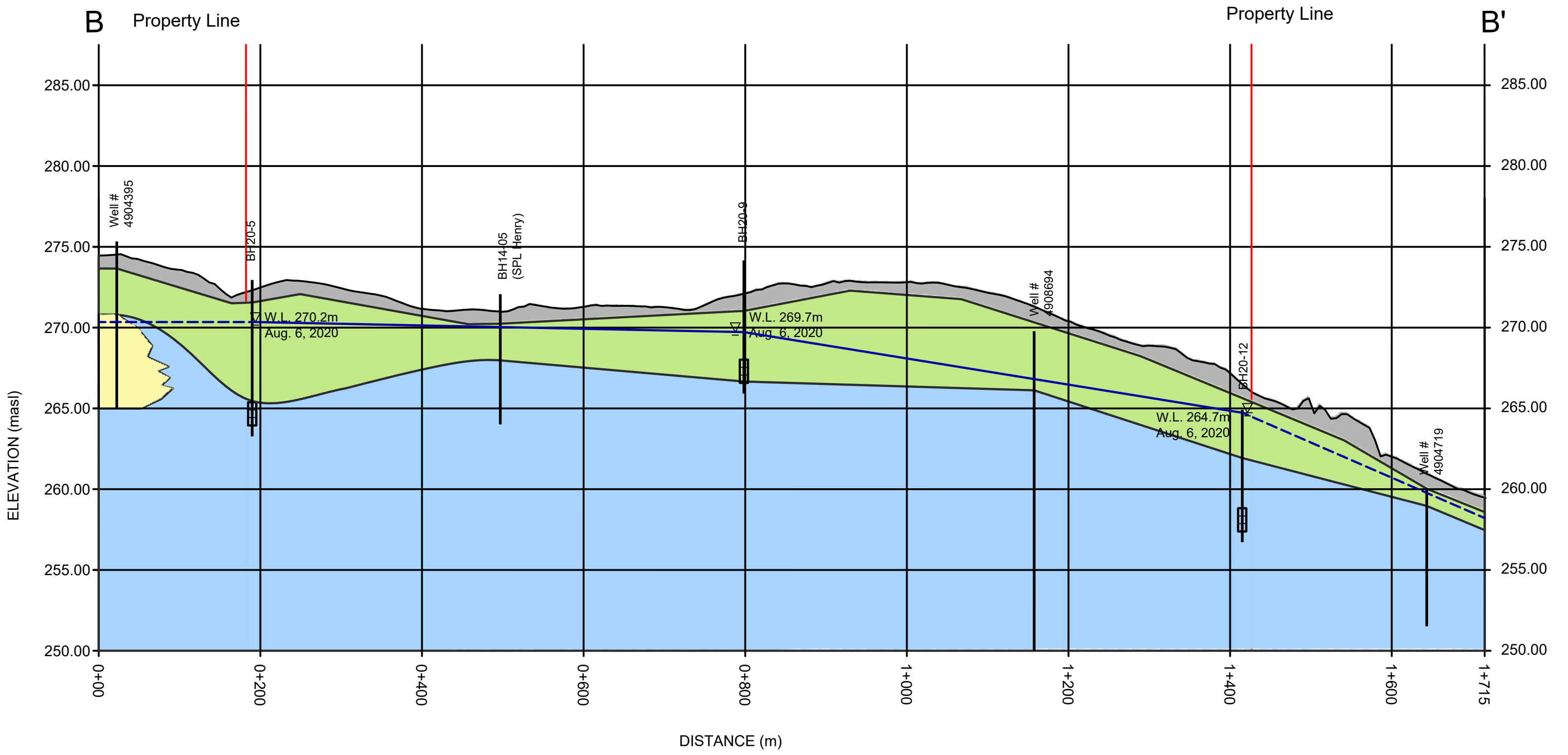
Title:

GEOLOGICAL CROSS SECTION A-A’

Client: Option 3 Landowners Group

Size: 8.5 x 11	Approved By: S.W	Drawn By: M.Z	Date: December 2020
Rev.	Scale: As Shown	Project No: 20-169-100	Figure No. **5A**

Path:192.168.2.252\projects\2020 projects\20-169-100 geo and hydro investigations bolton option 3 lands_argo development corp bolton option 3 landowners group\drawings\geo cross sections\working css.dwg



Horizontal Scale: 1:10,000
Vertical Scale: 1:400

--- Groundwater Level

🟨 Sand

▨ Disturbed/Fill

🟩 Clayey Silt Till

🟦 Silty Sand Till/Silt

Well

Screen

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title:

GEOLOGICAL CROSS SECTION B-B’

Client: Option 3 Landowners Group

Size: 8.5 x 11

Approved By: S.W

Drawn By: M.Z

Date: December 2020

Rev.

Scale: As Shown

Project No: 20-169-100

Figure No. **5B**

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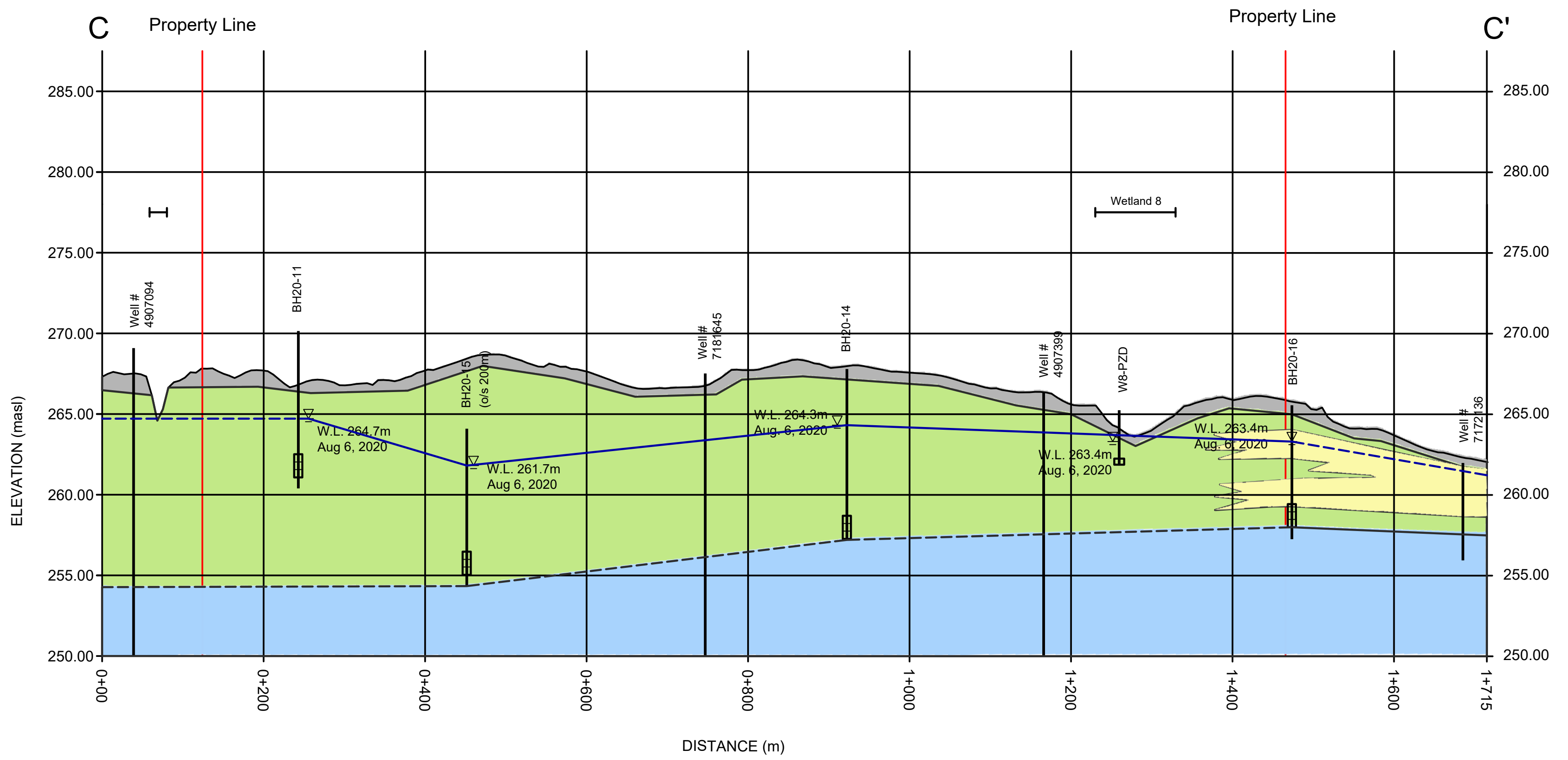

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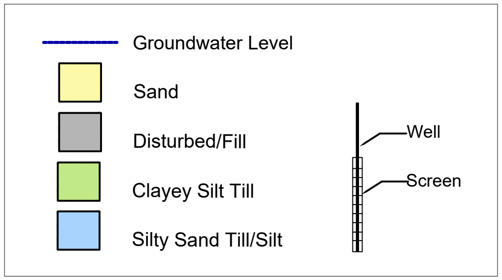

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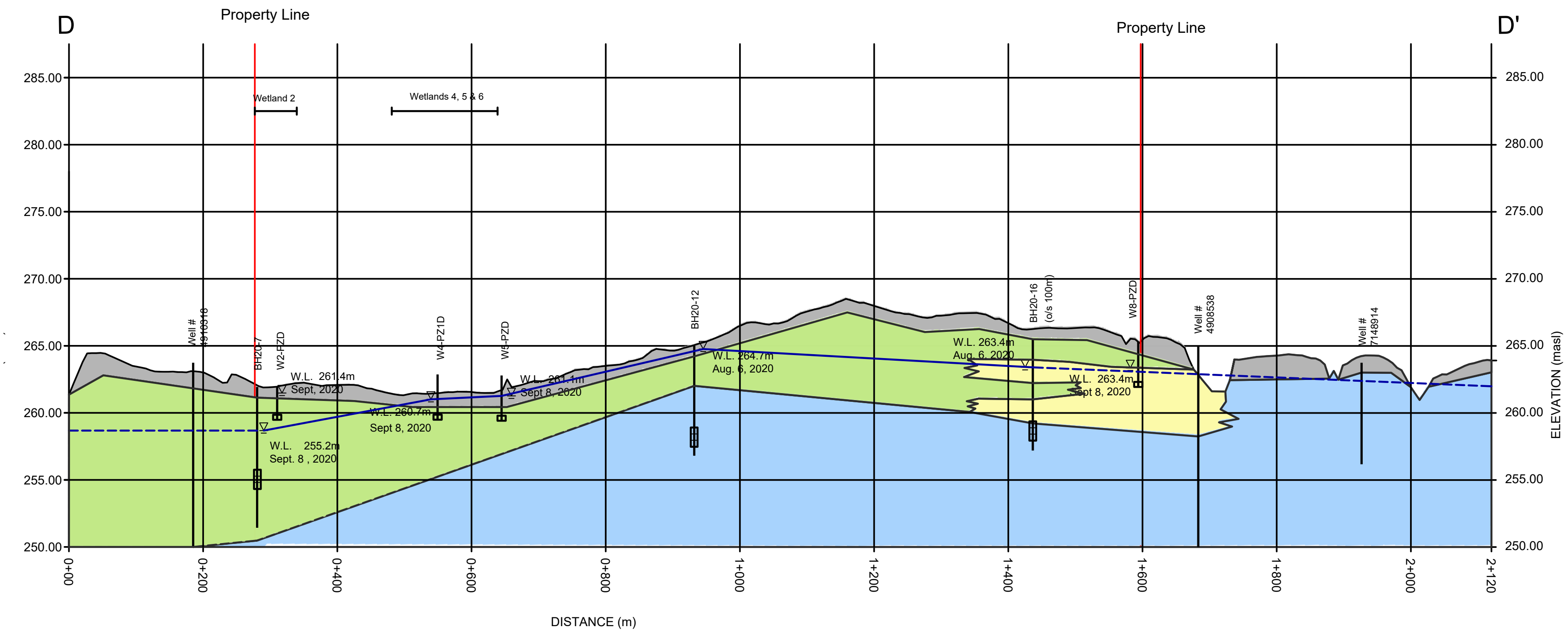
Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **GEOLOGICAL CROSS SECTION C-C'**

Client: Option 3 Landowners Group

Size: 8.5 x 11	Approved By: S.W	Drawn By: M.Z	Date: December 2020
Rev.	Scale: As Shown	Project No: 20-169-100	Figure No. **5C**

Path:192.168.2.252\projects\2020 projects\20-169-100 geo and hydro investigations bolton option 3 lands_argo development corp bolton option 3 landowners group\drawings\geo cross sections\working css.dwg



Horizontal Scale: 1:2000
Vertical Scale: 1:200

▬	Groundwater Level
🟨	Sand
▨	Disturbed/Fill
🟩	Clayey Silt Till
🟦	Silty Sand Till/Silt

Well
Screen

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title:

GEOLOGICAL CROSS SECTION D-D'

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5D**

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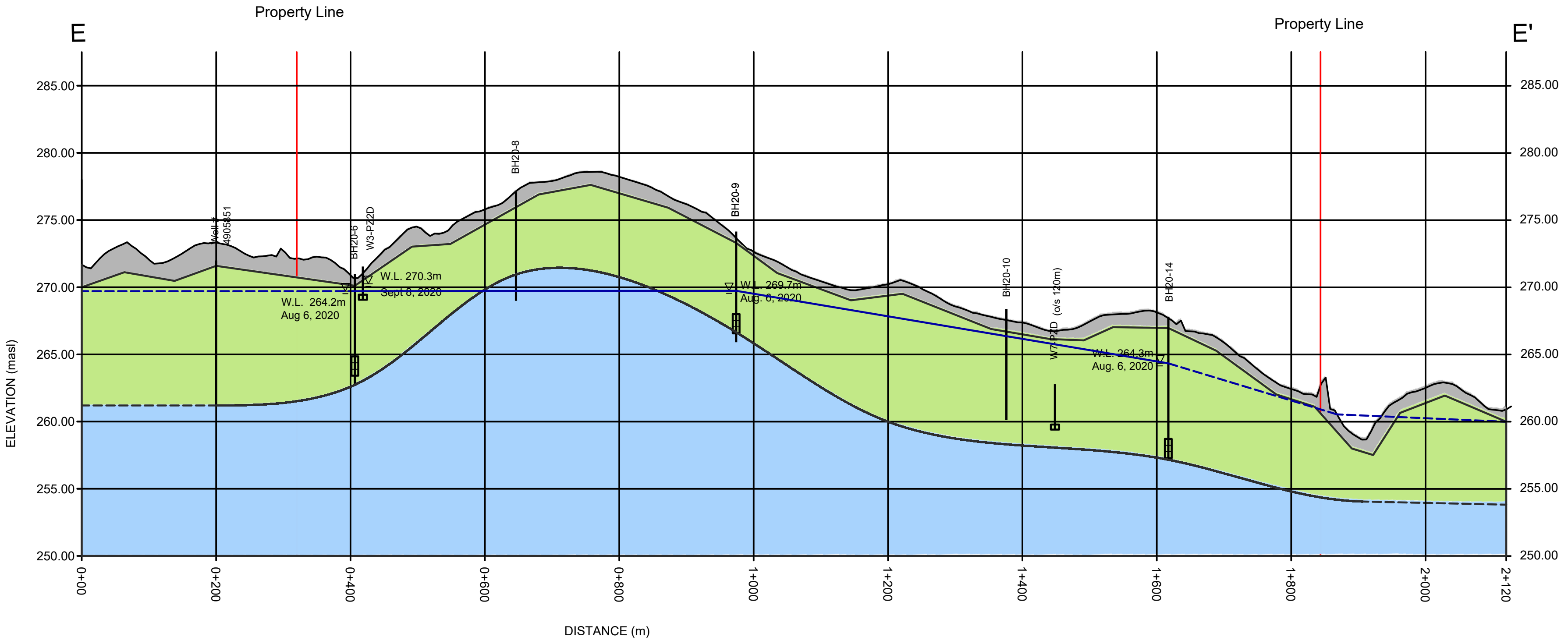

Horizontal Scale: 1:2000
Vertical Scale: 1:200

▬	Groundwater Level
🟨	Sand
▨	Disturbed/Fill
🟩	Clayey Silt Till
🟦	Silty Sand Till/Silt

Well
Screen

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Project: Hydrogeological Investigation and Water Balance Study- Macville Community

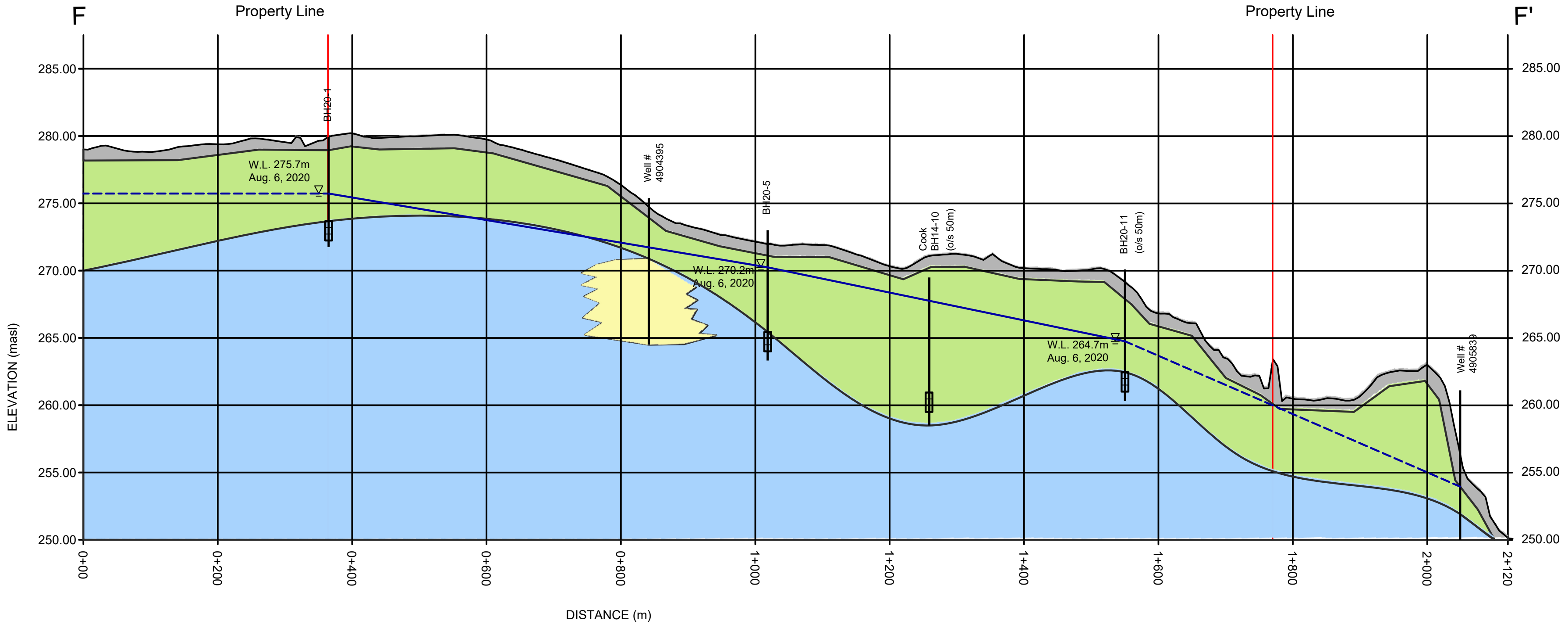
Title:

GEOLOGICAL CROSS SECTION E-E’

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	S.W	M.Z	December 2020
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5E**

Path:192.168.2.252\projects\2020 projects\20-169-100 geo and hydro investigations bolton option 3 lands_argo development corp bolton option 3 landowners group\drawings\geo cross sections\working css.dwg



Horizontal Scale: 1:2000
Vertical Scale: 1:200

--- Groundwater Level

🟨 Sand

▨ Disturbed/Fill

🟩 Clayey Silt Till

🟦 Silty Sand Till/Silt

Well

Screen

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

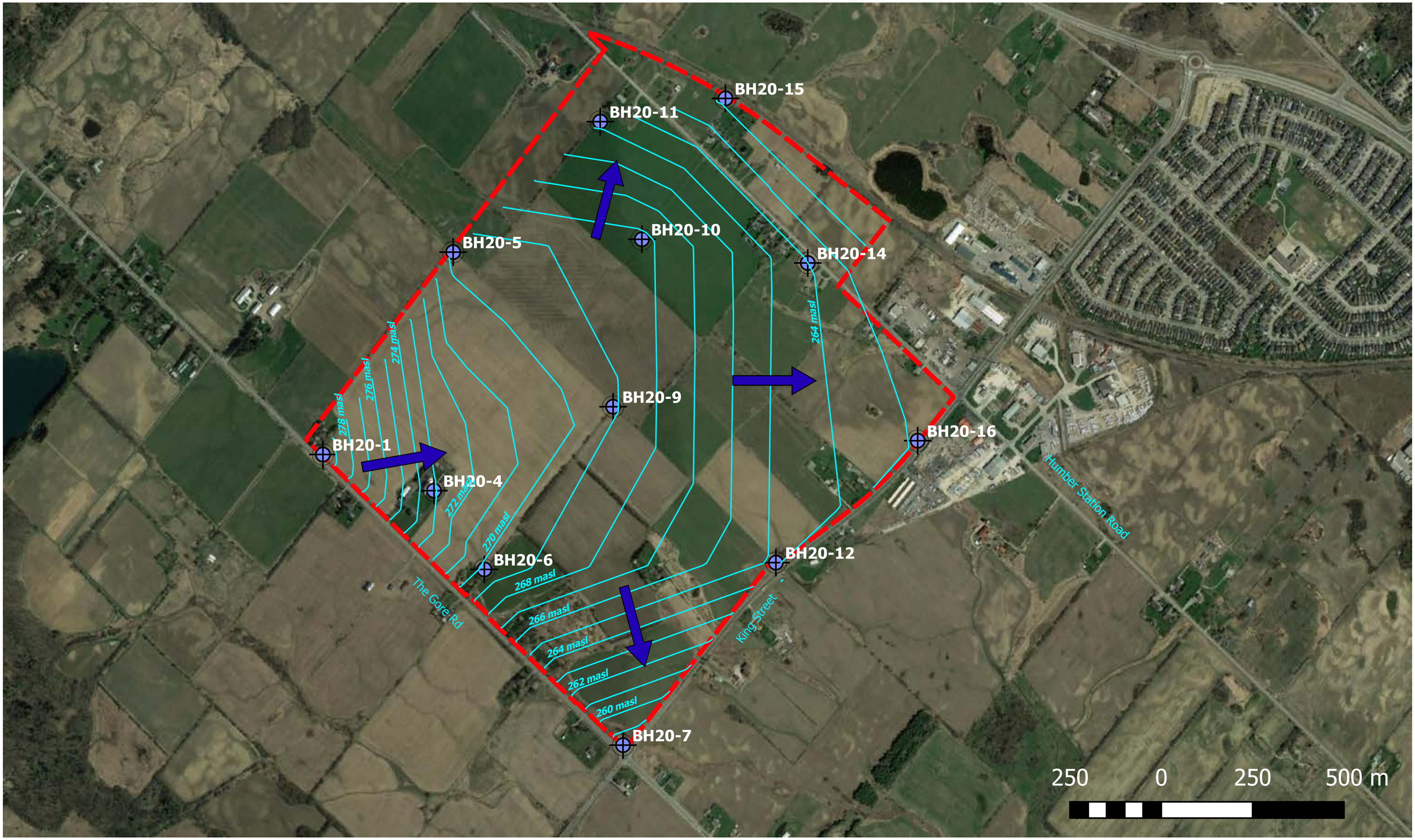
Title:

GEOLOGICAL CROSS SECTION F-F’

Client: Option 3 Landowners Group

Size: 8.5 x 11	Approved By: S.W	Drawn By: M.Z	Date: December 2020
Rev.	Scale: As Shown	Project No: 20-169-100	Figure No. 5F

C:\Projects\Bolton LOPA\Water Balance\GIS\GW flow map\GW flow map.qgs



Legend

- ▬ ▬ Site Boundary
- ⊕ Monitoring Well Location
- — Groundwater Contour (1m)
- ↓ Groundwater Flow

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Project: Hydrogeological Investigation and Water Balance Study - Macville Community

Title: **Groundwater Flow Map**

N

Client: Option 3 Landowners Group

Size: 8.5 x 11

Rev: 0

Approved By: S.W

Drawn By: M.Z

Date: December 2020

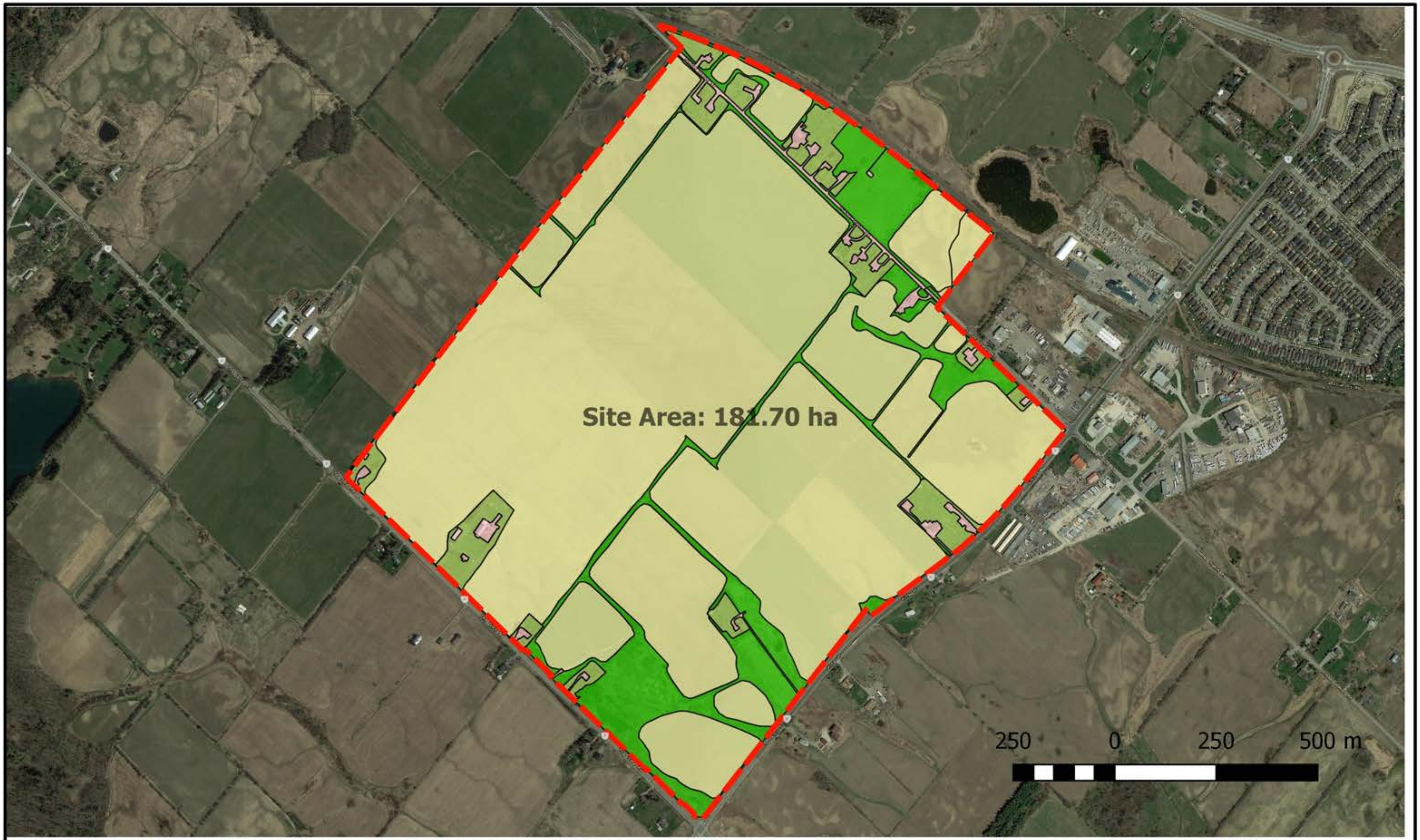
Scale: As Shown

Project No.: 20-169-100

Figure No.: 6

Image/Map Source: *Google Satellite Image*

C:\Projects\Bolton LOPA\Pre-Dev Site WB.qgs



Legend

Site Boundary

Hydrologic Cover Types

🟨 Cultivated

🟥 Impervious

🟩 Landscaped

🟩 Shrub

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Project: HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - MACKVILLE COMMUNITY

Title: **PRE-DEVELOPMENT CONCEPTUAL MODEL -SITE WATER BALANCE**

N

Client: Option 3 Landowners Group

Size: 8.5 x 11

Rev: 0

Approved By: M.G

Drawn By: S.W

Date: December 2020

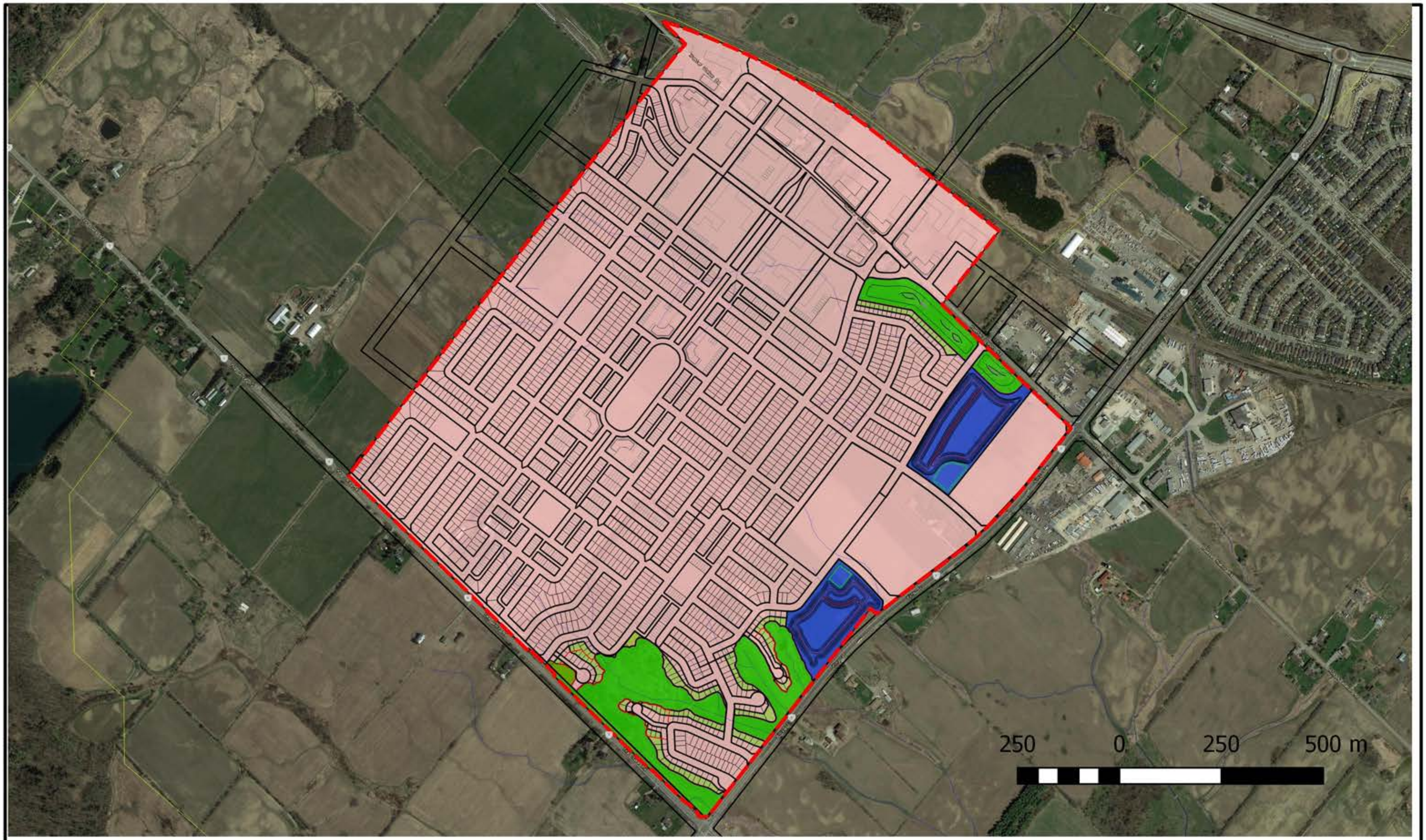
Scale: As Shown

Project No.: 20-169-100

Figure No.: 7

Image/Map Source: *Google Satellite Image*

C:\Projects\Bolton LOPA\Post-Dev Site WB.qgs



Legend

⬚ Site Boundary

Hydrologic Cover Types

🟥 Dev

🟩 Landscaped

🟩 NHS/Shrub

🟦 SWM Pond

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Project: HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - MACKVILLE COMMUNITY

Title: **POST-DEVELOPMENT CONCEPTUAL MODEL -SITE WATER BALANCE**

N

Client: Option 3 Landowners Group

Size: 8.5 x 11

Rev: 0

Approved By: M.G

Drawn By: S.W

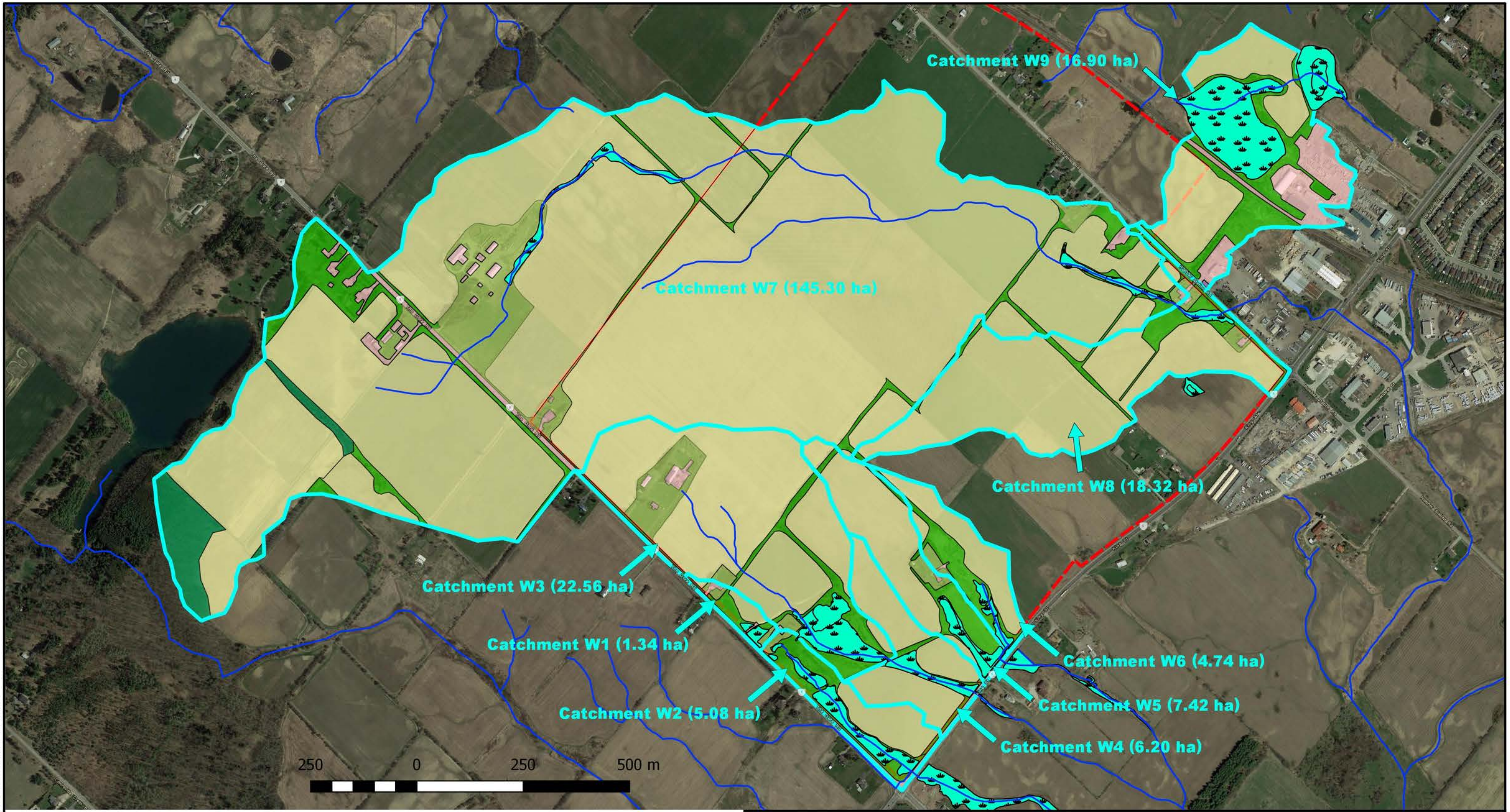
Date: December 2020

Scale: As Shown

Project No.: 20-169-100

Figure No.: 8

Image/Map Source: *Google Satellite Image*



Legend

- Site Boundary
- Wetlands
- Watercourse
- Pre-development Wetland Catchments

Hydrologic Cover Types

- 🟨 Cultivated
- 🟩 Forest
- 🟥 Impervious
- 🟩 Landscaped
- 🟩 Shrub

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Project:	HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - MACKVILLE COMMUNITY
Title:	**PRE-DEVELOPMENT LAND USE & WETLAND CATCHMENT MAP**
Client:	Option 3 Landowners Group
Size:	11x17
Rev.	0
Approved By:	SW
Drawn By:	S.Y
Date:	December, 2020
Scale:	As Shown
Project No.:	20-169-100
Figure No.:	9
Image/Map Source:	Google Satellite Image

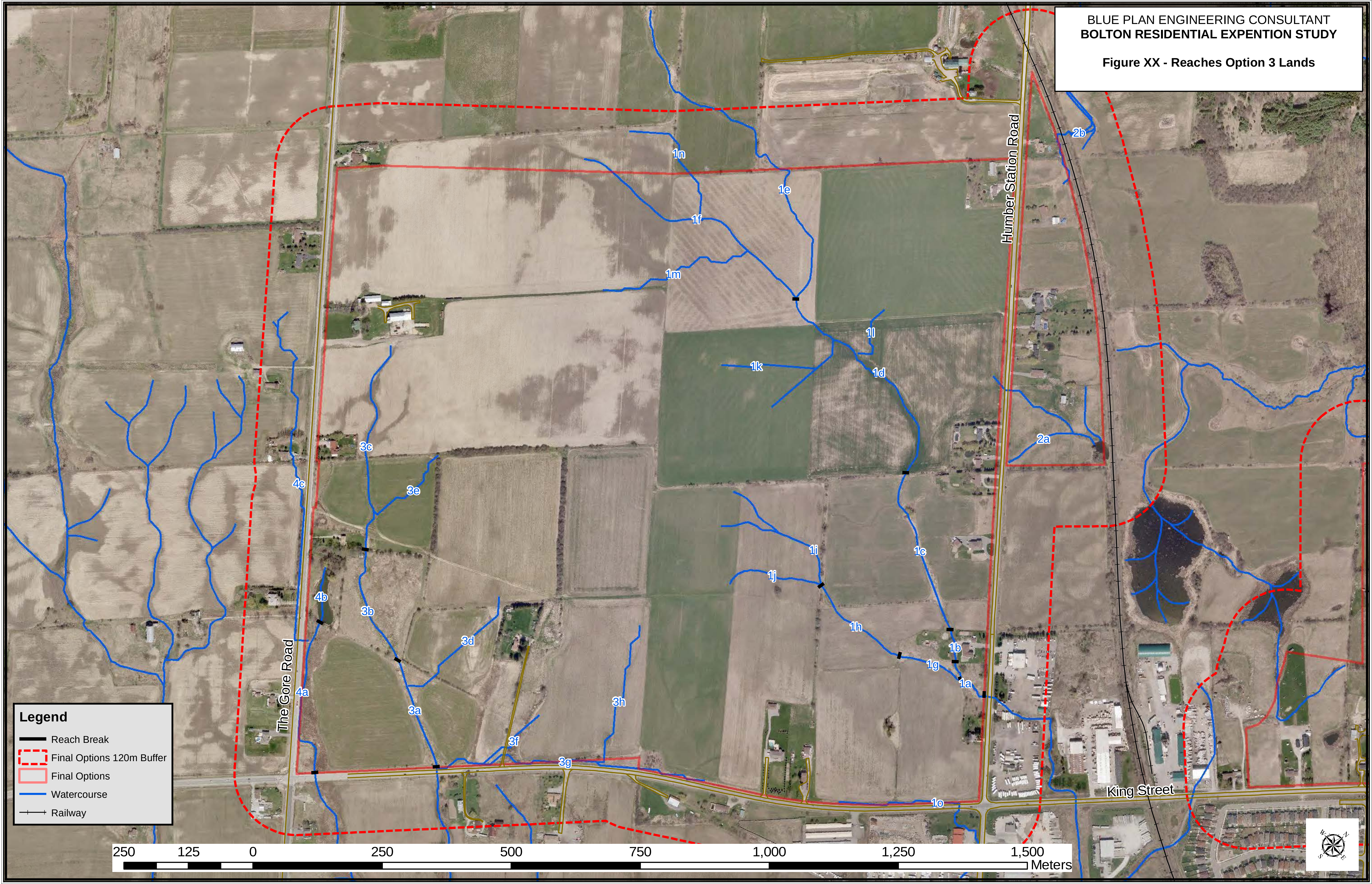
C:\Projects\Bolton LOPA\Pre-Dev Wetland WB.qgs Jan-06 12:06

Appendix A

BLUE PLAN ENGINEERING CONSULTANT

BOLTON RESIDENTIAL EXPENTION STUDY

Figure XX - Reaches Option 3 Lands



Appendix B

LOG OF BOREHOLE BH20-1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857815.92 E 597082.44

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

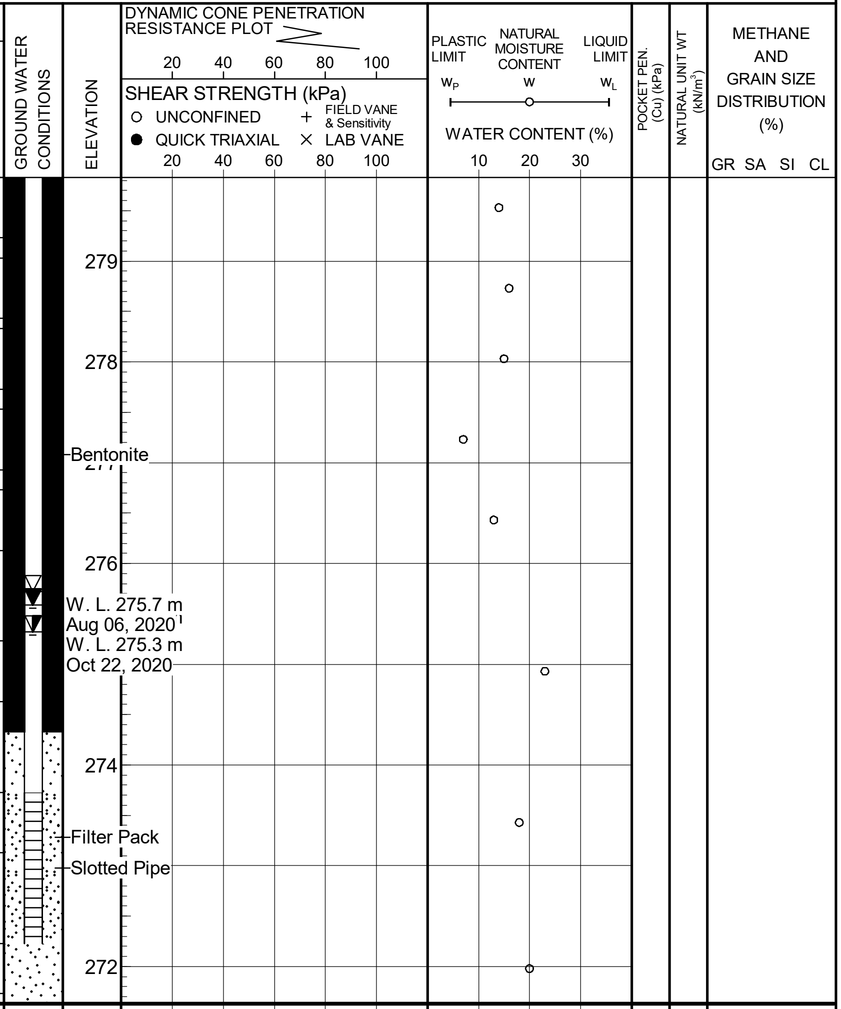
REF. NO.: 20-169-100
ENCL NO.: 2

SOIL PROFILE

(m) ELEV DEPTH	DESCRIPTION
279.8	
279.5 0.0	**TOPSOIL:** 300mm
0.3	**FILL:** sandy silt, trace gravel, dark brown, moist, loose
279.0 0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff to hard trace cobble below 2.3m
275.3 4.5	**SILTY CLAY:** trace sand, grey, very moist, very stiff
273.8 6.0	**SILT:** trace clay, grey, wet, compact
271.6 8.2	**END OF BOREHOLE:**

SAMPLES

NUMBER	TYPE	"N" BLOWS/0.3 m
1	SS	6
2	SS	19
3	SS	36
4	SS	55
5	SS	32
6	SS	17
7	SS	12
8	SS	20



Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	4.11
Sept 8, 2020	4.24
Oct 22, 2020	4.51

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

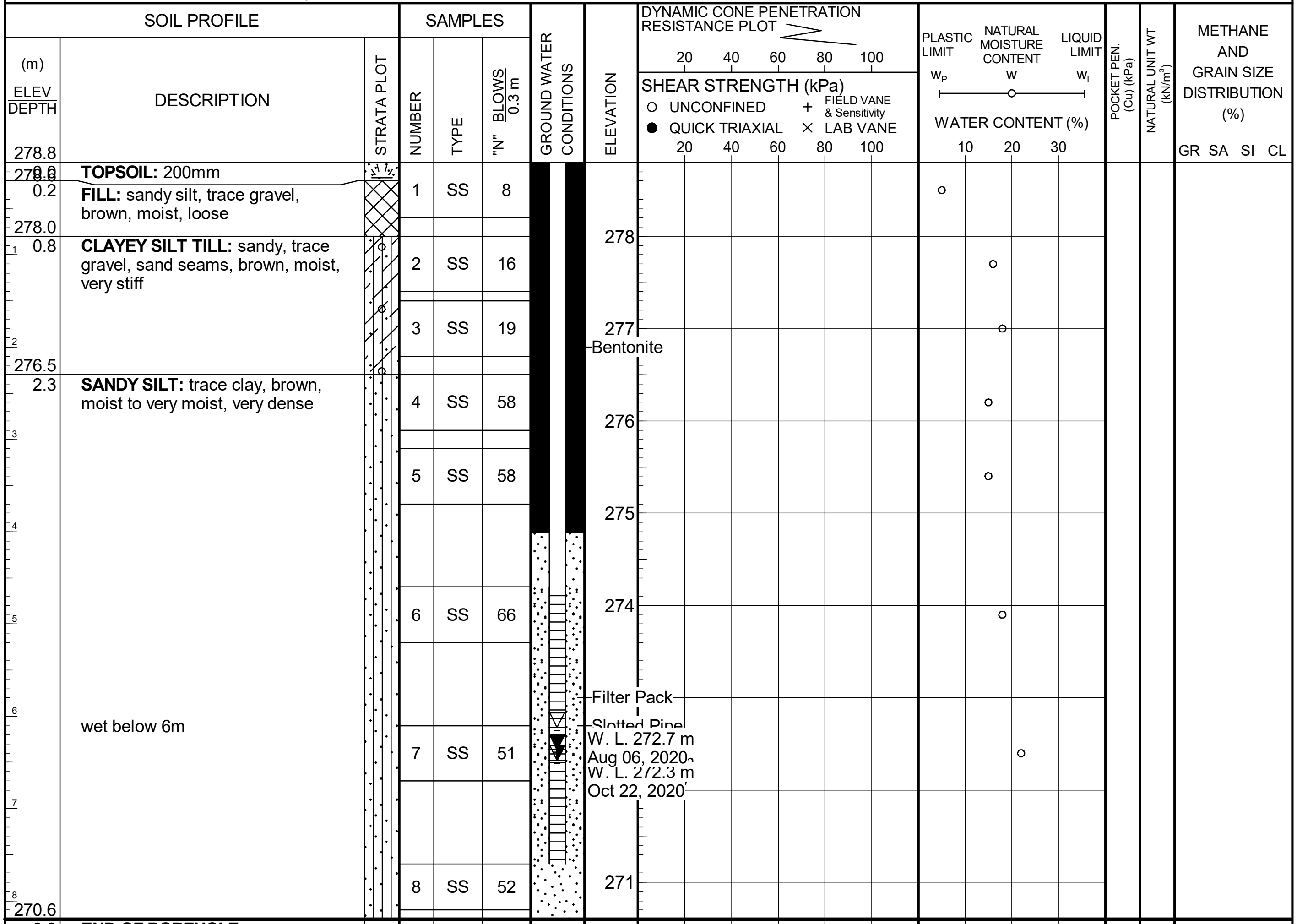
GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH20-2

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857663.29 E 597311.06

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 3



(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS / 0.3 m
278.8				
278.6 / 0.0	**TOPSOIL:** 200mm			
0.2	**FILL:** sandy silt, trace gravel, brown, moist, loose	1	SS	8
278.0 / 0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff	2	SS	16
		3	SS	19
276.5 / 2.3	**SANDY SILT:** trace clay, brown, moist to very moist, very dense	4	SS	58
		5	SS	58
		6	SS	66
	wet below 6m	7	SS	51
		8	SS	52
270.6 / 8.2	**END OF BOREHOLE:**			

Notes:
1) Water level at 6.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.12
Sept 8, 2020	6.36
Oct 22, 2020	6.48

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
$+^3, \times^3$: Numbers refer to Sensitivity
○ ^{8}=3% Strain at Failure

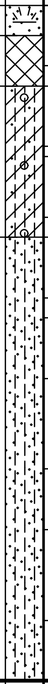
LOG OF BOREHOLE BH20-3

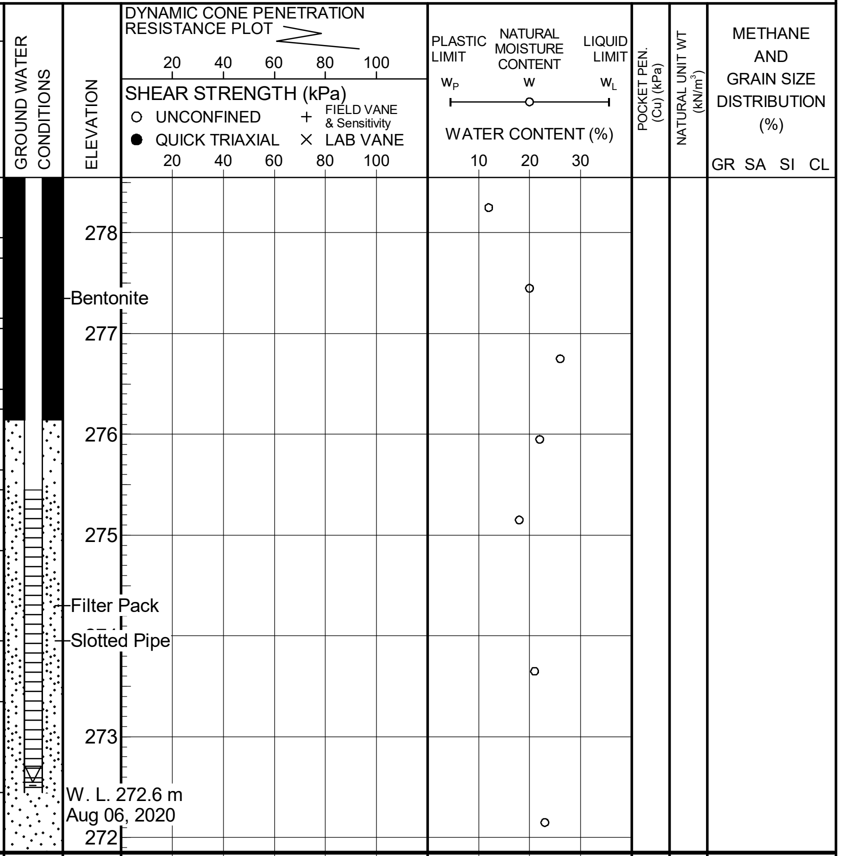
PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857648.82 E 597335.94

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 4

SOIL PROFILE			SAMPLES		
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3 m
278.6					
0.0	**TOPSOIL:** 300mm				
278.3 0.3	**FILL:** sandy silt, trace gravel, brown, moist, compact		1	SS	10
277.8 0.8	**SILTY CLAY TILL:** sandy, trace gravel, sand seams, brown, moist, stiff		2	SS	13
			3	SS	10
276.3 2.3	**SILTY SAND:** trace clay, grey, moist, compact to very dense		4	SS	15
			5	SS	35
	wet below 4.5m		6	SS	65
			7	SS	49
271.9 6.7	**END OF BOREHOLE:**				





Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.0
Sept 8, 2020	dry
Oct 22, 2020	dry

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
$+^3, \times^3$: Numbers refer to Sensitivity
○ $^{\varepsilon}$=3% Strain at Failure

DS CONSULTANTS LTD.

LOG OF BOREHOLE BH20-4

1 OF 1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857717.02 E 597386.34

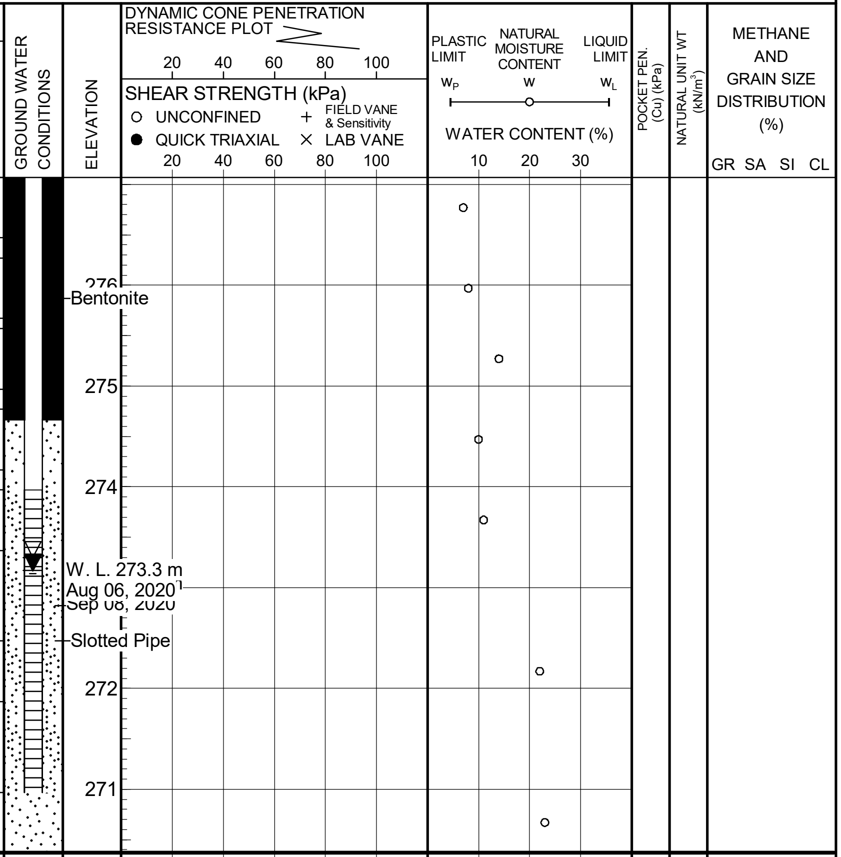
DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 5

SOIL PROFILE		SAMPLES		
(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS / 0.3 m
277.1				
276.8 0.0	**CONCRETE:** 300mm	1	SS	8
0.3 276.3	**FILL:** clayey silt, trace gravel, grey to brown, moist, stiff			
0.8	**SANDY SILT:** trace clay, brown, moist, compact to very dense	2	SS	21
		3	SS	42
		4	SS	62
		5	SS	56
	wet below 4.5m	6	SS	46
271.1 6.0	**SANDY SILT:** trace silt, brown, wet, compact	7	SS	28
270.4 6.7	**END OF BOREHOLE:**			

Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	3.77
Sept 8, 2020	3.90
Oct 22, 2020	inaccessible



GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ 8=3% Strain at Failure

DS CONSULTANTS LTD.

LOG OF BOREHOLE BH20-5

1 OF 1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858369.55 E 597438.77

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

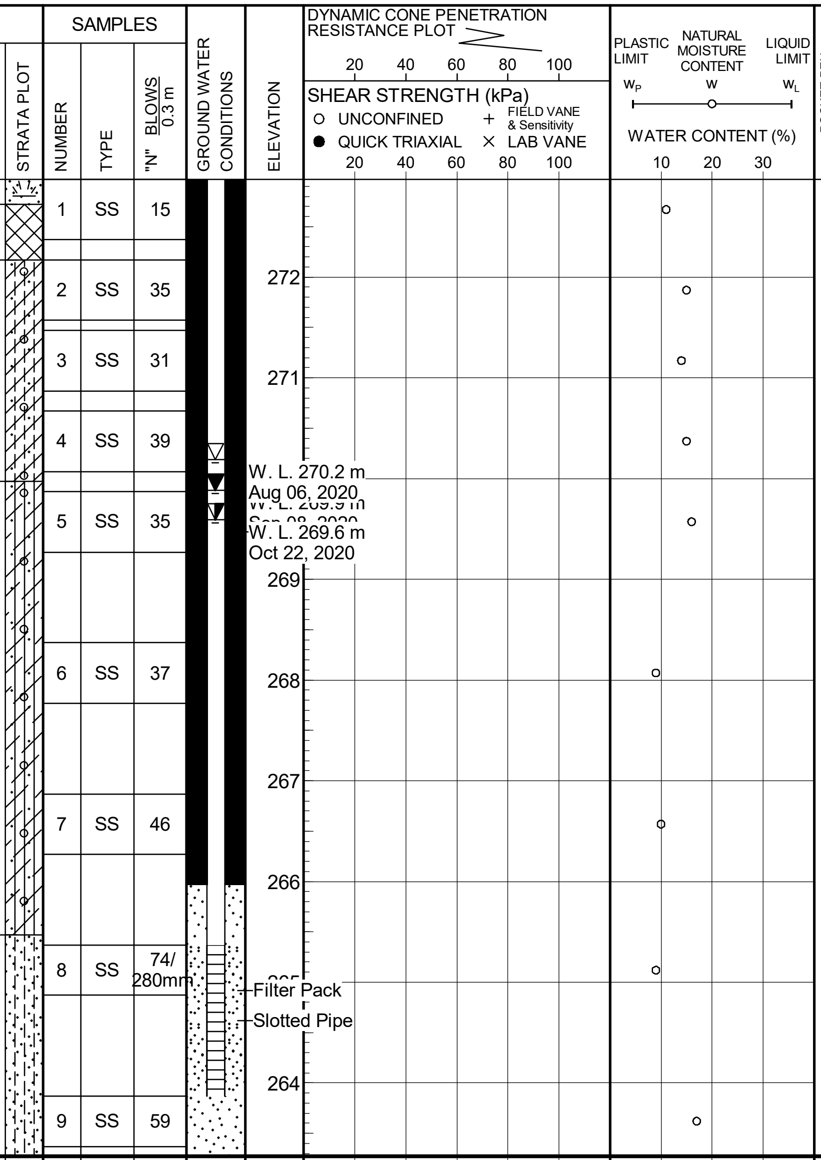
REF. NO.: 20-169-100
ENCL NO.: 6

SOIL PROFILE

(m) ELEV / DEPTH	DESCRIPTION
273.0	
272.7 / 0.0	**TOPSOIL:** 250mm
0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact
272.2 / 0.8	**SILTY CLAY TILL:** sandy, trace gravel, frequent sand seams, brown, moist, hard
270.0 / 3.0	**CLAYEY SILT TILL:** sandy, trace gravel, interbed of sandy silt layers, greyish brown, moist to very moist, hard grey below 4.5m sand seams below 6m
265.5 / 7.5	**SILTY SAND:** trace clay, grey, moist, very dense very moist at 9m
263.3 / 9.7	**END OF BOREHOLE:**

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	15	
2	SS	35	
3	SS	31	
4	SS	39	
5	SS	35	
6	SS	37	
7	SS	46	
8	SS	74/ 280mm	0 51 47 2
9	SS	59	



Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.78
Sept 8, 2020	3.09
Oct 22, 2020	3.38

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

DS CONSULTANTS LTD.

LOG OF BOREHOLE BH20-6

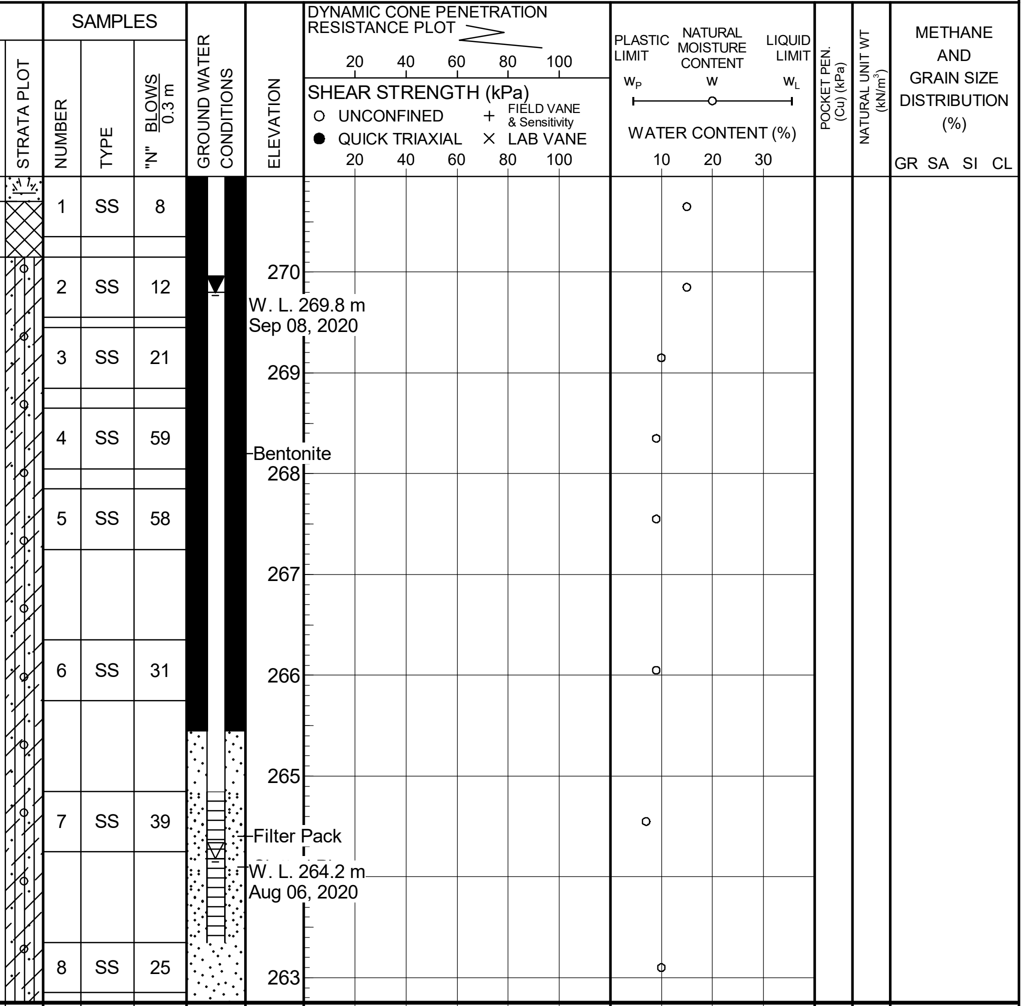
1 OF 1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857501.44 E 597524.2

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS / 0.3 m
271.0				
0.0 270.7	**TOPSOIL:** 250mm			
0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, loose	1	SS	8
270.2 0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, stiff to hard	2	SS	12
		3	SS	21
	hard below 2.3m	4	SS	59
		5	SS	58
	grey below 4.5m	6	SS	31
		7	SS	39
		8	SS	25
262.8 8.2	**END OF BOREHOLE:**			



Notes:
1) Borehole dry during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.77
Sept 8, 2020	1.15

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ 8 =3% Strain at Failure

DS CONSULTANTS LTD.

LOG OF BOREHOLE BH20-7

1 OF 1

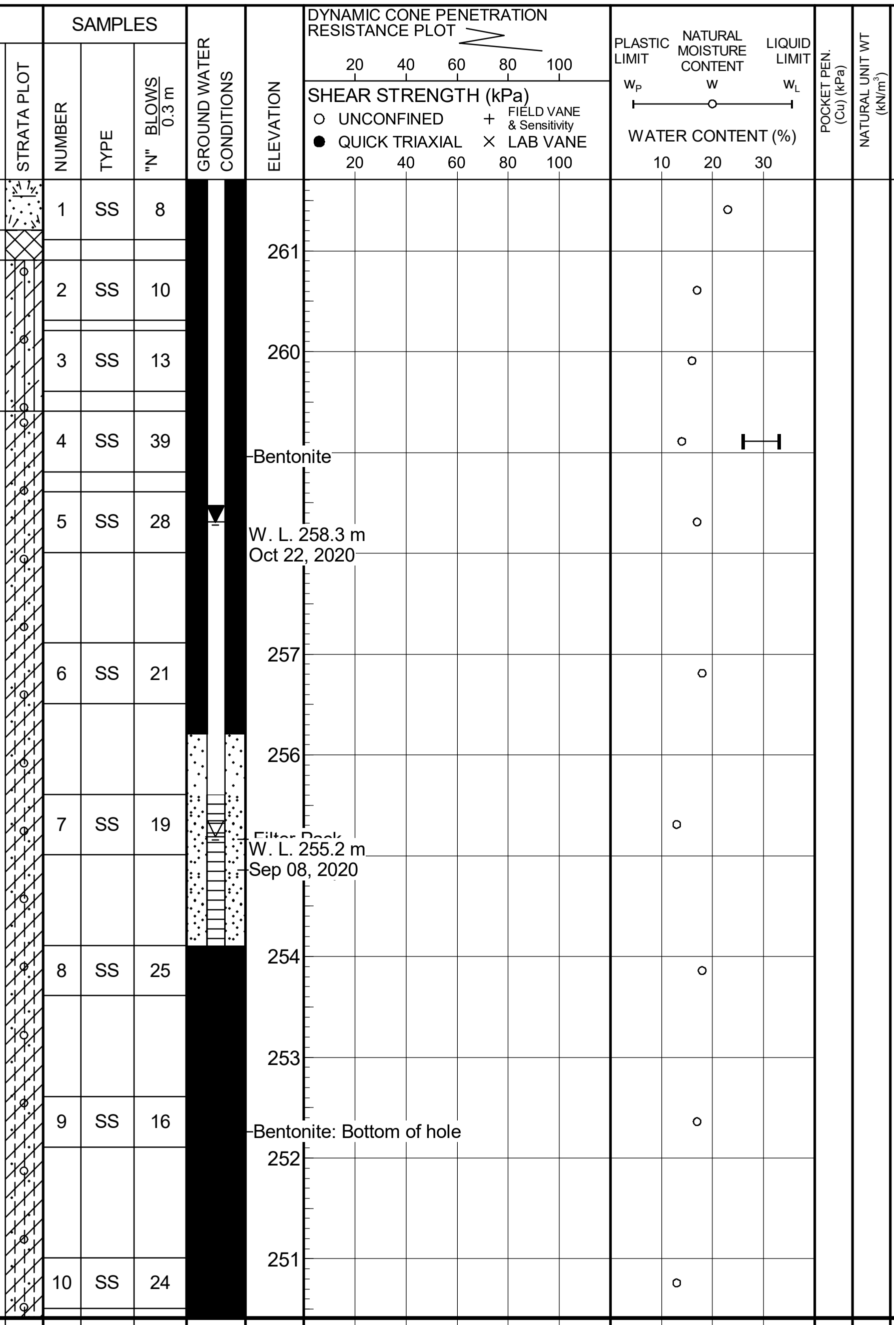
PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857020.81 E 597903.58

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 8

(m) ELEV DEPTH	DESCRIPTION
261.7	
261.2 0.0	**TOPSOIL:** 500mm
260.9 0.5	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, stiff
0.8	**CLAYEY SILT TILL:** some sand, trace gravel, brownish grey, very moist, stiff with silt and sand seams at 1.5m
259.4 2.3	**SILTY CLAY TILL:** some sand, some gravel, greyish brown, moist, very stiff to hard grey, very moist to wet below 3m
250.4 11.3	**END OF BOREHOLE:**

NUMBER	TYPE	"N" BLOWS/0.3 m	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	8	
2	SS	10	
3	SS	13	
4	SS	39	15 18 38 29
5	SS	28	
6	SS	21	
7	SS	19	
8	SS	25	
9	SS	16	
10	SS	24	



Notes:
1) Borehole dry during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	dry
Sept 8, 2020	6.52
Oct 22, 2020	3.40

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH20-8

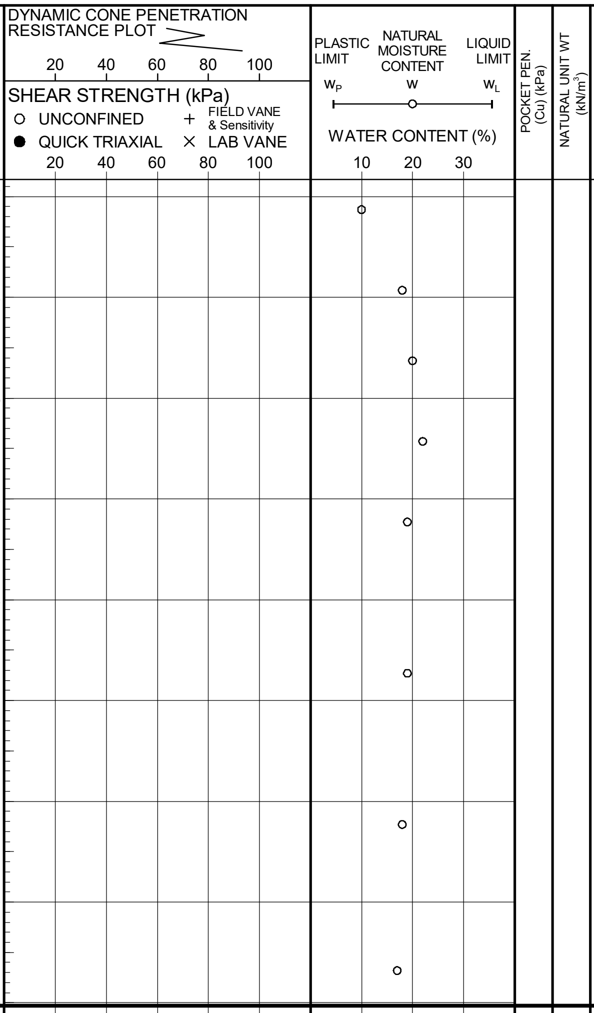
1 OF 1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857701.02 E 597673.81

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 9

(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
277.2 0.0	**TOPSOIL:** 340mm	1	SS	8		277	
276.8 0.4	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, brown, moist, loose						
276.4 0.8	**CLAYEY SILT TILL:** sandy, trace gravel, brown, moist, compact	2	SS	10		276	
275.7 1.5	**SILT:** some clay, trace sand, trace gravel, brown, very moist, compact to very dense	3	SS	19		275	
		4	SS	58			2 2 85 11
		5	SS	92/ 255mm		274	
		6	SS	74		273 272	
271.2 6.0	**SANDY SILT:** trace clay, brown, wet, very dense	7	SS	62		271 270	0 27 67 6
		8	SS	54			
269.0 8.2	**END OF BOREHOLE:** Notes: 1) Water at depth of 6.1m during drilling.					269	



GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ 8=3% Strain at Failure

DS CONSULTANTS LTD.

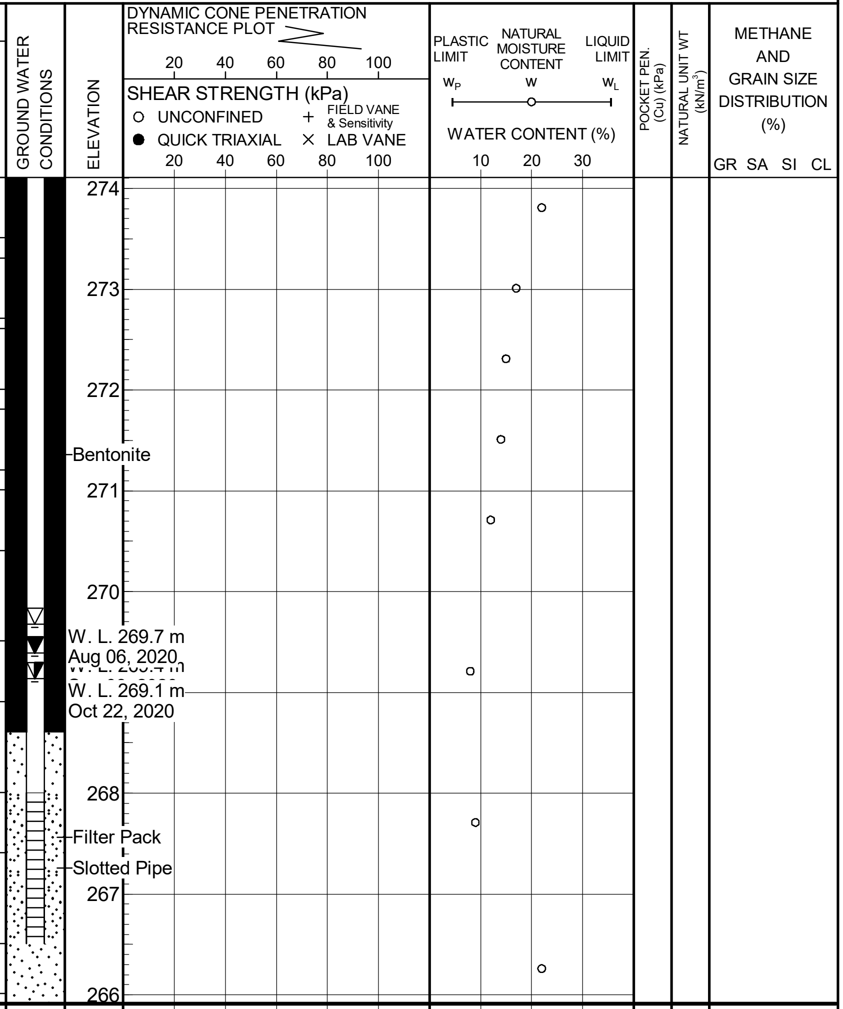
LOG OF BOREHOLE BH20-9

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857946.64 E 597876.44

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 10

(m) ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLES NUMBER	TYPE	"N" BLOWS/0.3 m
274.1 0.0	**TOPSOIL:** 550mm	1	SS	5
273.6 0.6	**FILL:** sandy silt, trace topsoil/ organics, trace clay, trace gravel, trace organics, trace rootlets, dark brown, moist, loose			
273.3 0.8	**SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard	2	SS	16
		3	SS	25
	sand seams below 2.3m	4	SS	38
		5	SS	72
	grey below 4.5m	6	SS	45
	trace cobble, very moist below 6m	7	SS	24
266.6 7.5	**SANDY SILT:** trace clay, grey, wet, compact	8	SS	29
265.9 8.2	**END OF BOREHOLE:**			



Notes:
1) Water level at 7.6m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	4.43
Sept 8, 2020	4.72
Oct 22, 2020	4.97

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ 8=3% Strain at Failure

DS CONSULTANTS LTD.

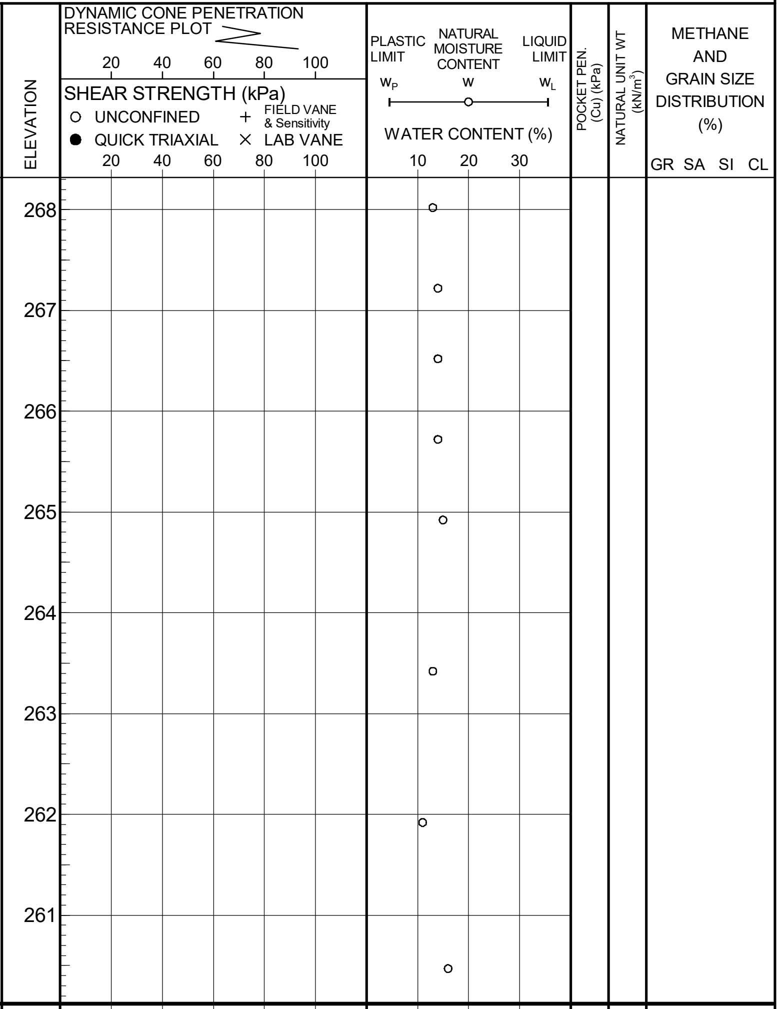
LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858404.6 E 597955.26

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

REF. NO.: 20-169-100
ENCL NO.: 11

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS
(m) ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3 m	
268.3 0.0	**TOPSOIL:** 300mm					
268.0 0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact		1	SS	15	
267.5 0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist to very moist, very stiff		2	SS	21	
			3	SS	25	
			4	SS	25	
	grey below 3m		5	SS	16	
			6	SS	20	
			7	SS	17	
			8	SS	15	
260.1 8.2	**END OF BOREHOLE:** Notes: 1) Borehole dry and open upon completion.					



GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

DS CONSULTANTS LTD.

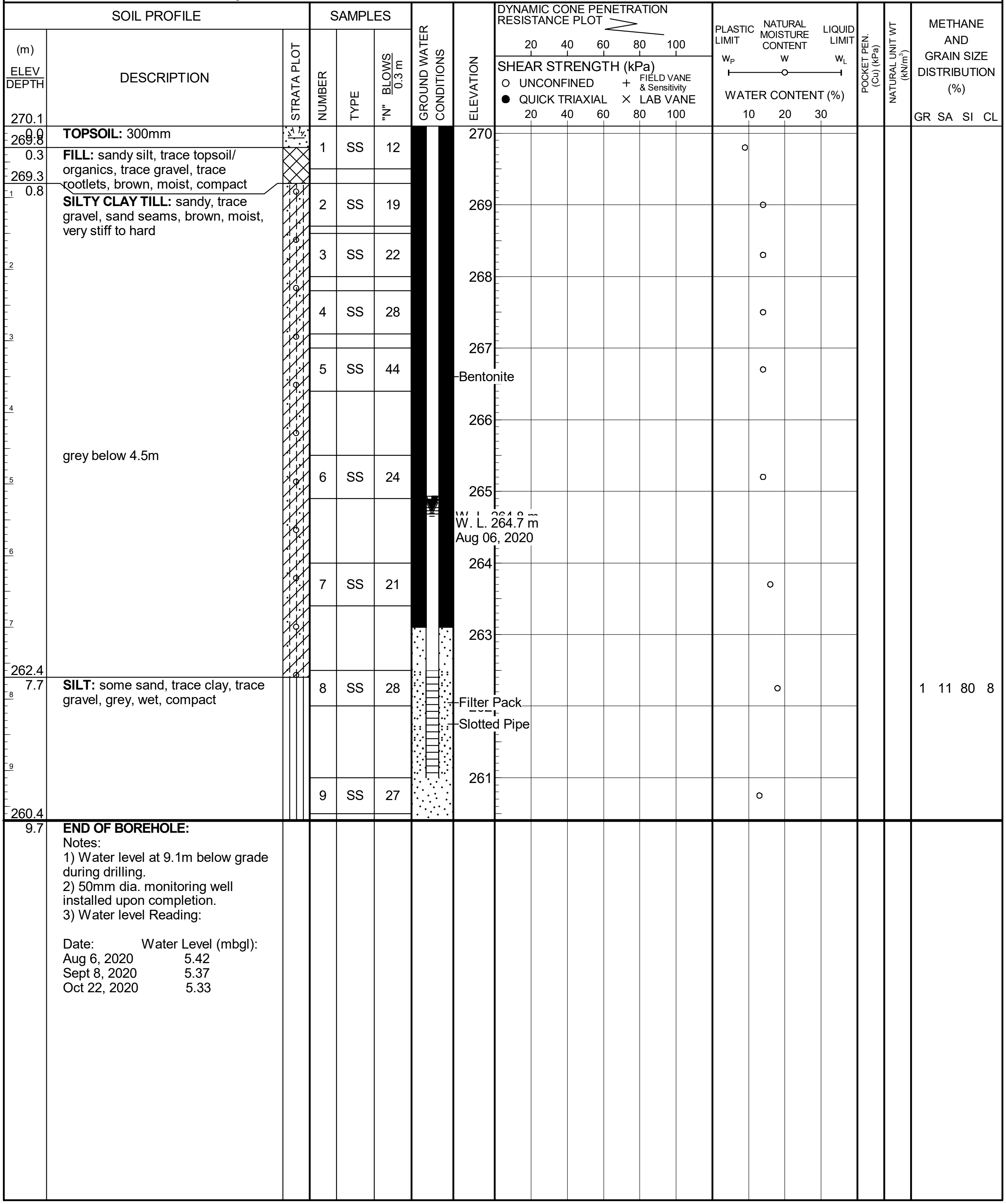
LOG OF BOREHOLE BH20-11

1 OF 1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858726.5 E 597841.19

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

REF. NO.: 20-169-100
ENCL NO.: 12



(m) ELEV DEPTH	DESCRIPTION
270.1	
269.8 0.0	**TOPSOIL:** 300mm
0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact
269.3 0.8	**SILTY CLAY TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff to hard grey below 4.5m
262.4 7.7	**SILT:** some sand, trace clay, trace gravel, grey, wet, compact
260.4 9.7	**END OF BOREHOLE:**

NUMBER	TYPE	"N" BLOWS / 0.3 m	GR	SA	SI	CL
1	SS	12				
2	SS	19				
3	SS	22				
4	SS	28				
5	SS	44				
6	SS	24				
7	SS	21				
8	SS	28	1	11	80	8
9	SS	27				

Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	5.42
Sept 8, 2020	5.37
Oct 22, 2020	5.33

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

DS CONSULTANTS LTD.

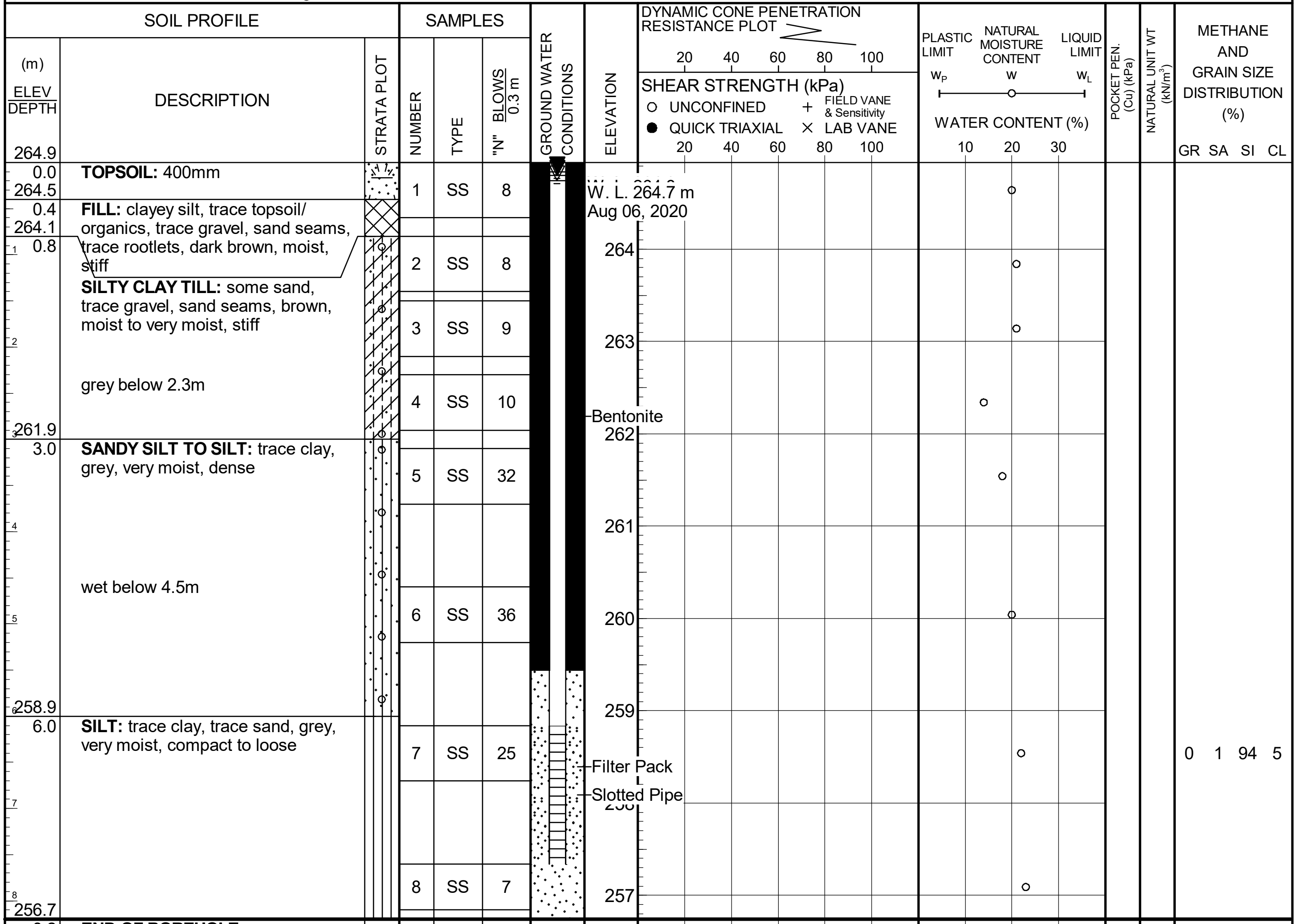
LOG OF BOREHOLE BH20-12

1 OF 1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857520.15 E 598321.99

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 13



(m) ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3 m	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
264.9					
0.0	**TOPSOIL:** 400mm	1	SS	8	
264.5 0.4	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, sand seams, trace rootlets, dark brown, moist, stiff				
264.1 0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist to very moist, stiff	2	SS	8	
		3	SS	9	
	grey below 2.3m	4	SS	10	
261.9 3.0	**SANDY SILT TO SILT:** trace clay, grey, very moist, dense	5	SS	32	
	wet below 4.5m	6	SS	36	
258.9 6.0	**SILT:** trace clay, trace sand, grey, very moist, compact to loose	7	SS	25	0 1 94 5
		8	SS	7	
256.7 8.2	**END OF BOREHOLE:**				

Notes:
1) Water level at 3.1m below grade during drilling
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	0.2
Sept 8, 2020	0.1
Oct 22, 2020	0.14

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH20-13

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857981.07 E 598332.09

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

REF. NO.: 20-169-100
ENCL NO.: 14

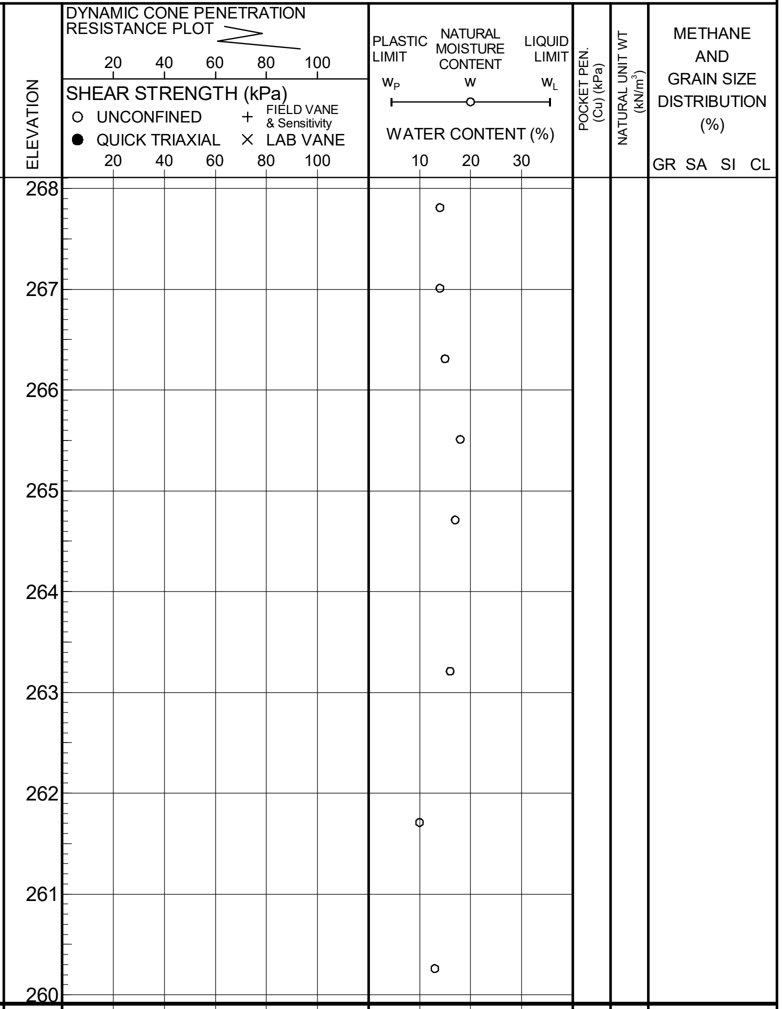
SOIL PROFILE

(m) ELEV DEPTH	DESCRIPTION
268.1 0.0	**TOPSOIL:** 200mm
267.9 0.2	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, stiff
267.3 0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brownish grey, moist, stiff to very stiff grey below 4.5m
260.6 7.5	**SANDY SILT TO SILT:** trace clay, trace gravel, grey, wet, very dense
259.9 8.2	**END OF BOREHOLE:** Notes: 1) Water at 7.6m below grade during drilling

SAMPLES

NUMBER	TYPE	"N" BLOWS/0.3 m
1	SS	12
2	SS	19
3	SS	20
4	SS	26
5	SS	14
6	SS	9
7	SS	19
8	SS	94/ 255mm

GROUND WATER CONDITIONS



DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

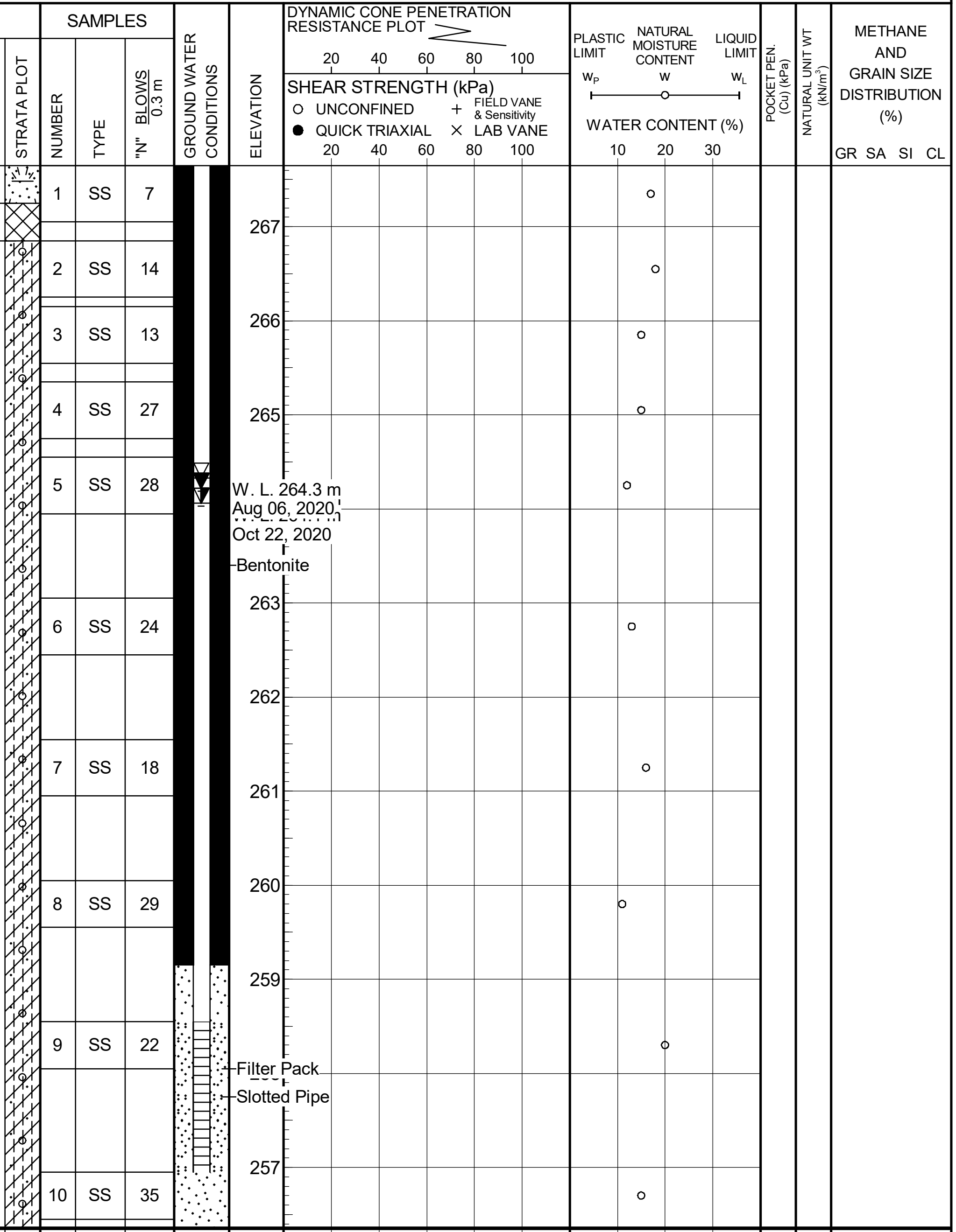
LOG OF BOREHOLE BH20-14

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858339.89 E 598409.18

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

REF. NO.: 20-169-100
ENCL NO.: 15

(m) ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS / 0.3 m
267.7				
0.0	**TOPSOIL:** 400mm	1	SS	7
267.3 0.4	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace sand, trace rootlets, brown, moist, firm			
266.9 0.8	**SILTY CLAY TILL:** some sand, trace gravel, frequent sand seams, brown, moist, stiff to hard	2	SS	14
		3	SS	13
		4	SS	27
		5	SS	28
		6	SS	24
	grey below 6m	7	SS	18
		8	SS	29
		9	SS	22
	interbed of clayey silt and sany silt layers, wet below 10.5m	10	SS	35
256.4 11.3	**END OF BOREHOLE:**			



Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	3.32
Sept 8, 2020	3.43
Oct 22, 2020	3.59

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3, \times^3$: Numbers refer to Sensitivity ○ ^{8}=3% Strain at Failure

DS CONSULTANTS LTD.

LOG OF BOREHOLE BH20-15

1 OF 1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858789.95 E 598183.97

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

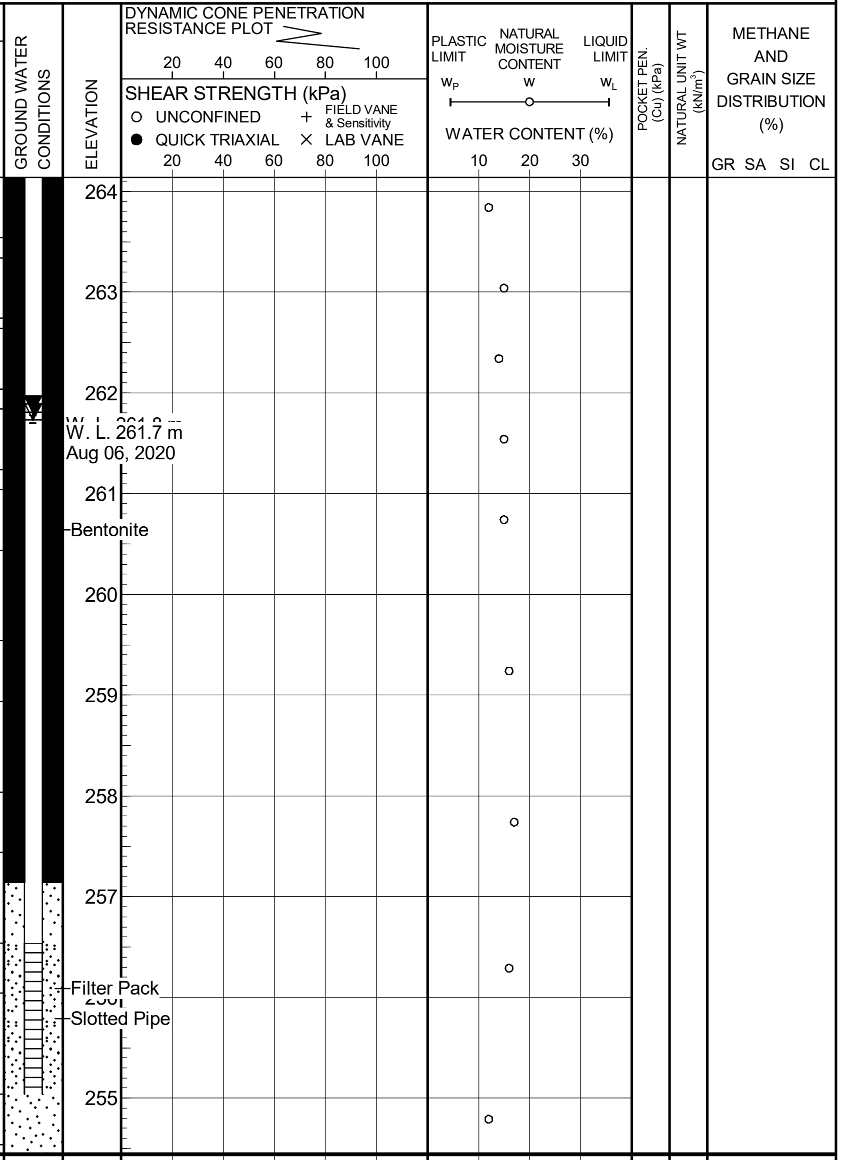
REF. NO.: 20-169-100
ENCL NO.: 16

SOIL PROFILE

(m) ELEV DEPTH	DESCRIPTION
264.1	
0.0	**TOPSOIL:** 350mm
263.8 0.4	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace sand, trace rootlets, brown, moist, stiff
263.3 0.8	**CLAYEY SILT TILL:** some sand, trace gravel, sand seams, brown, moist, stiff to very stiff
	grey below 4.5m
	wet below 9m
254.4 9.7	**END OF BOREHOLE:**

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m
1	SS	12
2	SS	18
3	SS	22
4	SS	27
5	SS	27
6	SS	17
7	SS	14
8	SS	16
9	SS	12



Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.41
Sept 8, 2020	2.33
Oct 22, 2020	2.41

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
$+^3, \times^3$: Numbers refer to Sensitivity
○ ^{8}=3% Strain at Failure

LOG OF BOREHOLE BH20-16

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857848.7 E 598703.75

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 17

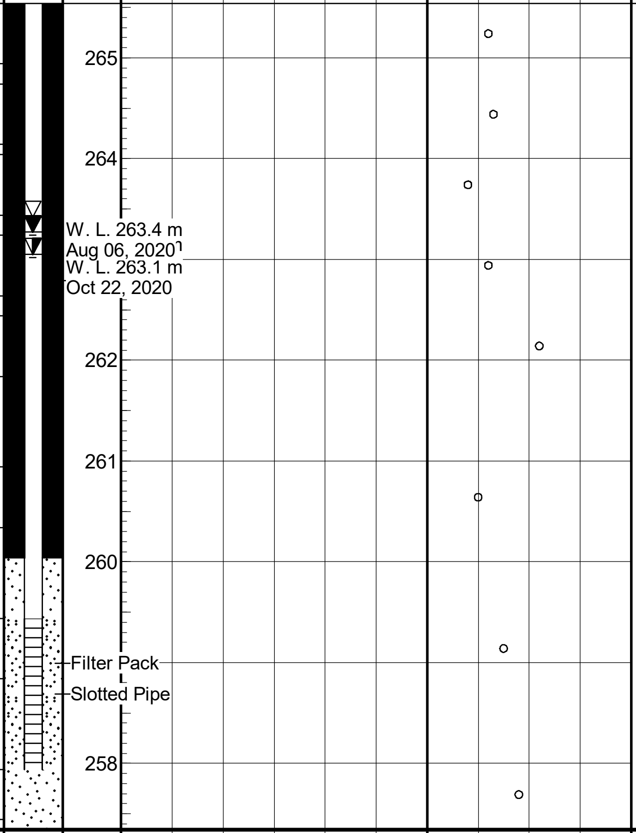
SOIL PROFILE

(m) ELEV / DEPTH	DESCRIPTION
265.5	
0.0	**TOPSOIL:** 400mm
265.1 / 0.4	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, stiff
264.7 / 0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist, stiff to hard
264.0 / 1.5	**GRAVELLY SAND:** some silt, trace clay, brown, very moist to wet, compact to dense
262.2 / 3.3	**SANDY SILT:** trace clay, brown, wet, compact
261.0 / 4.5	**SAND AND GRAVEI:** some silt, trace clay, brownish grey, wet, very dense
259.3 / 6.2	**SILTY SAND:** some clay, trace gravel, greyish brown, wet, dense
258.0 / 7.5	**SANDY SILT:** trace clay, grey, wet, dense
257.3 / 8.2	**END OF BOREHOLE:**

SAMPLES

NUMBER	TYPE	"N" BLOWS / 0.3 m	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR	SA	SI	CL
1	SS	9				
2	SS	33				
3	SS	30				
4	SS	24	22	64	10	4
5	SS	20				
6	SS	66	42	37	15	6
7	SS	38	3	61	26	10
8	SS	41				

GROUND WATER CONDITIONS | ELEVATION | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 | SHEAR STRENGTH (kPa) ○ UNCONFINED + FIELD VANE & Sensitivity ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30 | POCKET PEN. (Cu) (kPa) | NATURAL UNIT WT (kN/m³)



Notes:
1) Water level at 2.3m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.12
Sept 8, 2020	2.27
Oct 22, 2020	2.49

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ 8=3% Strain at Failure

Appendix C

Table: MECP Water Wells Records (500 m Radius)

Project: 20-169-100
Location: North Bolton, King Rd and The Gore

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
4908650	597296	4857460	2	0.6	2	0.6	Brown	Loam	-	-	74	22.6	19	5.8	Fresh	6/Oct/00	Water Supply	Domestic
			12	3.7	10	3.0	Brown	Sand	Clay	-								
			68	20.7	56	17.1	Grey	Clay	Silt	-								
			74	22.6	6	1.8	Grey	MSND	-	-								
7292728	598935	4857759	-	-	-	-	-	-	-	-	-	-	-	-	-	3/Aug/17	Abandoned	-
4904998	597281	4857522	1	0.3	1	0.3	Brown	Loam	-	-	34	10.4	25	7.6	not stated	4/Dec/75	Water Supply	Domestic
			10	3.0	9	2.7	Brown	Clay	-	-								
			34	10.4	24	7.3	Grey	Sand	-	-								
			40	12.2	6	1.8	Grey	Sand	-	-								
4900215	597688	4857323	15	4.6	15	4.6	Brown	Loam	-	-	65	19.8	15	4.6	Fresh	9/Sep/67	Water Supply	Domestic
			63	19.2	48	14.6	Grey	Clay	-	-								
			65	19.8	2	0.6	-	MSND	-	-								
7239897	599227	4857714	-	-	-	-	-	-	-	-	-	-	-	-	-	26/Mar/15	Abandoned	not used
4908538	598806	4858096	1	0.3	1	0.3	-	Loam	-	-	80	24.4	12	3.7	Fresh	1/Oct/99	Water Supply	Domestic
			8	2.4	7	2.1	Brown	Clay	-	-								
			22	6.7	14	4.3	Brown	Sand	-	-								
			61	18.6	39	11.9	Brown	Clay	-	-								
			80	24.4	19	5.8	Blue	Clay	-	-								
			93	28.3	13	4.0	Blue	FSND	-	-								
4906797	598651	4857730	-	-	-	-	-	-	-	-	-	-	-	-	-	10/Nov/87	Water Supply	Domestic
4900213	598212	4856795	20	6.1	20	6.1	Brown	Clay	-	-	45 & 115	14 & 35	Flowing		Fresh	14/Jun/66	Water Supply	Domestic
			45	13.7	25	7.6	Blue	Clay	-	-								
			55	16.8	10	3.0	-	MSND	Gravel	Clay								
			115	35.1	60	18.3	Blue	Clay	-	-								
			136	41.5	21	6.4	-	FSND	-	-								
			138	42.1	2	0.6	Blue	Clay	-	-								
4903995	597764	4857063	22	6.7	22	6.7	Brown	Clay	-	-	120	36.6	Flowing		Fresh	24-Nov-72	Water Supply	Domestic
			35	10.7	13	4.0	Blue	Clay	-	-								
			78	23.8	78	23.8	-	HPAN	-	-								
			120	36.6	42	12.8	Blue	Clay	-	-								
			140	42.7	140	42.7	-	Sand	Silt	-								
			146	44.5	6	1.8	-	Sand	-	-								
			150	45.7	4	1.2	-	FSND	-	-								
4908193	597907	4857031	2	0.6	2	0.6	Brown	Peat	Loose	-	-	-	-	-	-	10-Jan-97	Test Hole	Municipal
			40	12.2	38	11.6	Grey	Clay	Till	Silty								
			108	32.9	68	20.7	Grey	Silt	Stones	LYRD								
			130	39.63	22	6.7	Grey	Clay	Sand	LYRD								
			164	50.0	34	10.4	Grey	Clay	Sand	Silt								
			184	56.1	20	6.1	Grey	Silt	Stones	Sandy								
			201	61.3	17	5.2	Grey	FSND	Silt	Dense								
			218	66.4	17	5.2	Grey	Sand	Gravel	LYRD								
			246	75.0	28	8.5	Grey	Sand	Silt	LYRD								
			250	76.2	4	1.2	Grey	Shale	LYRD	WTHD								
4907295	598206	4857250	2	0.6	2	0.6	-	Loam	-	-	134	40.9	-	-	Fresh	18-Apr-91	Water Supply	Domestic
			37	11.3	35	10.7	-	Clay	-	-								
			39	11.9	2	0.6	-	Sand	GRVL	-								
			95	29.0	56	17.1	Blue	Clay	GRVL	-								
			98	29.9	3	0.9	-	Sand	GRVL	-								
			134	40.8	36	11.0	Blue	Clay	-	-								
			140	42.7	6	1.8	Blue	Sand	-	-								
			7	2.1	7	2.1	Brown	Silt	Clay	Soft								

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
7148914	598946	4858295	16	4.9	9	2.7	Brown	Silt	Clay	Dense	-	-	-	-	Fresh	14-Jul-10	Test Hole	Test Hole
			25	7.6	9	2.7	Grey	Clay	Silt	-								
4908194	597904	4857073	2	0.6	2	0.6	Brown	Peat	Loose	-	-	-	-	-	-	3-Jan-97	Test Hole	Municipal
			40	12.2	38	11.6	Grey	Clay	Silt	LYRD								
			108	32.9	68	20.7	Grey	Silt	Stones	LYRD								
			130	39.6	22	6.7	Grey	Silt	Sand	LYRD								
			164	50.0	34	10.4	Grey	Silt	Clay	Sand								
			184	56.1	20	6.1	Grey	Silt	Stones	Sandy								
			201	61.3	17	5.2	Grey	FSND	Silt	LYRD								
			218	66.5	17	5.2	Grey	Clay	Sand	LYRD								
			246	75.0	28	8.5	Grey	Clay	Sand	Dense								
			250	76.2	4	1.2	Grey	SHLE	WTHD	PCKD								
4904238	598060	4858628	20	6.1	20	6.1	Brown	Clay	Stones	-	177	54.0	23	7.0	Fresh	30-Nov-73	Water Supply	Domestic
			67	20.4	47	14.3	Blue	Clay	Gravel	-								
			78	23.8	11	3.4	Blue	Clay	Gravel	Sand								
			120	36.6	42	12.8	Blue	Clay	-	-								
			177	54.0	57	17.4	Blue	Clay	-	-								
			190	57.9	13	4.0	-	FSND	MSND	Clay								
4906470	598853	4857932	1	0.3	1	0.3	Black	Loam	-	-	80	24.4	4	1.22	Fresh	1-Nov-85	Water supply	Commerical
			6	1.8	5	1.5	Brown	Clay	Gravel	-								
			11	3.4	5	1.5	Blue	Clay	-	-								
			83	25.3	72	22.0	Brown	MSND	-	-								
			92	28.0	9	2.7	Grey	MSND	-	-								
			107	32.6	15	4.6	Blue	Clay	Gravel	-								
			125	38.1	18	5.5	Grey	Clay	Shale	-								
4904994	597064	4857323	1	0.3	1	0.3	Brown	Loam	Hard	-	30	9.1	25	7.6	not stated	30-Oct-76	Water Supply	Domestic
			20	6.1	19	5.8	Brown	Clay	Hard	-								
			45	13.7	25	7.6	Grey	Clay	Sand	Loose								
4907844	599080	4857704	-	-	-	-	-	-	-	-	-	-	-	-	-	13-Jul-94	-	-
4900273	598846	4858021	5	1.5	5	1.5	Brown	Clay	-	-	6	1.8	6	1.8	Fresh	7-Nov-60	Water Supply	Domestic
			8	2.4	3	0.9	-	Clay	MSND	-								
			18	5.5	10	3.0	-	MSND	-	-								
7285847	598658	4858218	-	-	-	-	-	-	-	-	-	-	-	-	-	25-Jan-17	-	-
4900282	597481	4859341	12	3.7	12	3.7	Brown	Clay	-	-	59	18.0	Flowing		Fresh	15-Jan-57	Water Supply	Domestic
			59	18.0	47	14.3	Grey	Clay	MSND	Stones								
			60	18.3	1	0.3	-	MSND	-	-								
4907399	598634	4858225	19	5.8	19	5.8	Brown	Clay	Stones	Gravel	88	26.8	22	6.7	Fresh	28-Oct-90	Water Supply	Commerical
			39	11.9	20	6.1	Blue	Clay	Soft	-								
			55	16.8	16	4.9	Blue	Clay	Soft	Hard								
			62	18.9	7	2.1	-	HPAN	-	-								
			82	25.0	20	6.1	Blue	Clay	Hard	-								
			88	26.8	6	1.8	Blue	Clay	Stones	Gravel								
			93	28.4	5	1.5	Blue	CSND	Gravel	-								
			118	36.0	25	7.6	Blue	Shale	-	-								
4900143	597301	4857436	12	3.7	12	3.7	Brown	Clay	MSND	-	64	19.5	31	9.5	Fresh	20-Aug-65	Water Supply	Domestic/Livestock
			40	12.2	28	8.5	White	Clay	-	-								
			64	19.5	24	7.3	-	Clay	MSND	HPAN								
			66	20.1	2	0.6	-	FSND	-	-								
7172781	599128	4858060	4	1.2	4	1.2	Black	-	-	-	73	22.3	Flowing		not tested	7-Jul-11	Water Supply	Industrial
			17	5.2	13	4.0	Brown	Clay	Stones	-								
			50	15.2	33	10.1	Grey	Clay	Stones	-								
			70	21.3	20	6.1	Grey	Clay	Stones	CMTD								
			80	24.4	10	3.0	Grey	Gravel	Clay	MGVL								
7172137	599023	4857883	0.5	0.2	0.5	0.2	Black	-	-	-	-	-	-	-	-	2-Nov-11	Test Hole	Monitoring
			1	0.3	0.5	0.2	Brown	Sand	Gravel	Loose								
			12	3.7	11	3.4	Brown	Silt	Sand	Loose								
			20	6.1	8	2.4	Grey	Silt	Clay	Dense								

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
4905615	597364	4857723	48	14.6	48	14.6	-	Topsoil	-	-	100	30.5	26	7.9	Fresh	27-Apr-79	Water Supply	Livestock
			76	23.2	28	8.5	Brown	Sand	Clay	Silt								
			92	28.0	16	4.9	Blue	Clay	Silt	Gravel								
			100	30.5	8	2.4	Blue	HPAN	-	-								
			103	31.4	3	0.9	Blue	Gravel	Sand	Clay								
			106	32.3	3	0.9	Blue	Shale	-	-								
4907843	597908	4857037	-	-	-	-	-	-	-	-	-	-	-	-	-	13-Jul-94	-	-
4908534	597428	4857420	25	7.6	25	7.6	Brown	Sand	MSND	-	34	10.4	34	10.4	Fresh	27-Jan-00	Water Supply	Domestic
			66	20.1	41	12.5	Grey	Sand	MSND	-								
7292729	598776	4857763	-	-	-	-	-	-	-	-	-	-	-	-	-	3/Aug/17	Abandoned	-
4904393	597637	4857116	1	0.3	1	0.3	Brown	Loam	-	-	38	11.6	20	6.1	Not stated	01-Aug-74	Water Supply	Domestic
			10	3.0	9	2.7	Brown	Clay	-	-								
			38	11.6	28	8.5	Grey	Clay	-	-								
			42	12.8	4	1.2	Grey	Sand	-	-								
7275497	597641	4857180	16	4.9	16	4.9	Brown	Clay	-	-	-	-	-	-	-	6-May-16	Water Supply	Domestic
			38	11.6	22	6.7	Grey	Clay	Stones	-								
			98	29.9	60	18.3	Grey	Silt	Sand	-								
			110	33.5	12	3.7	Grey	Silt	-	-								
			113	34.5	3	0.9	Grey	Clay	Silt	-								
			125	38.1	12	3.7	Grey	Sand	Clay	-								
			133	40.5	8	2.4	Grey	Sand	Gravel	-								
			143	43.6	10	3.0	Grey	Shale	-	-								
4908694	598144	4857707	1	0.3	1	0.3	Brown	Loam	-	-	75	22.9	7	2.1	Fresh	18-May-00	Water Supply	Domestic
			10	3.0	9	2.7	Brown	Clay	-	-								
			12	3.7	2	0.6	Blue	Clay	-	-								
			75	22.9	63	19.2	Grey	FSND	-	-								
			84	25.6	9	2.7	Grey	MSND	-	-								
			91	27.7	7	2.1	Grey	FSND	-	-								
			93	28.4	2	0.6	Grey	Sand	Silt	Clay								
4903854	597814	4857025	12	3.7	12	3.7	Brown	Clay	-	-	85	25.9	90	27.4	Salty	12-Jun-72	Water Supply	Domestic
			81	24.7	69	21.0	Grey	Clay	-	-								
			120	36.6	39	11.9	Grey	Shale	-	-								
4905640	598114	4857523	2	0.6	2	0.6	Black	Topsoil	-	-	14	4.3	8	2.4	not tested	30-Apr-80	Water Supply	Domestic
			14	4.3	12	3.7	Blue	Clay	-	Hard								
			25	7.6	11	3.4	Brown	Sand	Pebbles	Coarse								
4910378	597322	4857684	-	-	-	-	-	-	-	-	-	-	-	-	-	30/Sep/06	Abandoned	-
4910318	597792	4856990	12	3.7	12	3.7	Brown	Clay	-	-	170	51.8	Flowing		Fresh	20-Aug-06	Water Supply	Domestic
			93	28.4	81	24.7	Grey	Clay	-	-								
			123	37.5	30	9.1	Grey	Silt	Clay	-								
			167	50.9	44	13.4	Grey	Clay	Stones	-								
			180	54.9	13	4.0	Grey	FSND	-	-								
4900214	598726	4858045	2	0.6	2	0.6	-	Loam	-	-	21	6.4	5	1.5	Fresh	13-Apr-66	Water Supply	Domestic
			5	1.5	3	0.9	Brown	Clay	-	-								
			20	6.1	15	4.6	Brown	Clay	BLDR	-								
			21	6.4	1	0.3	Blue	Clay	-	-								
			22	6.7	1	0.3	-	CSND	-	-								
4905851	597414	4857323	1	0.3	1	0.3	Brown	Loam	Hard	-	30	9.1	15	4.6	not stated	15-Dec-81	Water Supply	Domestic
			20	6.1	19	5.8	Brown	Clay	Hard	-								
			30	9.1	10	3.0	Grey	Clay	Hard	-								
			35	10.7	5	1.5	Grey	Sand	Loose	-								
4905839	597964	4859273	1	0.3	1	0.3	Brown	Loam	-	-	22	6.7	17.0	5.2	Fresh	20-May-81	Water Supply	Domestic
			10	3.0	9	2.7	Brown	Clay	Stones	-								
			29	8.8	19	5.8	Grey	Clay	Stones	Sand								
			35	10.7	6	1.8	Grey	Stones	Clay	-								
			36	11.0	1	0.3	Grey	Clay	Shale	-								
			38	11.6	2	0.6	Grey	Shale	Very Hard	-								
			12	3.7	12	3.7	Brown	Loam	-	-							Water	

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
4905116	597054	4857923	42	12.8	30	9.1	Grey	Clay	-	-	42	12.8	35	10.7	Fresh	10-May-77	Water supply	Domestic
			48	14.6	6	1.8	-	Sand	Gravel	WBRG								
4904011	598755	4858099	34	10.4	34	10.4	-	PRDG	-	-	110	33.54	Flowing		Fresh	26-Aug-72	Water supply	Domestic
			65	19.8	31	9.5	Blue	Clay	Sand	-								
			110	33.5	45	13.7	Blue	FSND	Clay	-								
			115	35.1	5	1.5	-	FSND	-	-								
4907849	598780	4857872	-	-	-	-	-	-	-	-	-	-	-	-	-	13-Jul-94	-	-
4906516	598226	4857340	18	5.5	18	5.5	Brown	Clay	-	-	23	7.0	Flowing		Fresh	11-Oct-86	Water Supply	Domestic
			23	7.0	5	1.5	Blue	Clay	-	-								
			35	10.7	12	3.7	Brown	MSND	-	-								
			45	13.7	10	3.0	Blue	Clay	-	-								
7220334	598903	4858000	3	0.9	3	0.9	Brown	Fill	Sand	Loose	-	-	-	-	-	1-May-14	Observe.	Monitoring
			14.5	4.4	11.5	3.5	Brown	Clay	Silt	Hard								
			18	5.5	3.5	1.1	Grey	Clay	Silt	Hard								
			25.5	7.8	7.5	2.3	Grey	Sand	Silt	Dense								
7292795	598776	4857763	-	-	-	-	-	-	-	-	-	-	-	-	-	3-Aug-17	Abandoned	-
7267796	596880	4858246	2	0.6	2	0.6	Brown	Loam	-	Soft	8	2.4	13	4.0	Fresh	13-Jun-16	Water Supply	Livestock / Domestic
			13	4.0	11	3.4	Brown	Clay	-	Hard								
			27	8.2	14	4.3	Grey	Clay	Stones	Hard								
			29	8.8	2	0.6	Brown	Sand	-	Loose								
			65	19.8	36	11.0	Grey	Clay	-	Hard								
			75	22.9	10	3.0	Brown	Sand	Gravel	LYRD								
			85	25.9	10	3.0	Grey	Gravel	Sand	Loose								
			98	29.9	13	4.0	Gray	Sand	Silt	DRTY								
			98	29.9	0	0.0	Grey	Shale	-	Hard								
4908369	598459	4857745	25	7.6	25	7.6	Brown	Clay	Stones	Dense	99	30.2	36	11.0	Fresh	25-Aug-97	Water Supply	Domestic
			28	8.5	3	0.9	Blue	CSND	Loose	-								
			33	10.1	5	1.5	Blue	FSND	Silt	Soft								
			48	14.6	15	4.6	Blue	Clay	Soft	-								
			53	16.2	5	1.5	Blue	FSND	Loose	-								
			86	26.2	33	10.1	Blue	FSND	Silt	Loose								
			97	29.6	11	3.4	Blue	Clay	Stones	PCKD								
			107	32.6	10	3.0	Blue	CSND	WBRG	Loose								
7181645	598283	4858462	1	0.3	1	0.3	Black	Loam	-	Soft	117	35.7	25	7.6	Fresh	20-Feb-12	Water Supply	Domestic
			17	5.2	16	4.9	Brown	Clay	-	Hard								
			92	28.0	75	22.9	Grey	Clay	Silt	Layered								
			98	29.9	6	1.8	Grey	Gravel	-	Loose								
			113	34.5	15	4.6	Grey	Clay	-	Hard								
			117	35.7	4	1.2	Grey	Sand	-	Loose								
4904720	597876	4857244	7	2.1	7	2.1	-	Clay	-	-	28	8.5	4	1.2	Fresh	26-Aug-74	Water Supply	Domestic
			10	3.0	3	0.9	-	Clay	Stones	-								
			12	3.7	2	0.6	-	Sand	-	-								
			16	4.9	4	1.2	-	Stones	-	-								
			18	5.5	2	0.6	-	Clay	-	-								
			30	9.1	12	3.7	-	Sand	Stones	-								
4908519	598914	4857996	4	1.2	4	1.2	Brown	Clay	-	-	-	-	3	0.9	Fresh	18-Oct-99	Water Supply	Commercial / Industrial
			16	4.9	12	3.7	Brown	Clay	Gravel	-								
			34	10.4	18	5.5	Brown	Sand	FSND	-								
			42	12.8	8	2.4	Blue	Clay	-	-								
			68	20.7	26	7.9	-	Sand	-	-								
			71	21.6	3	0.9	Blue	Clay	-	-								
7172136	598984	4857838	0.5	0.2	0.5	0.2	Brown	Loam	-	Loose	-	-	-	-	-	2-Nov-11	Test Hole	Monitoring
			12	3.7	11.5	3.5	Brown	Sand	Silt	Loose								
			20	6.1	8	2.4	Grey	Silt	Sand	Dense								
4906643	598903	4857852	19	5.8	19	5.8	Brown	Clay	-	-	84	25.6	Flowing		Fresh	30-Aug-86	Water Supply	Commercial
			46	14.0	27	8.2	Blue	Clay	-	-								
			84	25.6	38	11.6	Blue	Clay	Silt	Sand								

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
			91	27.7	7	2.1	Brown	MSND	-	-								
4904007	597556	4857470	2	0.6	2	0.6	Brown	Loam	-	-	23	7.0	Flowing		Fresh	15-Jun-72	Water Supply	Domestic
			9	2.7	7	2.1	Brown	Clay	-	-								
			23	7.0	14	4.3	Blue	Clay	Stones	-								
			25	7.6	2	0.6	Blue	Gravel	-	-								
4904847	596987	4858136	32	9.8	32	9.8	-	Topsoil	-	-	90	27.4	22	6.7	Fresh	4-Feb-76	Water Supply	Livestock / Domestic
			35	10.7	3	0.9	Blue	Clay	-	-								
			90	27.4	55	16.8	-	FSND	-	-								
			95	29.0	5	1.5	-	Gravel	-	-								
4907932	597435	4857461	1	0.3	1	0.3	Brown	Loam	Hard	-	60	18.3	5	1.5	not stated	10-Sep-94	Water Supply	Domestic
			30	9.1	29	8.8	Brown	Clay	Hard	-								
			60	18.3	30	9.1	Grey	Clay	Hard	-								
			72	22.0	12	3.7	Grey	Sand	Loose	-								
4904395	597189	4858347	1	0.3	1	0.3	Brown	Loam	-	-	20	6.1	15	4.6	not stated	1-Aug-74	Water Supply	Domestic
			15	4.6	14	4.3	Brown	Clay	-	-								
			34	10.4	19	5.8	Brown	Sand	Gravel	-								
4900216	596886	4858130	2	0.6	2	0.6	-	Loam	-	-	132	40.2	25	7.6	Fresh	13-Nov-64	Water Supply	Domestic
			15	4.6	13	4.0	-	Clay	-	-								
			45	13.7	30	9.1	-	HPAN	-	-								
			110	33.5	65	19.8	-	Clay	MSND	-								
			130	39.6	20	6.1	-	QSND	-	-								
			132	40.2	2	0.6	-	GRVL	-	-								
4904146	598039	4858691	2	0.6	2	0.6	Black	Loam	-	-	33	10.1	57	17.4	Fresh	6-Jul-73	Water Supply	Domestic
			35	10.7	33	10.1	Brown	Clay	Stones	-								
			57	17.4	22	6.7	Blue	Clay	Stones	-								
			67	20.4	10	3.0	Grey	Sand	-	-								
			75	22.9	8	2.4	Blue	Clay	-	-								
4907881	598405	4857436	-	-	-	-	-	-	-	-	-	-	-	-	-	2-Sep-94	-	-
4904437	598238	4858479	23	7.0	23	7.0	Brown	Clay	-	-	100	30.5	23	7.0	Fresh	30-Jul-73	Water	Domestic
			100	30.5	77	23.5	Blue	Clay	Stones	-								
			112	34.1	12	3.7	Blue	Sand	Gravel	Clay								

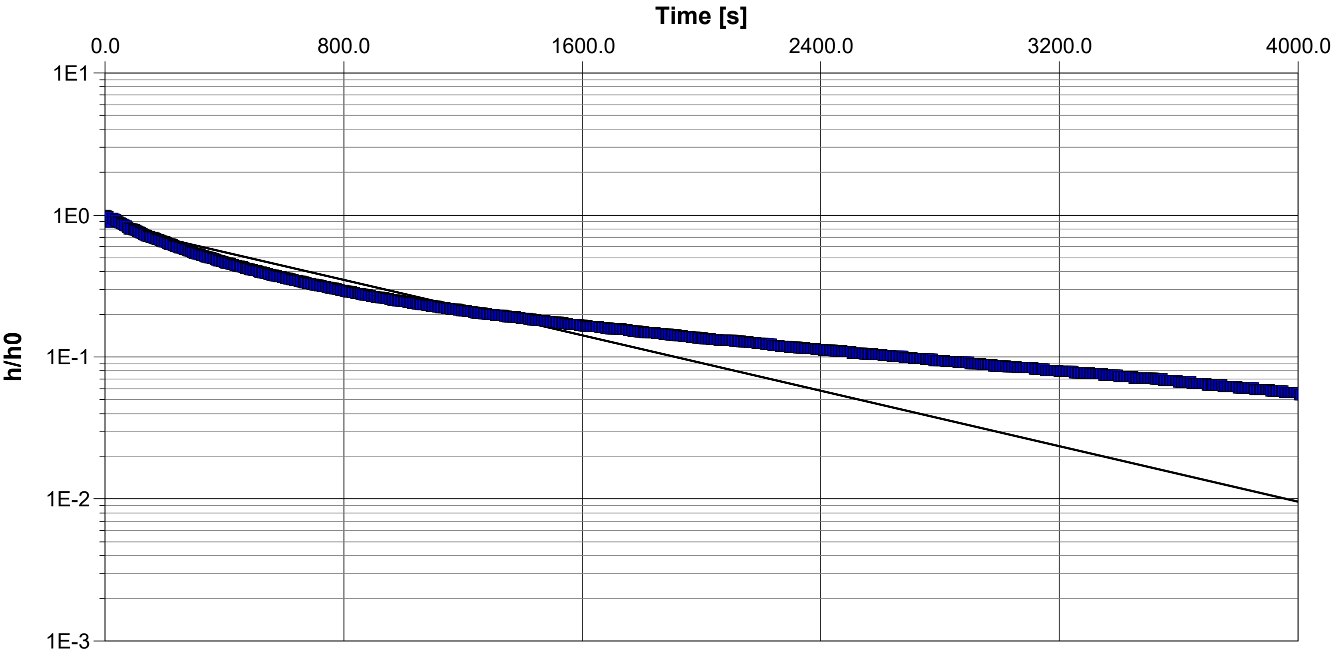
MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
			127	38.7	15	4.6	Blue	Shale	Clay	-							Supply	
			180	54.9	53	16.2	Blue	Shale	-	-								
4903300	598214	4858623	12	3.7	12	3.7	Brown	Clay	-	-	175	53.4	35	10.7	Fresh	11-Aug-69	Water Supply	Domestic
			122	37.2	110	33.5	Blue	Clay	-	-								
			175	53.4	53	16.2	Grey	Silt	-	-								
4908027	597914	4856940	2	0.6	2	0.6	-	Loam	-	-	124	37.8	1	0.3	Fresh	16-Aug-95	Water supply	Domestic
			12	3.7	10	3.0	Brown	Clay	-	-								
			27	8.2	15	4.6	Blue	Clay	-	-								
			78	23.8	51	15.5	Blue	Clay	Gravel	-								
			124	37.8	46	14.0	Blue	Clay	Soft	-								
			130	39.6	6	1.8	Brown	Sand	-	-								
4907094	597663	4858835	22	6.7	22	6.7	Brown	Clay	Stones	-	199	60.7	26	7.9	Fresh	20-Jan-89	Water Supply	Livestock / Domestic
			65	19.8	43	13.1	Blue	Clay	Stones	-								
			72	22.0	7	2.1	Blue	Clay	Soft	-								
			85	25.9	13	4.0	Blue	Clay	Gravel	Sand								
			190	57.9	105	32.0	Blue	Clay	Silt	-								
			199	60.7	9	2.7	Blue	Clay	Silt	Sand								
			214	65.2	15	4.6	-	FSND	-	-								
7241065	598679	4857836	1.5	0.5	1.5	0.5	Brown	Loam	-	Loose	7	2.1	-	-	not tested	24-Mar-15	Test Hole	Monitoring
			7	2.1	5.5	1.7	Brown	Clay	-	Silty								
			16	4.9	9	2.7	Brown	Sand	Clay	Gravel								
			20	6.1	4	1.2	Brown	Silt	Clay	Soft								
			35	10.7	15	4.6	Grey	Silt	-	Loose								
4904719	598523	4857402	9	2.7	9	2.7	-	Clay	-	-	10	3.0	6	1.8	Fresh	29-Aug-74	Water Supply	Domestic
			12	3.7	3	0.9	-	Sand	-	-								
			18	5.5	6	1.8	-	Sand	-	-								
			28	8.5	10	3.0	-	Clay	-	-								
7172135	599026	4857798	0.5	0.2	0.5	0.2	Brown	Loam	-	Loose	-	-	-	-	-	2-Nov-11	Test Hole	Monitoring
			12	3.7	11.5	3.5	Brown	Silt	Sand	Loose								
			20	6.1	8	2.4	Grey	Silt	Clay	Dense								
4905545	598514	4857723	1	0.3	1	0.3	Brown	Loam	-	-	16	4.9	15	4.6	not stated	31-Jul-79	Water Supply	Domestic
			9	2.7	8	2.4	Brown	Clay	-	-								
			16	4.9	7	2.1	Brown	Clay	Sand	-								
			24	7.3	8	2.4	Brown	Sand	-	-								
			32	9.8	8	2.4	Brown	Clay	Sand	-								
			35	10.7	3	0.9	Grey	Sand	-	-								
4909556	598425	4858349	15	4.6	15	4.6	Brown	Clay	-	Hard	75	22.9	17	5.2	Fresh	24-Oct-04	Water Supply	Domestic
			25	7.6	10	3.0	Grey	Clay	-	Hard								
			64	19.5	39	11.9	Grey	Clay	Stones	Hard								
			70	21.3	6	1.8	Grey	Clay	-	Loose								
			77	23.5	7	2.2	Grey	Gravel	-	Loose								
4909415	599081	4858056	20	6.1	20	6.1	Brown	Fill	-	-	-	-	2	0.6	Fresh	13-Apr-04	Water Supply	Domestic
			38	11.6	18	5.5	Grey	Clay	-	-								
			41	12.5	3	0.9	Brown	Sand	-	-								
			50	15.2	9	2.8	Grey	Sand	Soft	Clean								
			60	18.3	10	3.0	Grey	Clay	Hard	-								
7278360	599062	4857830	-	-	-	-	-	-	-	-	-	-	-	-	-	10-Jun-16	-	-
4908422	599026	4857876	4	1.2	4	1.2	Brown	Clay	Stones	Fill	71	21.6	0	0	Fresh	26-Oct-91	Water Supply	Commercial
			12	3.7	8	2.4	Brown	Clay	Sand	-								
			34	10.4	22	6.7	Brown	Clay	Gravel	-								
			71	21.6	37	11.3	Grey	FSND	-	-								
			114	34.8	43	13.1	Grey	FSND	-	-								
			118	36.0	4	1.2	Blue	Clay	Gravel	Sand								
4904761	597397	4857685	2	0.6	2	0.6	Brown	Loam	-	-	24	7.3	23	7.0	not stated	23-Sep-75	Water Supply	Domestic
			24	7.3	22	6.7	Brown	Sand	Clay	-								
			38	11.6	14	4.3	Grey	Sand	-	-								
			43	13.1	5	1.5	Brown	Sand	-	-								

MEOCC WWR ID	Easting	Northing	Depth		Thickness		Stratigraphy				Water Found		Static Level		Water Kind	Date Completed	Status	Water Use
	UTM N17	UTM N17	(ft)	(m)	(ft)	(m)	Color	Primary	Secondary	Tertiary	(ft)	(m)	(ft)	(m)				
7221650	598993	4858315	-	-	-	-	-	-	-	-	4	1.2	-	-	Fresh	14-May-14	-	-
4905784	598114	4858823	100	30.5	100	30.5	-	PRDG	-	-	208		22		Fresh	12-Dec-80	Water Supply	Domestic
			160	48.8	60	18.3	Blue	Clay	-	-								
			208	63.4	48	14.6	Blue	Clay	Silt	FSND								
			212	64.6	4	1.2	-	Gravel	CSND	Clay								

Appendix D

	Slug Test Analysis Report C
	Project: Hydrogeological Investigation
	Number: 20-169-100
	Client: Argos Development Corp.

Location: Bolton Option 3 Lands	Slug Test: BH20-1	Test Well: BH20-1
Test Conducted by:		Test Date: 7/6/2020
Analysis Performed by: AS	BH2-01	Analysis Date: 12/7/2020
Aquifer Thickness: 3.80 m		

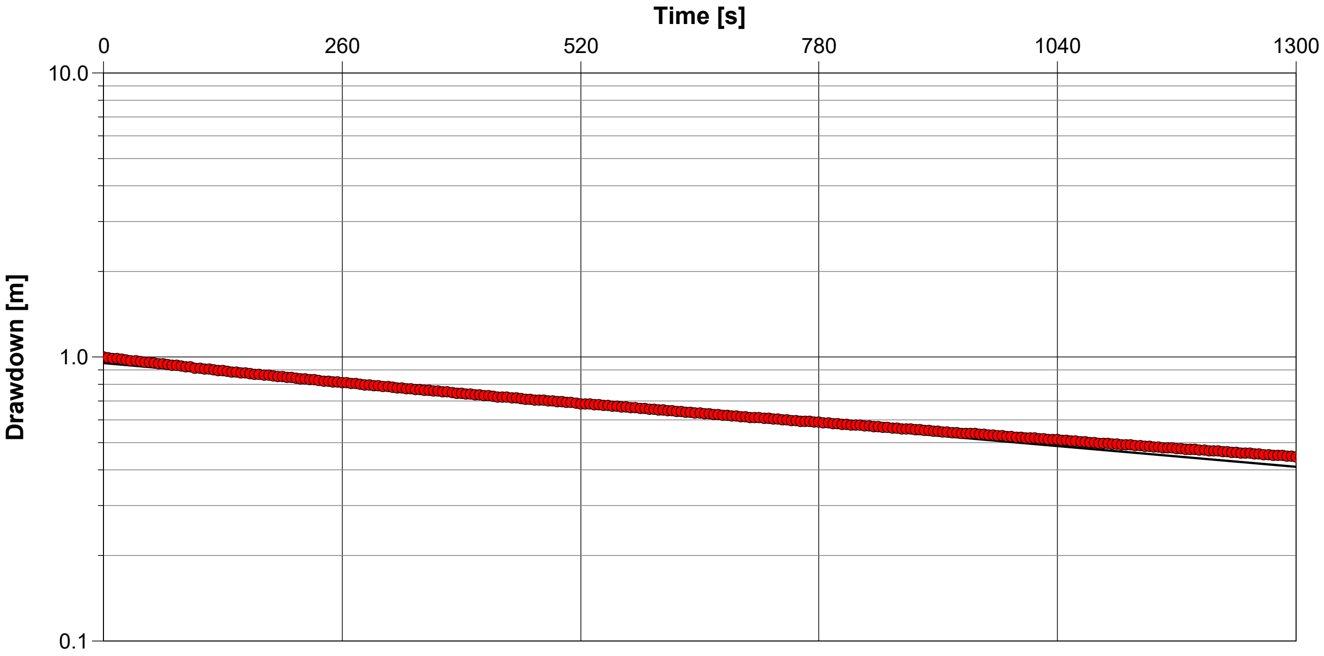


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-1	7.34×10^{-7}	

	Slug Test Analysis Report C
	Project: Hydrogeological Investigation
	Number: 20-169-100
	Client: Argos Development Corp.

Location: Bolton Option 3 Lands	Slug Test: BH20-5	Test Well: BH20-5
Test Conducted by:		Test Date: 12/7/2020
Analysis Performed by: AS	BH20-5	Analysis Date: 12/7/2020
Aquifer Thickness: 7.00 m		

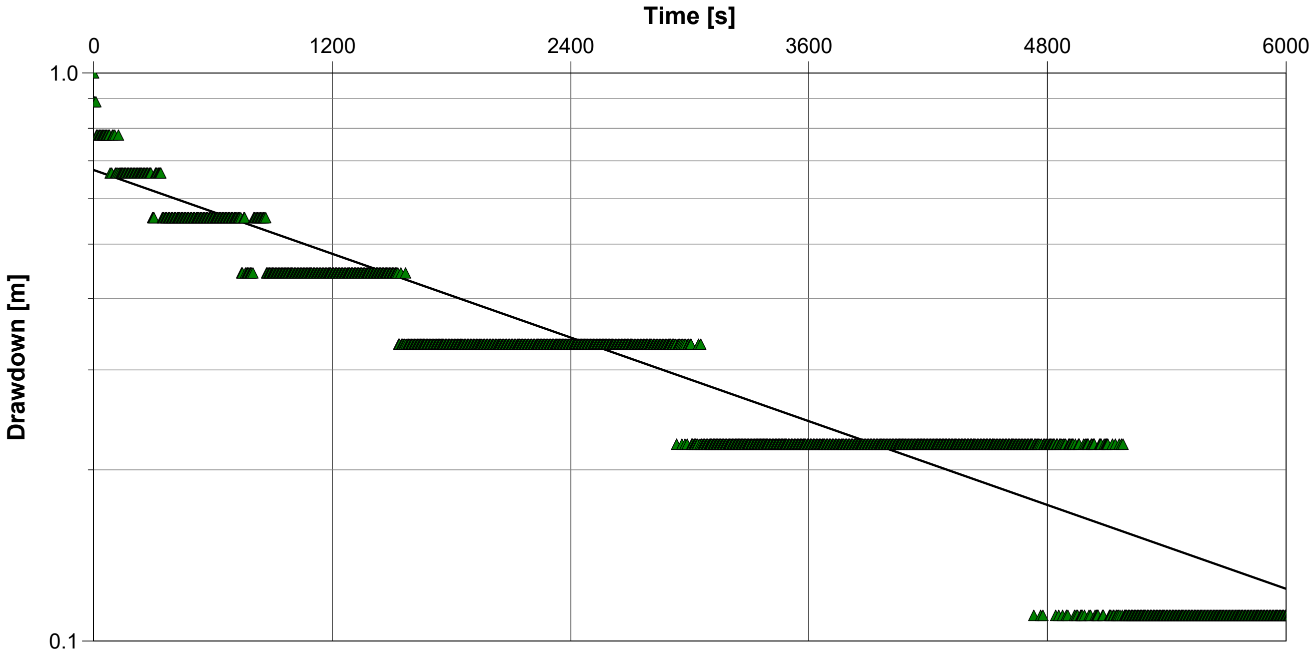


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-5	5.34×10^{-7}	

	Slug Test Analysis Report C
	Project: Hydrogeological Investigation
	Number: 20-169-100
	Client: Argos Development Corp.

Location: Bolton Option 3 Lands	Slug Test: BH20-6	Test Well: BH20-6
Test Conducted by:		Test Date: 12/7/2020
Analysis Performed by: AS	BH20-6	Analysis Date: 12/7/2020
Aquifer Thickness: 1.08 m		

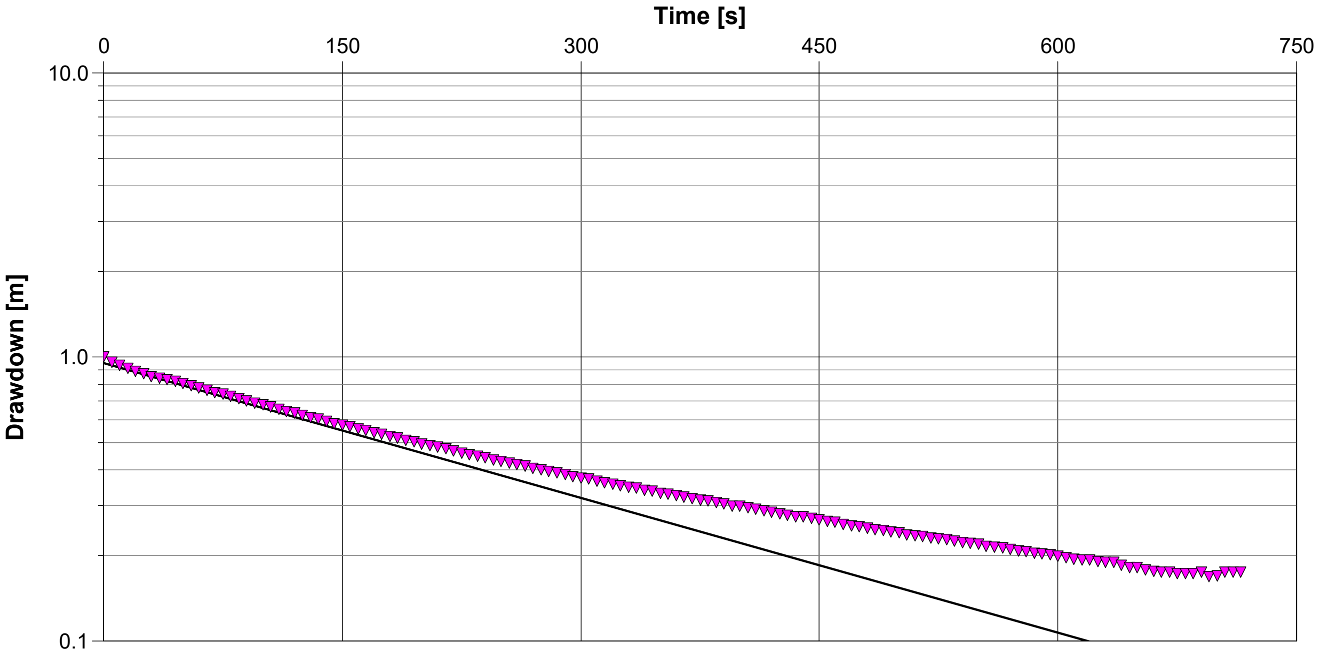


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-6	1.42×10^{-7}	

	Slug Test Analysis Report	C
	Project: Hydrogeological Investigation	
	Number: 20-169-100	
	Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-9	Test Well: BH20-9
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-9	Analysis Date: 12/8/2020
Aquifer Thickness: 3.08 m		

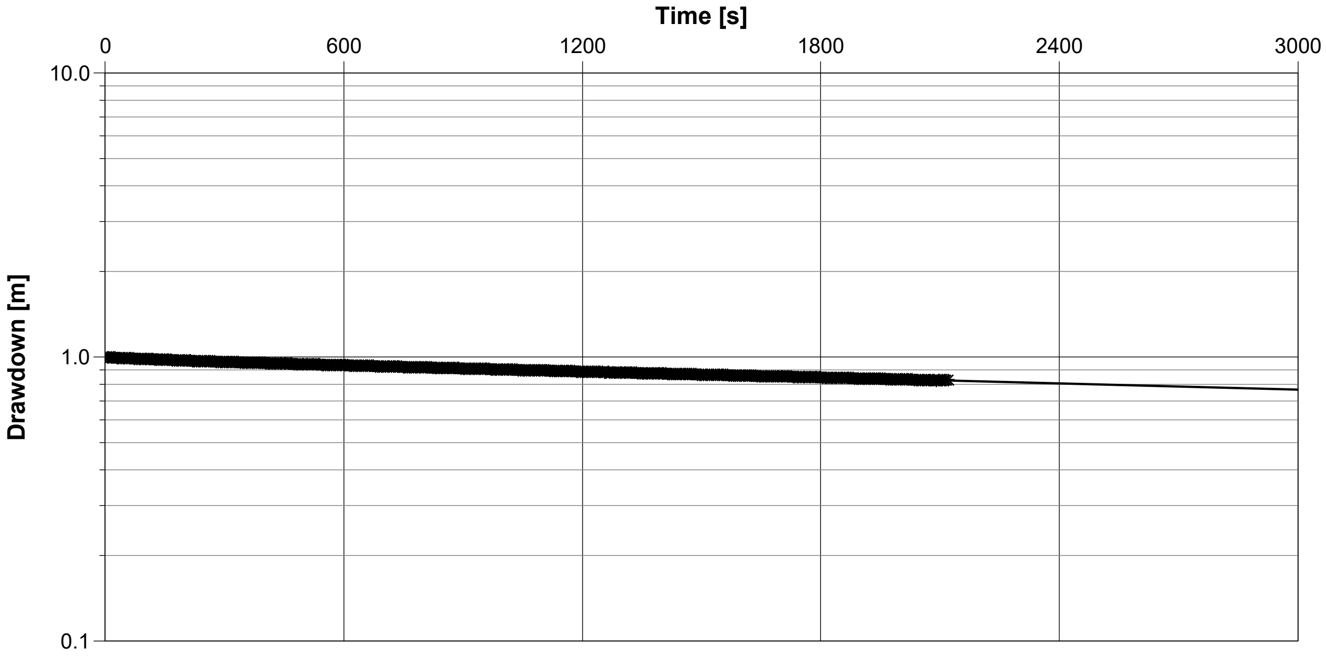


Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BH20-9	3.21×10^{-6}	

	Slug Test Analysis Report C
	Project: Hydrogeological Investigation
	Number: 20-169-100
	Client: Argos Development Corp.

Location: Bolton Option 3 Lands	Slug Test: BH20-11	Test Well: BH20-11
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-11	Analysis Date: 12/8/2020
Aquifer Thickness: 2.00 m		

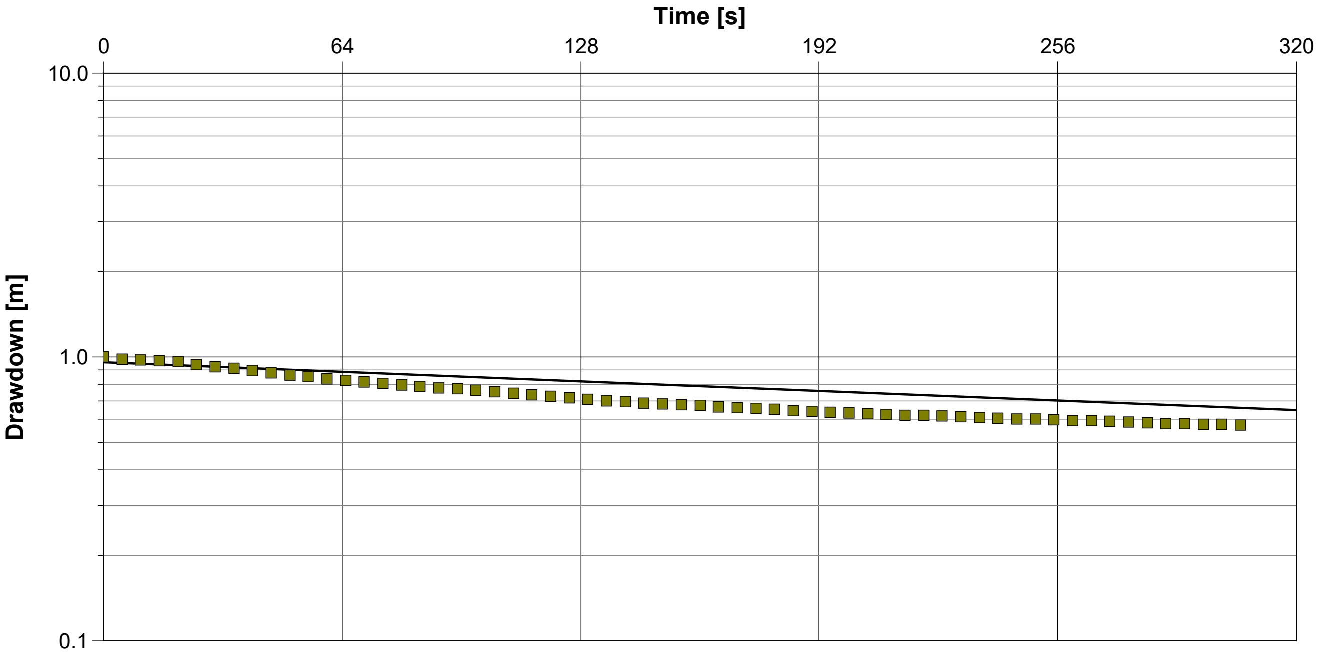


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-11	5.22×10^{-8}	

Slug Test Analysis Report	C
Project: Hydrogeological Investigation	
Number: 20-169-100	
Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-12	Test Well: BH20-12
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-12	Analysis Date: 12/8/2020
Aquifer Thickness: 2.20 m		

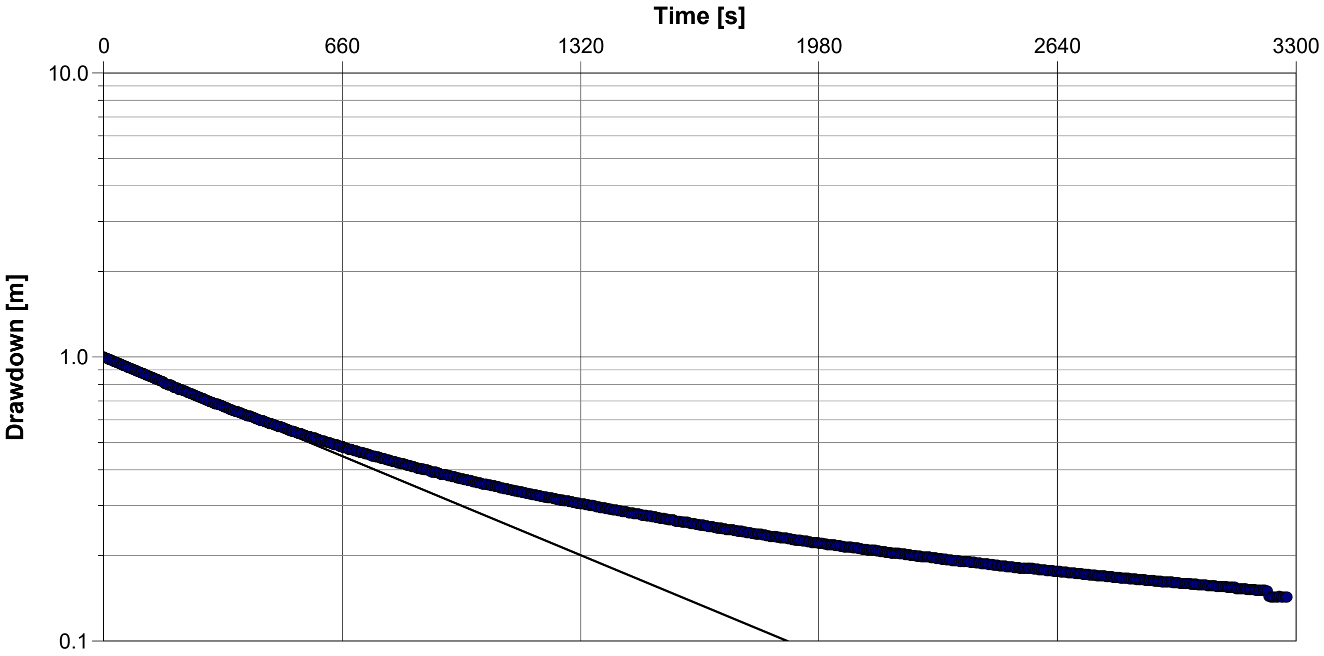


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-12	7.33×10^{-7}	

	Slug Test Analysis Report C
	Project: Hydrogeological Investigation
	Number: 20-169-100
	Client: Argos Development Corp.

Location: Bolton Option 3 Lands	Slug Test: BH20-14	Test Well: BH20-14
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-14	Analysis Date: 12/8/2020
Aquifer Thickness: 0.80 m		

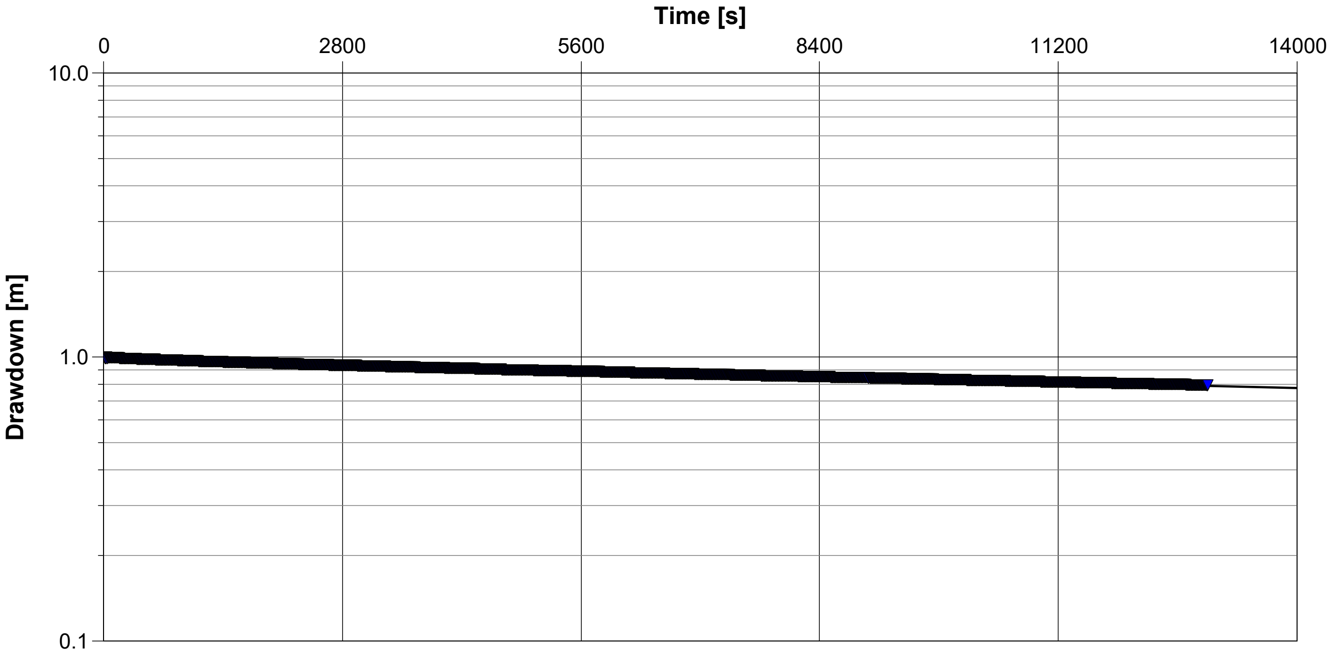


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-14	6.01×10^{-7}	

	Slug Test Analysis Report C
	Project: Hydrogeological Investigation
	Number: 20-169-100
	Client: Argos Development Corp.

Location: Bolton Option 3 Lands	Slug Test: BH20-15	Test Well: Well 9
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-15	Analysis Date: 12/8/2020
Aquifer Thickness: 0.70 m		

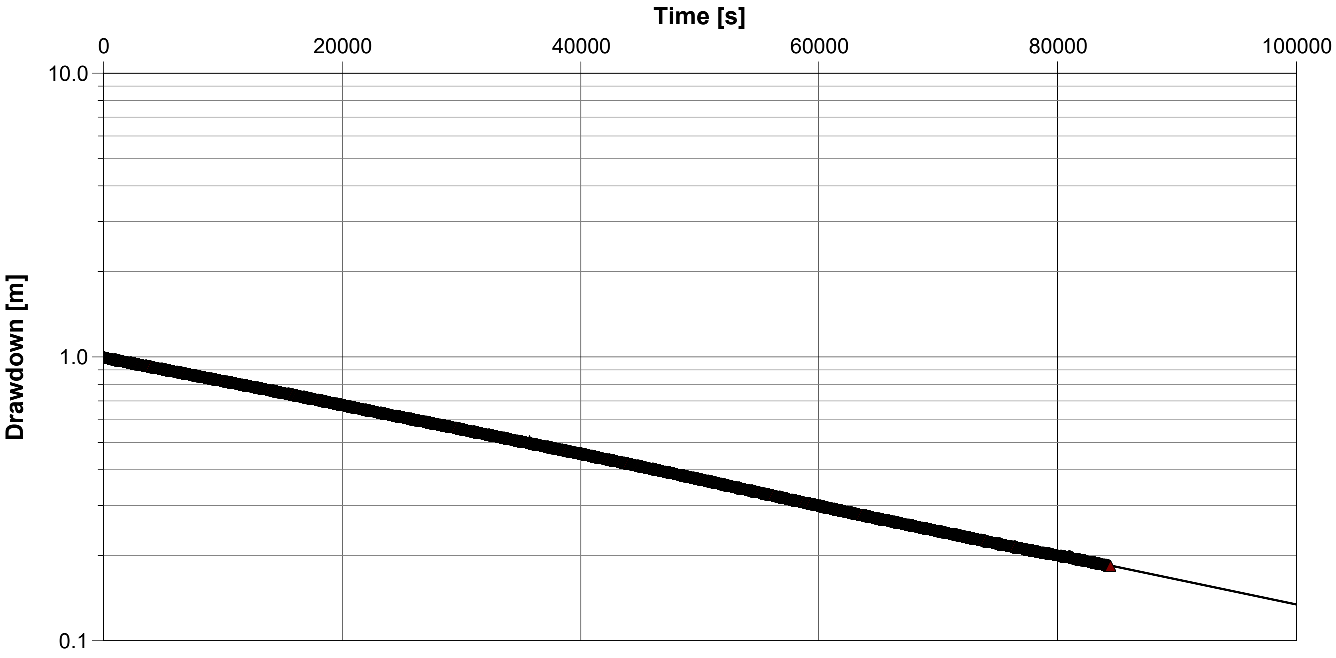


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
Well 9	7.38×10^{-9}	

Slug Test Analysis Report	C
Project: Hydrogeological Investigation	
Number: 20-169-100	
Client: Argos Development Corp.	

Location: Bolton Option 3 Lands	Slug Test: BH20-16	Test Well: BH20-16
Test Conducted by:		Test Date: 12/8/2020
Analysis Performed by: AS	BH20-16	Analysis Date: 12/8/2020
Aquifer Thickness: 6.12 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH20-16	1.50×10^{-8}	

Appendix E

FINAL REPORT

CA15868-OCT20 R1

20-169-100

Prepared for

DS Consultants

FINAL REPORT

CA15868-OCT20 R1

First Page

CLIENT DETAILS

Client	DS Consultants
Address	6221 Highway 7 Unit 16 Vaughan, Ontario L4H 0K8, Canada
Contact	Dorothy Garda
Telephone	905-264-9393
Facsimile	905-264-2685
Email	dorothy.garda@dsconsultants.ca
Project	20-169-100
Order Number	
Samples	Surface Water (2)

LABORATORY DETAILS

Project Specialist	Brad Moore Hon. B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
Facsimile	705-652-6365
Email	brad.moore@sgs.com
SGS Reference	CA15868-OCT20
Received	10/29/2020
Approved	10/30/2020
Report Number	CA15868-OCT20 R1
Date Reported	10/30/2020

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
NR - Not reportable under applicable Provincial drinking water regulations as per client.

Temperature of Sample upon Receipt: 9 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:018069

Hg spike reported as NV due to technician error. No spike used for the replicate sample. Data accepted as the spike blank met tolerance as well as secondary QC

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

FINAL REPORT

Client: DS Consultants
Project: 20-169-100
Project Manager: Dorothy Garda
Samplers: Dorothy Grada

PACKAGE: **PWQO_L - General Chemistry**
(WATER)

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	8
			Sample Name	SGW1	SGW6
			Sample Matrix	Surface Water	Surface Water
			Sample Date	29/10/2020	29/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
General Chemistry					
Dissolved Oxygen	mg/L	1		8.8	9.1
Total Suspended Solids	mg/L	2		103	33
Alkalinity	mg/L as CaCO3	2		247	375
Bicarbonate	mg/L as CaCO3	2		247	375
Carbonate	mg/L as CaCO3	2		< 2	< 2
OH	mg/L as CaCO3	2		< 2	< 2
Colour	TCU	3		9	13
Conductivity	uS/cm	2		889	2190
Turbidity	NTU	0.10		56.7	50.1
Ammonia+Ammonium (N)	as N mg/L	0.04		0.04	0.32
Phosphorus (total reactive)	mg/L	0.03		0.09	0.10
Total Organic Carbon	mg/L	1		4	8
Ion Ratio	-	-9999		1.58	1
Total Dissolved Solids (calculated)	mg/L	-9999		460	1155
Conductivity (calculated)	uS/cm	-9999		1020	2135
Langeliers Index 4° C	@ 4° C	-9999		0.46	0.77
Saturation pH 4°C	pHs @ 4°C	-9999		7.61	7.25

PACKAGE: **PWQO_L - Metals and Inorganics**
(WATER)

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

Sample Number	7	8
Sample Name	SGW1	SGW6
Sample Matrix	Surface Water	Surface Water
Sample Date	29/10/2020	29/10/2020

Metals and Inorganics

Parameter	Units	RL	L1	Result	Result
Fluoride	mg/L	0.06		0.12	0.67
Bromide	mg/L	0.05		<0.05	0.15
Nitrite (as N)	as N mg/L	0.003		<0.003	<0.003
Nitrate (as N)	as N mg/L	0.006		0.058	0.042
Sulphate	mg/L	0.04		20	14
Mercury	µg/L	0.01	0.2	< 0.01	< 0.01
Hardness	mg/L as CaCO3	0.05		311	467
Aluminum	µg/L	1	75	2610	2400
Aluminum (0.2µm)	mg/L	0.001	0.015	0.034	0.096
Arsenic	µg/L	0.2	5	12.0	1.0
Boron	µg/L	2	200	17	32
Barium	µg/L	0.02		178	82.0
Beryllium	µg/L	0.007	1100	0.139	0.109
Cobalt	µg/L	0.004	0.9	1.86	1.87
Calcium	mg/L	0.01		93.0	153
Cadmium	µg/L	0.003	0.5	0.059	0.036
Copper	µg/L	0.2	5	5.9	3.2
Chromium	µg/L	0.08	100	3.82	2.80
Iron	ug/L	7	300	36800	4300
Potassium	mg/L	0.009		2.69	7.23
Magnesium	mg/L	0.001		19.1	20.8
Manganese	µg/L	0.01		1910	3270
Molybdenum	µg/L	0.04	40	1.34	1.53

PACKAGE: **PWQO_L - Metals and Inorganics** (WATER)

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	8
			Sample Name	SGW1	SGW6
			Sample Matrix	Surface Water	Surface Water
			Sample Date	29/10/2020	29/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Metals and Inorganics (continued)					
Nickel	µg/L	0.1	25	1.8	2.8
Sodium	mg/L	0.01		87.3	254
Phosphorus	mg/L	0.003	0.01	1.93	0.358
Lead	µg/L	0.01	25	5.68	1.72
Silicon	ug/L	20		12800	9560
Silver	µg/L	0.05	0.1	< 0.05	< 0.05
Strontium	µg/L	0.02		306	466
Thallium	µg/L	0.005	0.3	0.034	0.026
Tin	µg/L	0.06		0.20	0.19
Titanium	ug/L	0.05		87.3	75.4
Antimony	µg/L	0.09	20	0.19	0.19
Selenium	µg/L	0.04	100	0.22	0.28
Uranium	µg/L	0.002	5	0.220	1.30
Vanadium	µg/L	0.01	6	5.20	3.92
Zinc	µg/L	2	20	24	19
Cation sum	meq/L	-9999		12.5	21.35
Anion Sum	meq/L	-9999		7.89	21.36
Anion-Cation Balance	% difference	-9999		22.58	-0.03

PACKAGE: **PWQO_L - Other (ORP)** (WATER)

L1 = PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E

			Sample Number	7	8
			Sample Name	SGW1	SGW6
			Sample Matrix	Surface Water	Surface Water
			Sample Date	29/10/2020	29/10/2020
Parameter	**Units**	**RL**	**L1**	**Result**	**Result**
Other (ORP)					
pH	No unit	0.05	8.6	8.07	8.02
Chloride	mg/L	0.04		90	480

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	PWQO_L / WATER / - - Table 2 - General - July 1999 PIBS 3303E L1
SGW1				
Aluminum	SM 3030/EPA 200.8	µg/L	2610	75
Aluminum (dissolved)	SM 3030/EPA 200.8	µg/L	0.034	0.015
Arsenic	SM 3030/EPA 200.8	µg/L	12.0	5
Cobalt	SM 3030/EPA 200.8	µg/L	1.86	0.9
Copper	SM 3030/EPA 200.8	µg/L	5.9	5
Iron	SM 3030/EPA 200.8	µg/L	36800	300
Phosphorus	SM 3030/EPA 200.8	µg/L	1.93	0.01
Zinc	SM 3030/EPA 200.8	µg/L	24	20
SGW6				
Aluminum	SM 3030/EPA 200.8	µg/L	2400	75
Aluminum (dissolved)	SM 3030/EPA 200.8	µg/L	0.096	0.015
Cobalt	SM 3030/EPA 200.8	µg/L	1.87	0.9
Iron	SM 3030/EPA 200.8	µg/L	4300	300
Phosphorus	SM 3030/EPA 200.8	µg/L	0.358	0.01

QC SUMMARY

Alkalinity

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0551-OCT20	mg/L as CaCO3	2	< 2	1	20	102	80	120	NA		

Ammonia by SFA

Method: SM 4500 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0324-OCT20	mg/L	0.04	<0.04	0	10	100	90	110	99	75	125

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0586-OCT20	mg/L	0.05	<0.05	ND	20	102	80	120	98	75	125
Chloride	DIO0586-OCT20	mg/L	0.04	<0.04	8	20	100	80	120	94	75	125
Nitrite (as N)	DIO0586-OCT20	mg/L	0.003	<0.003	ND	20	101	80	120	98	75	125
Nitrate (as N)	DIO0586-OCT20	mg/L	0.006	<0.006	20	20	103	80	120	102	75	125
Sulphate	DIO0586-OCT20	mg/L	0.04	<0.04	NV	20	98	80	120	91	75	125
Chloride	DIO0590-OCT20	mg/L	0.04	<0.04	2	20	98	80	120	100	75	125

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Organic Carbon	SKA0327-OCT20	mg/L	1	<1	2	10	103	90	110	109	75	125

QC SUMMARY

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0551-OCT20	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0551-OCT20	mg/L as CaCO3	2	< 2	1	10	NA	90	110	NA		
OH	EWL0551-OCT20	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

Colour

Method: SM 2120 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0563-OCT20	TCU	3	< 3	ND	10	100	80	120	NA		

QC SUMMARY

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0551-OCT20	uS/cm	2	< 2	0	20	99	90	110	NA		

Fluoride by Specific Ion Electrode

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0560-OCT20	mg/L	0.06	<0.06	ND	10	98	90	110	111	75	125

Mercury by CVAAS

Method: SM3112/EPA 245 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury	EHG0029-OCT20	ug/L	0.01	-0.020	ND	20	90	80	120	NV	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver	EMS0179-OCT20	ug/L	0.05	<0.00005	ND	20	101	90	110	98	70	130
Aluminum	EMS0179-OCT20	ug/L	1	<0.001	ND	20	99	90	110	115	70	130
Aluminum (0.2µm)	EMS0179-OCT20	mg/L	0.001	<0.001	ND	20	99	90	110	115	70	130
Arsenic	EMS0179-OCT20	ug/L	0.2	<0.0002	4	20	102	90	110	101	70	130
Barium	EMS0179-OCT20	ug/L	0.02	<0.00002	4	20	98	90	110	109	70	130
Beryllium	EMS0179-OCT20	ug/L	0.007	<0.000007	0	20	95	90	110	94	70	130
Boron	EMS0179-OCT20	ug/L	2	<0.002	6	20	91	90	110	NV	70	130
Calcium	EMS0179-OCT20	mg/L	0.01	<0.01	3	20	96	90	110	103	70	130
Cadmium	EMS0179-OCT20	ug/L	0.003	<0.000003	7	20	99	90	110	100	70	130
Cobalt	EMS0179-OCT20	ug/L	0.004	<0.000004	3	20	100	90	110	98	70	130
Chromium	EMS0179-OCT20	ug/L	0.08	<0.00008	ND	20	102	90	110	104	70	130
Copper	EMS0179-OCT20	ug/L	0.2	<0.0002	14	20	101	90	110	105	70	130
Iron	EMS0179-OCT20	ug/L	7	<0.007	18	20	97	90	110	NV	70	130
Potassium	EMS0179-OCT20	mg/L	0.009	<0.009	2	20	100	90	110	100	70	130
Magnesium	EMS0179-OCT20	mg/L	0.001	<0.001	4	20	95	90	110	97	70	130
Manganese	EMS0179-OCT20	ug/L	0.01	<0.00001	1	20	101	90	110	104	70	130
Molybdenum	EMS0179-OCT20	ug/L	0.04	<0.00004	ND	20	102	90	110	106	70	130
Sodium	EMS0179-OCT20	mg/L	0.01	<0.01	6	20	91	90	110	94	70	130
Nickel	EMS0179-OCT20	ug/L	0.1	<0.0001	18	20	101	90	110	83	70	130
Lead	EMS0179-OCT20	ug/L	0.01	<0.00001	2	20	96	90	110	105	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus	EMS0179-OCT20	mg/L	0.003	<0.003	ND	20	96	90	110	NV	70	130
Antimony	EMS0179-OCT20	ug/L	0.09	<0.0009	ND	20	98	90	110	110	70	130
Selenium	EMS0179-OCT20	ug/L	0.04	<0.00004	ND	20	100	90	110	110	70	130
Silicon	EMS0179-OCT20	ug/L	20	<0.02	5	20	99	90	110	NV	70	130
Tin	EMS0179-OCT20	ug/L	0.06	<0.00006	ND	20	98	90	110	NV	70	130
Strontium	EMS0179-OCT20	ug/L	0.02	< 0.02	3	20	102	90	110	103	70	130
Titanium	EMS0179-OCT20	ug/L	0.05	<0.00005	ND	20	98	90	110	NV	70	130
Thallium	EMS0179-OCT20	ug/L	0.005	<0.000005	13	20	99	90	110	104	70	130
Uranium	EMS0179-OCT20	ug/L	0.002	<0.000002	4	20	97	90	110	102	70	130
Vanadium	EMS0179-OCT20	ug/L	0.01	<0.00001	8	20	99	90	110	87	70	130
Zinc	EMS0179-OCT20	ug/L	2	<0.002	ND	20	97	90	110	126	70	130

QC SUMMARY

Metals in aqueous samples - ICP-OES

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-[ENV]SPE-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Hardness	EMS0179-OCT20	mg/L as CaCO3	0.05		3	20						

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0551-OCT20	No unit	0.05	NA	0		101			NA		

Reactive Phosphorus by SFA

Method: SM 4500-P F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Phosphorus (total reactive)	SKA0319-OCT20	mg/L	0.03	<0.03	ND	10	97	90	110	NV	75	125

QC SUMMARY

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0555-OCT20	mg/L	2	< 2	0	10	96	90	110	NA		

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0554-OCT20	NTU	0.10	< 0.10	1	10	99	90	110	NA		

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --

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- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Request for Laboratory Services and CHAIN OF CUSTODY

No: 018069

Page 1 of 1

Laboratory Information Section - Lab use only

Received By: Scott
Received By (signature):
Received Date: 10 / 29 / 2020 (mm/dd/yy)
Received Time: 16 20 (hr : min)
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: Ice
Temperature Upon Receipt (°C) 9°c, 9°c, 8°c
LAB LIMS #: CA15868-OCT20

REPORT INFORMATION

Company: DS
Contact: Dorothy Garda
Address: 16-6221 Hwy 7
Vaughan, ON
Phone: (905) 324-2735
Fax:
Email: dorothy.garda@dsconsultants.ca

INVOICE INFORMATION

☒ (same as Report Information)
Company: accounting
Contact:
Address:
Phone:
Email: accounting@dsconsultants.ca

Quotation #:
P.O. #:
Project #: 20-169-100
Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☐ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☒ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture:
☐ Table 2 ☐ Ind/Com ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ Medium/Fine
☐ Table ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☒ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA
☐ ODWS Not Reportable *See note

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

						M & I				SVOC		PCB	PHC		VOC		Pest	Other (please specify)							TCLP	
	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics incl CrVI, CN,Hg pH,(B(HWS),EC,SAR-soil) (Cl, Na-water)	Full Metals Suite ICP metals plus B(HWS-soil only) Hg, CrVI	ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni,	PAHs only	SVOCs all incl PAHs, ABNs, CPs	PCBs ☐ Total ☐ Aroclor	F1-F4 + BTEX	F1-F4 only no BTEX	VOCs all incl BTEX	BTEX only	Pesticides Organochlorine or specify other ☐	DO	TSS	Gen Chem Characterization	Package	Appendix 2: 406/19 Leachate Screening Levels Table : ____	Sewer Use: Specify pkg:	Water Characterization Pkg General ☐ Extended ☐	Specify TCLP tests ☐M&I ☐VOC ☐PCB ☐B(a)P ☐ABN ☐Ignit.	COMMENTS:
1	SGW1	10/29/20	8:30am	8	SW													X	X	X						
2	SGW6	10/29/20	9.am	8	SW													X	X	X						
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										

Observations/Comments/Special Instructions

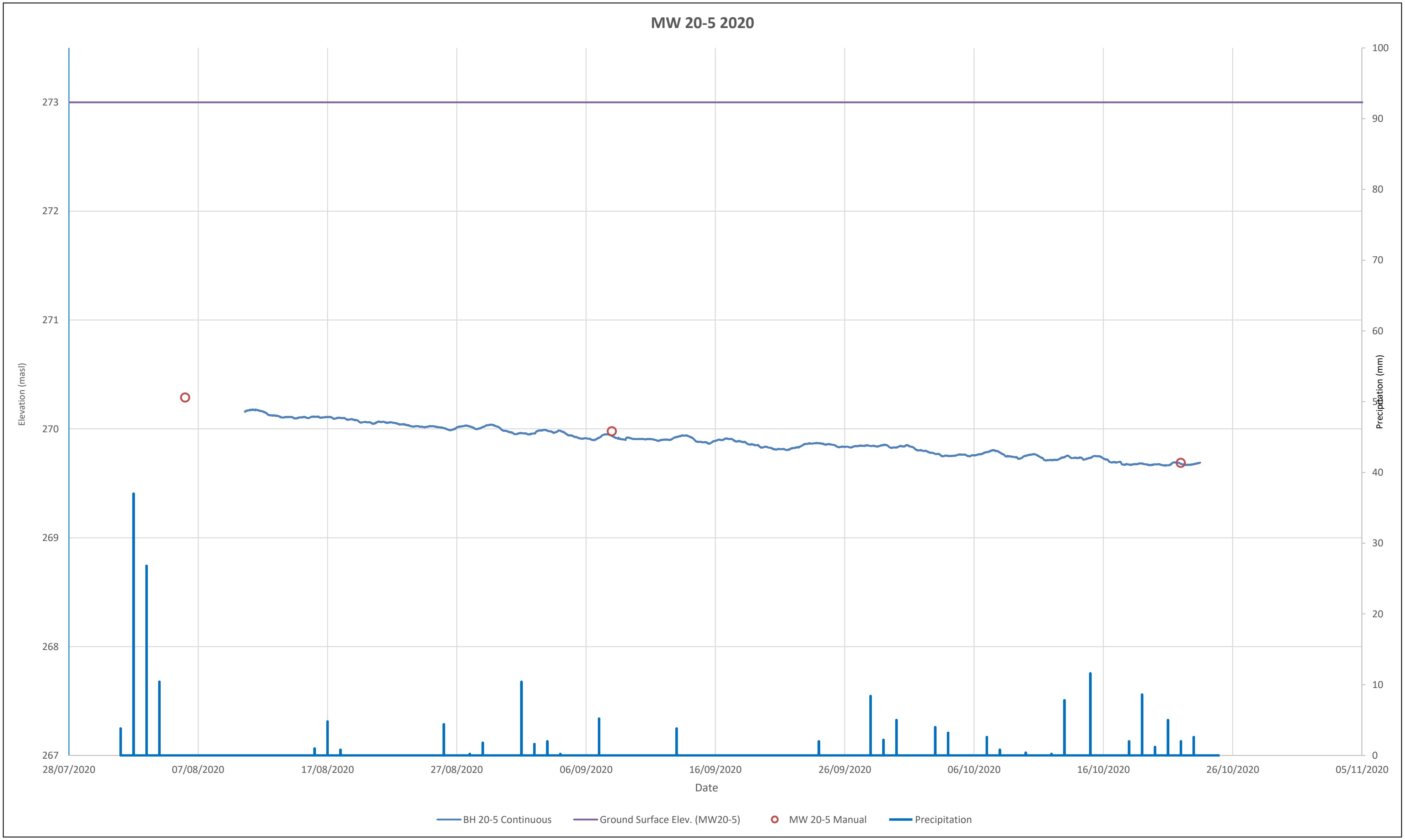
Sampled By (NAME): Dorothy Garda Signature: Date: 10 / 29 / 20 (mm/dd/yy) Pink Copy - Client
Relinquished by (NAME): Dorothy Garda Signature: Date: 10 / 29 / 20 (mm/dd/yy) Yellow & White Copy - SGS

Revision #: 1.4
Date of Issue: 22 May, 2020

Note: Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. {2} Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). {3} Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Appendix F

WATER LEVEL HYDROGRAPH



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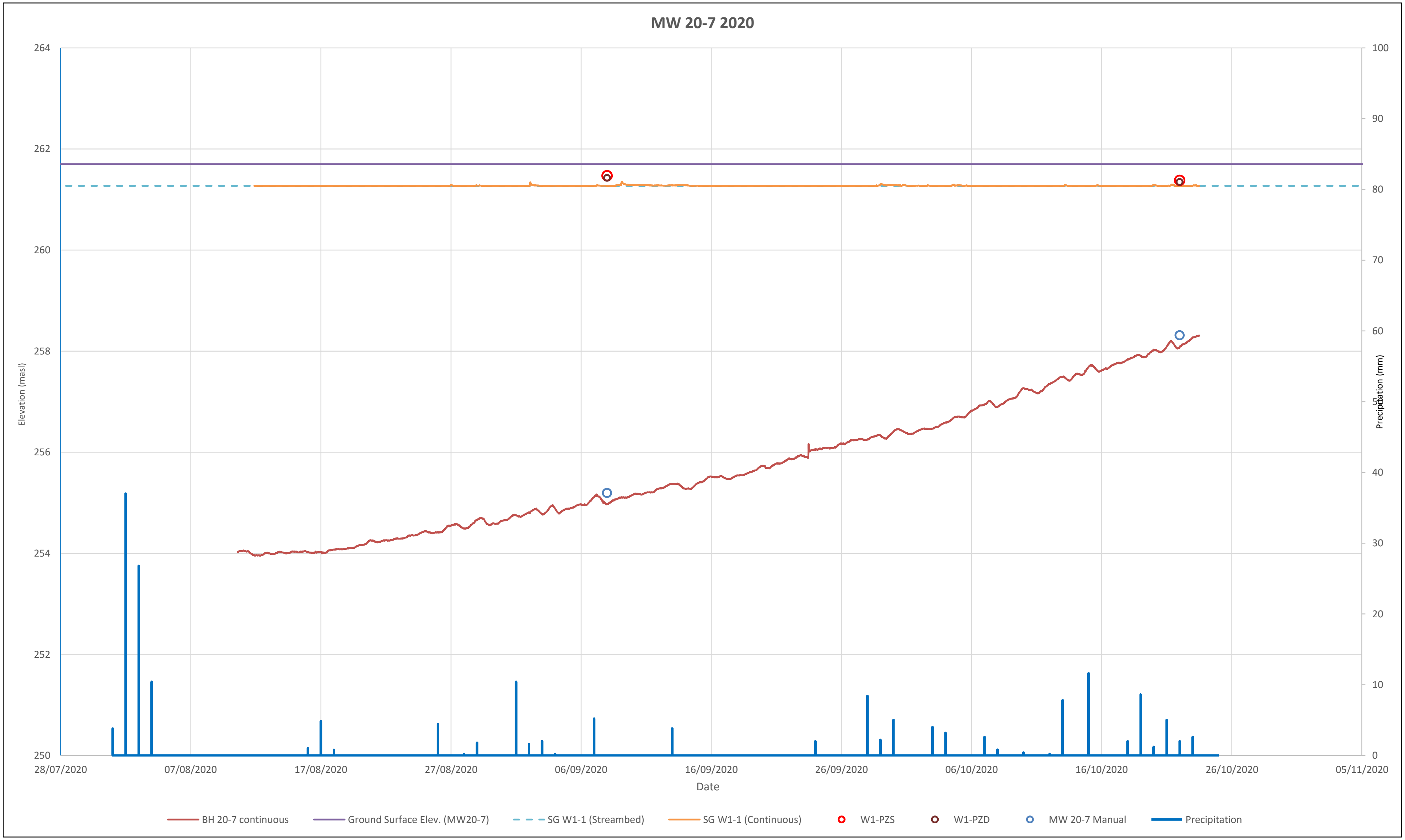
Macville Community
MW 20-5 HYDROGRAPH

August 2020 - 2021
F-7

WATER LEVEL HYDROGRAPH



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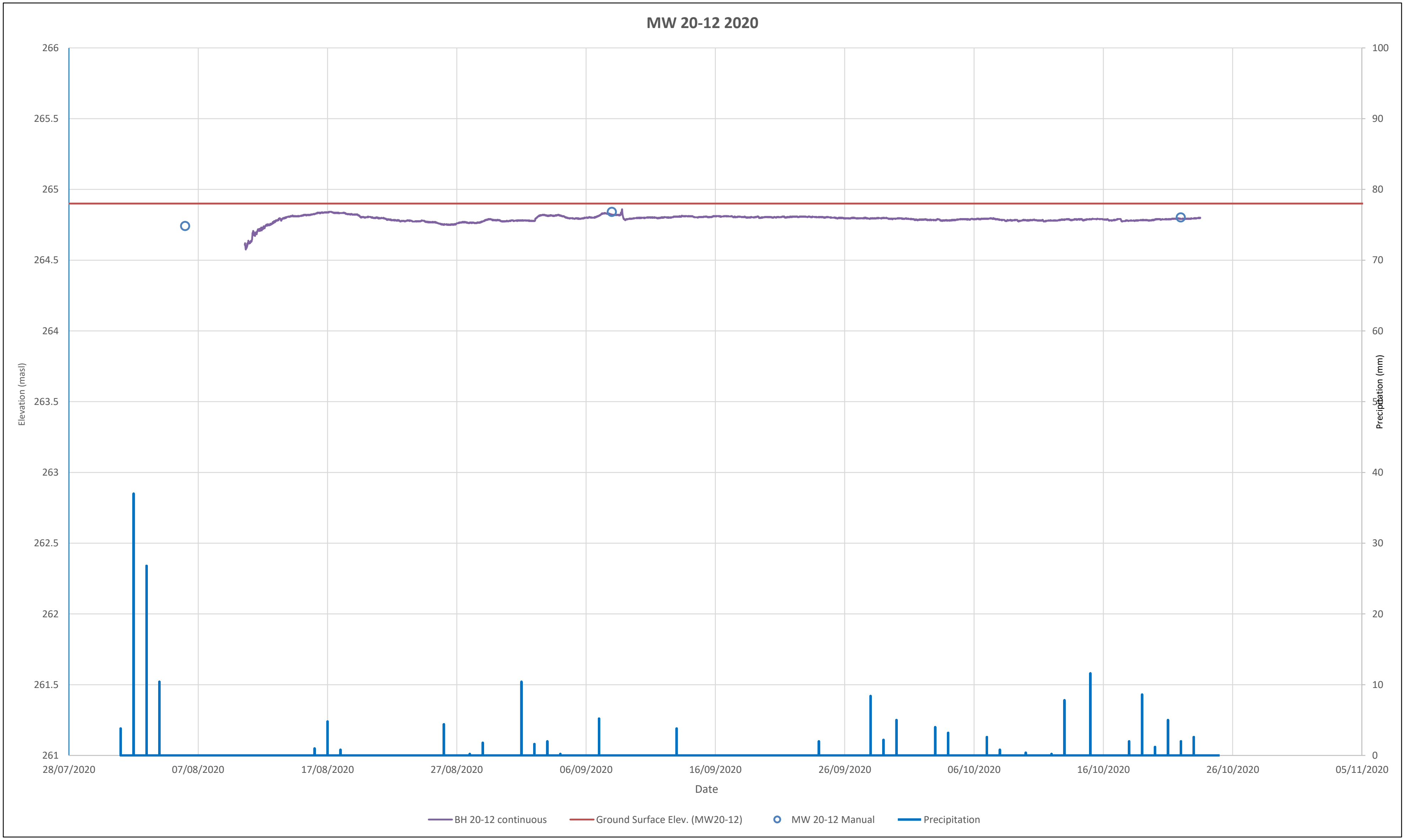
MW 20-7 HYDROGRAPH

August 2020 - 2021
F-7

WATER LEVEL HYDROGRAPH



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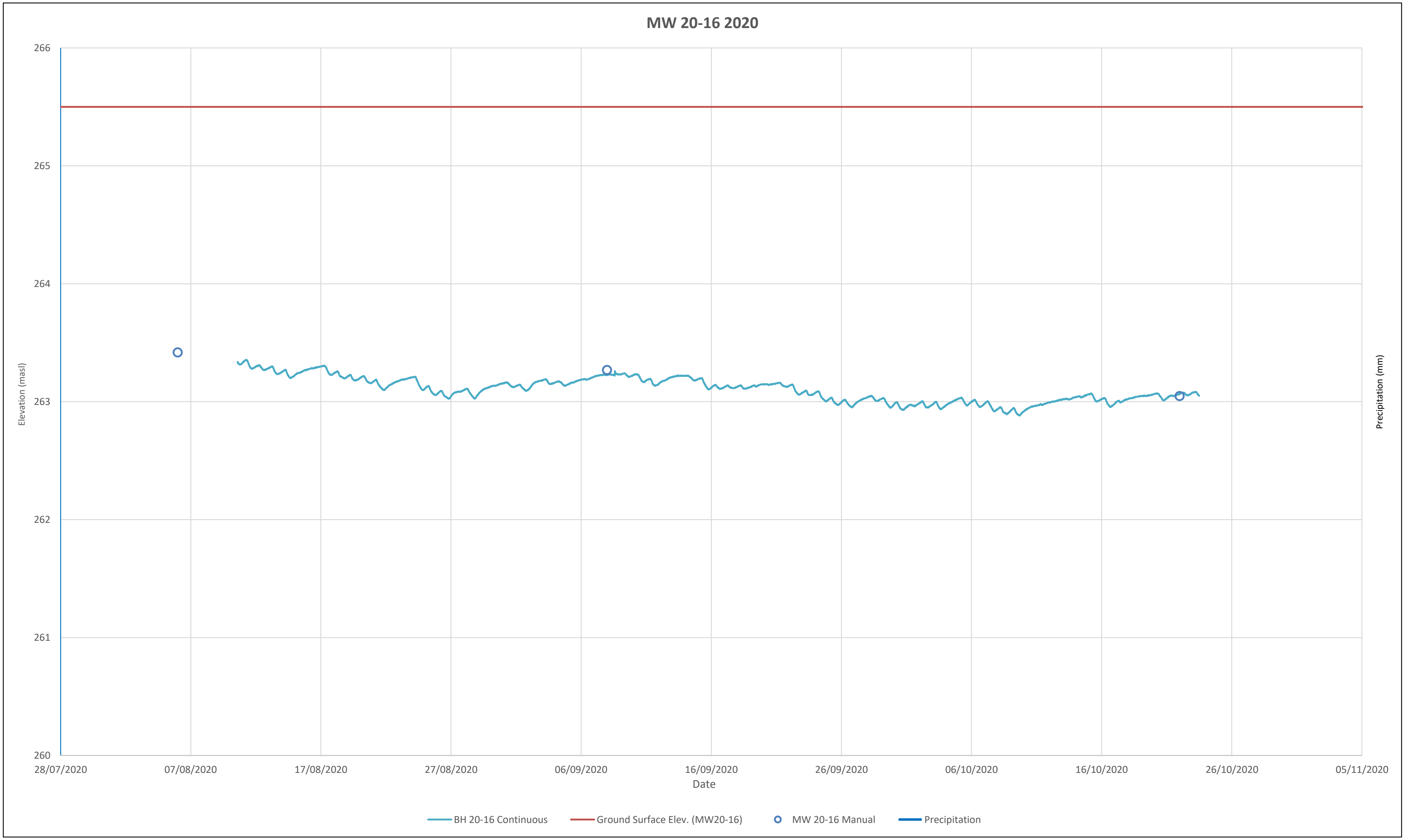
MW 20-12 HYDROGRAPH

August 2020 - 2021

F-7

WATER LEVEL HYDROGRAPH



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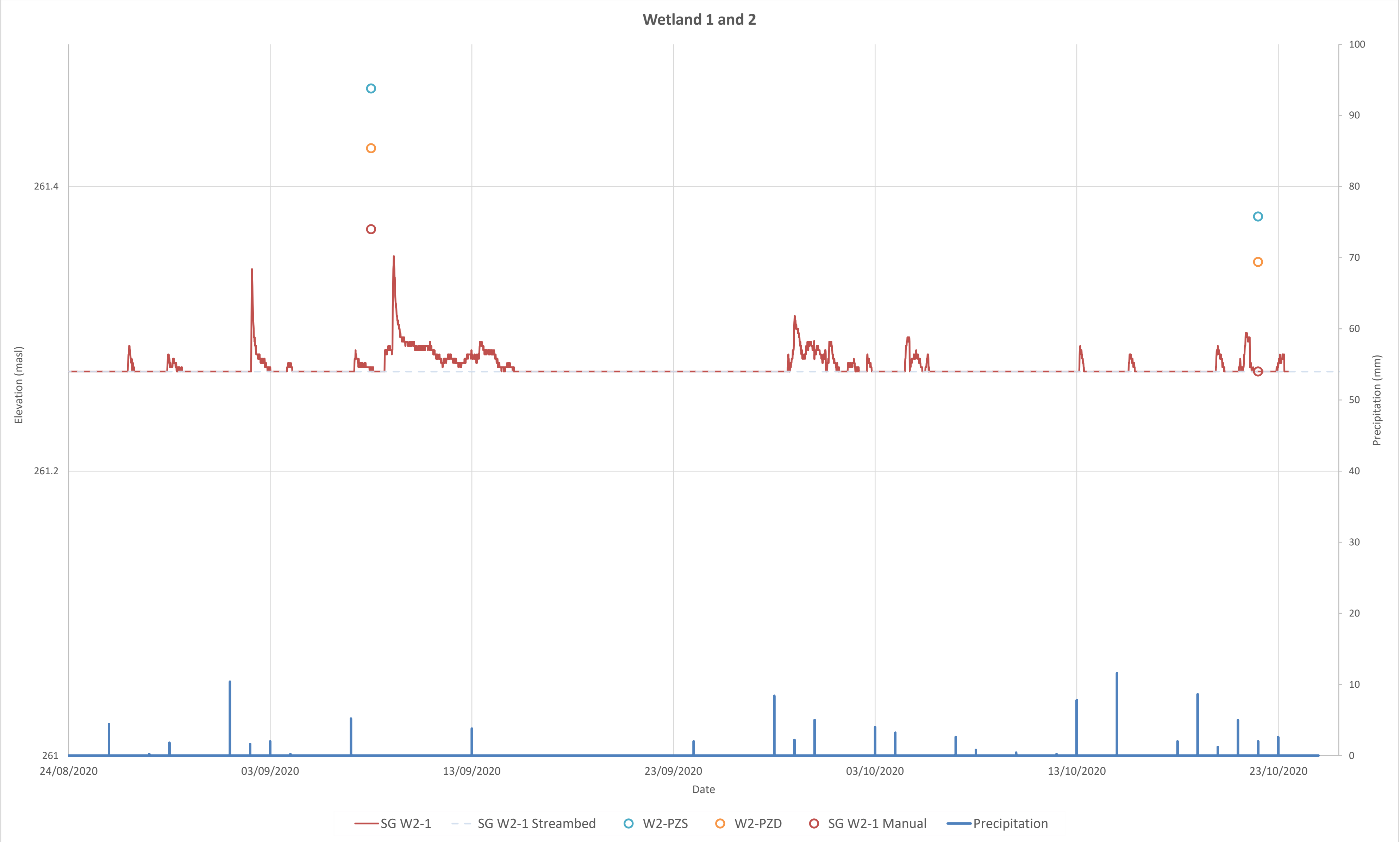
MW 20-16 HYDROGRAPH

August 2020 - 2021

F-7

WATER LEVEL HYDROGRAPH



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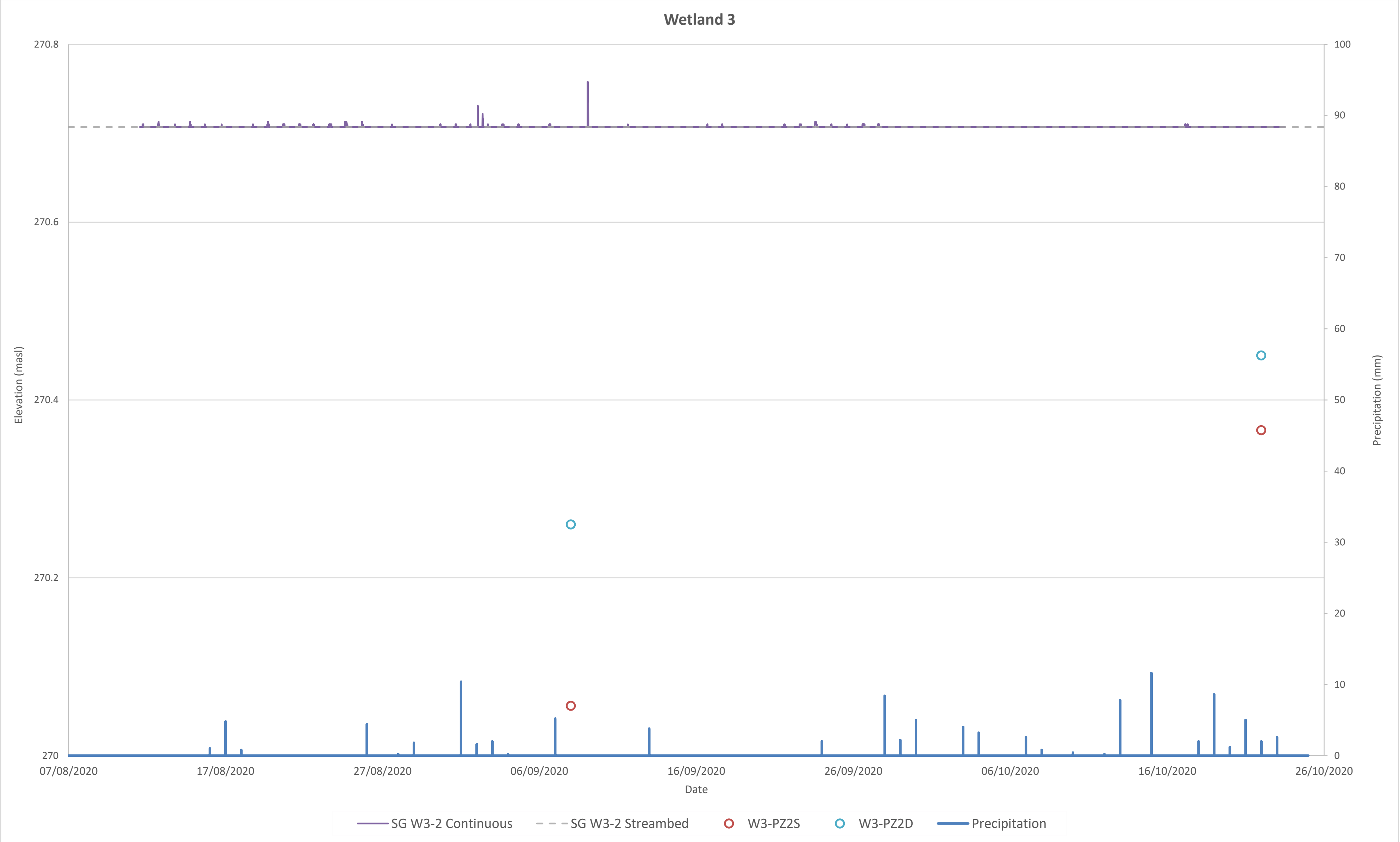
WETLAND 1 & 2 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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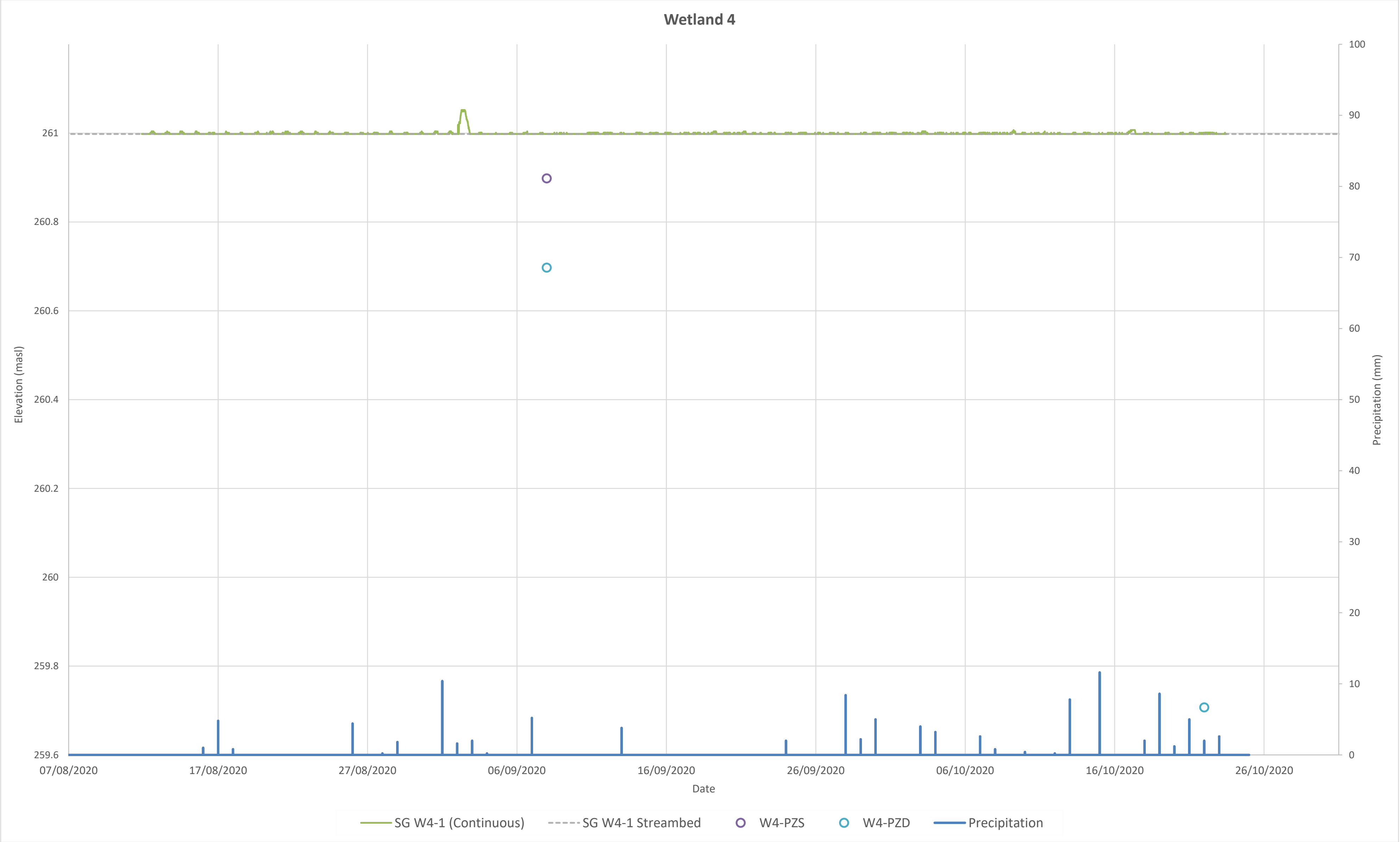
WETLAND 3 HYDROGRAPH

August 2020 - 2021

D-2

WATER LEVEL HYDROGRAPH



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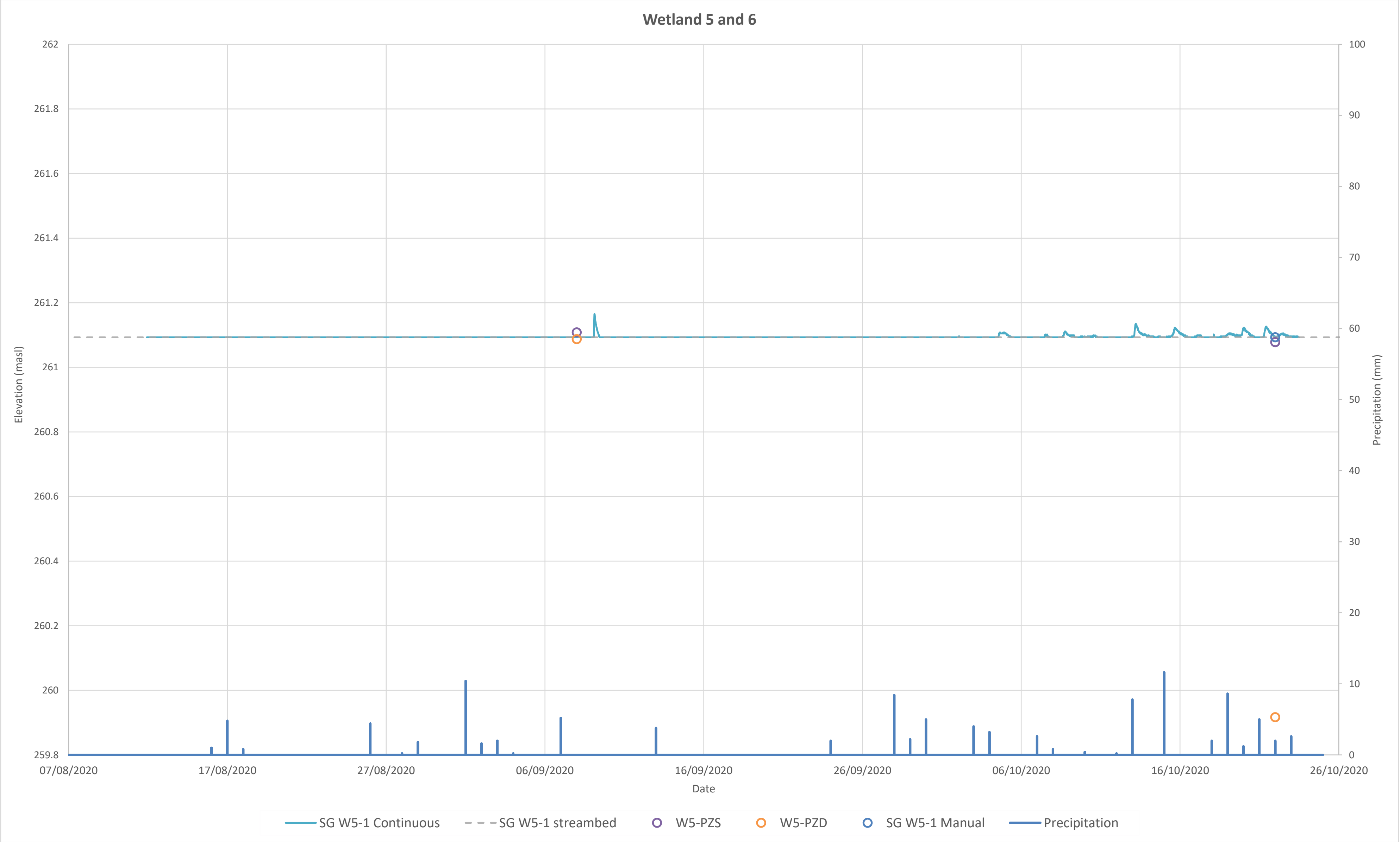
WETLAND 4 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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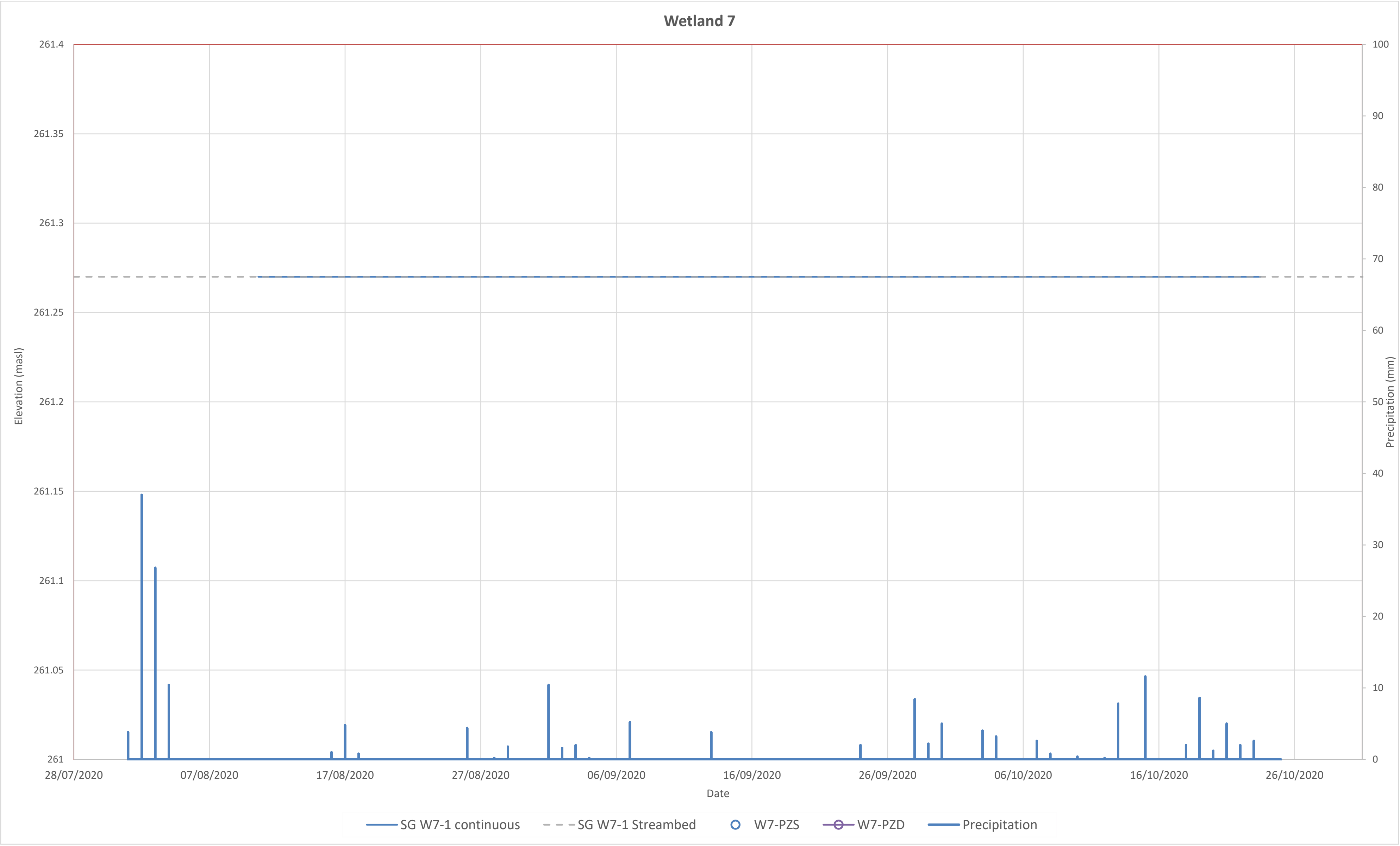
WETLANDS 5 & 6 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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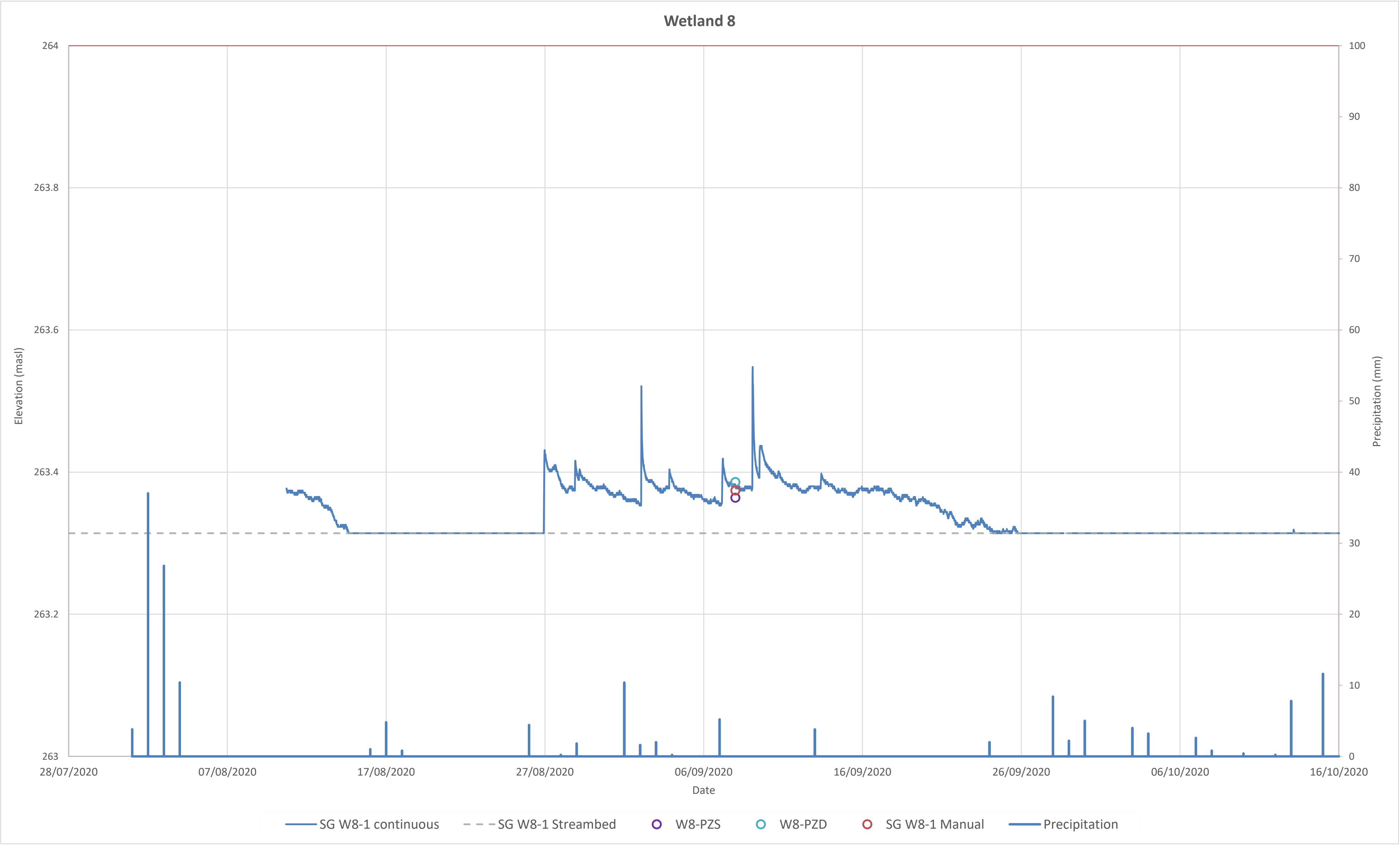
WETLAND 7 HYDROGRAPH

August 2020 - 2021
D-2

WATER LEVEL HYDROGRAPH



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WETLAND 8 HYDROGRAPH

August 2020 - 2021

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Appendix G

TABLE 1
Pre-development Water Balance
Bolton LOPA Submission for Option 3 Lands

Month	Thornthwaite (1948)					
	Mean Temperature (°C)	Heat Index	Unadjusted Potential Evapotranspiration (mm)	Daylight Correction Value	Adjusted Potential Evapotranspiration (mm)	Total Precipitation (mm)
January	-5.5	0.0	0.0	0.78	0.0	51.8
February	-4.5	0.0	0.0	0.88	0.0	47.7
March	0.1	0.0	0.2	0.99	0.2	49.8
April	7.1	1.7	30.4	1.12	34.1	68.5
May	13.1	4.3	60.7	1.22	74.1	74.3
June	18.6	7.3	90.2	1.28	115.4	71.5
July	21.5	9.1	106.2	1.25	132.7	75.7
August	20.6	8.5	101.2	1.16	117.4	78.1
September	16.2	5.9	77.2	1.04	80.2	74.5
October	9.5	2.6	42.3	0.92	38.9	61.1
November	3.7	0.6	14.6	0.81	11.8	75.1
December	-2.2	0.0	0.0	0.75	0.0	57.9
TOTALS		**40.1**	**522.9**		**604.8**	**786.0**

Notes: Daylight Correction values obtained from Instruction and Tables For Computing Potential Evapotranspiration and The Water Balance (Thornthwaite & Mather, 1957)

TABLE 2
Pre-development Site Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Site	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 208030.47	**Monthly Volumes**												
		AET (m^3)	51.22	7090.97	15410.94	23005.67	23313.47	19491.50	15838.43	8088.91	2459.07	0.00	0.00	0.00	114750.18
		Infiltration (m^3)	4123.48	2863.65	18.29	0.00	0.00	0.00	0.00	0.00	0.00	4219.68	4310.39	3969.22	19504.71
		Run-Off (m^3)	6185.22	4295.47	27.43	0.00	0.00	0.00	0.00	0.00	0.00	6329.52	6465.59	5953.83	29257.06
	Moderately Rooted Crop, Silty Clay Soils	**Soil Moisture Storage (mm)**	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = 1479082.32	**Monthly Volumes**												
		AET (m^3)	364.19	50416.29	109570.75	161192.49	155581.05	126918.48	110585.62	57511.56	17483.80	0.00	0.00	0.00	789624.23
		Infiltration (m^3)	25652.94	17815.30	113.77	0.00	0.00	0.00	0.00	0.00	5462.41	29973.60	26815.76	24693.28	130527.06
		Run-Off (m^3)	47641.17	33085.55	211.30	0.00	0.00	0.00	0.00	0.00	10144.48	55665.26	49800.70	45858.95	242407.40
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 98444.53	**Monthly Volumes**												
		AET (m^3)	24.24	3355.60	7292.79	10095.99	8615.54	7688.52	7334.12	3827.85	1163.68	0.00	0.00	0.00	49398.33
		Infiltration (m^3)	1463.49	1016.36	6.49	0.00	0.00	0.00	0.00	0.00	1258.84	1709.98	1529.83	1408.74	8393.72
		Run-Off (m^3)	3414.81	2371.50	15.15	0.00	0.00	0.00	0.00	0.00	2937.29	3989.96	3569.60	3287.06	19585.36
	Impervious Development	**Catchment Area (m^2) = 31447.95**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	234.92	323.13	350.49	337.28	357.09	368.41	351.43	288.22	354.26	273.13	244.35	225.01	**3707.71**
		Run-Off from Imperv. (m^3) - with 15% evap.	1331.19	1831.06	1986.10	1911.25	2023.52	2087.67	1991.44	1633.25	2007.48	1547.71	1384.65	1275.06	**21010.38**
	Total Catchment Volumes														
	Total ET (m^3)		234.92	323.13	350.49	337.28	357.09	368.41	351.43	288.22	354.26	273.13	244.35	225.01	**3707.71**
	Total AET (m^3)		439.65	60862.86	132274.48	194294.15	187510.05	154098.50	133758.16	69428.31	21106.55	0.00	0.00	0.00	**953772.73**
	Total Infiltration (m^3)		31239.90	21695.30	138.55	0.00	0.00	0.00	0.00	0.00	6721.25	35903.27	32655.98	30071.24	**158425.50**
	Total Runoff (m^3)		58572.39	41583.58	2239.97	1911.25	2023.52	2087.67	1991.44	1633.25	15089.24	67532.46	61220.54	56374.90	**312260.20**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

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TABLE 3
Post-development Site Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Site	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 113814.56	**Monthly Volumes**												
		AET (m^3)	28.02	3879.51	8431.41	12586.52	12754.92	10663.90	8665.29	4425.48	1345.37	0.00	0.00	0.00	62780.42
		Infiltration (m^3)	2255.98	1566.72	10.01	0.00	0.00	0.00	0.00	0.00	0.00	2308.61	2358.24	2171.58	10671.13
		Run-Off (m^3)	3383.96	2350.08	15.01	0.00	0.00	0.00	0.00	0.00	0.00	3462.92	3537.36	3257.37	16006.69
	Development - Pervious Landscape	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 425797.60	Imperv coeff. 0.75	**Monthly Volumes**											
		AET (m^3)	104.84	14513.82	31543.18	43667.73	37264.38	33254.79	31721.92	16556.40	5033.23	0.00	0.00	0.00	213660.30
		Infiltration (m^3)	6329.96	4395.99	28.07	0.00	0.00	0.00	0.00	0.00	5444.79	7396.10	6616.89	6093.16	36304.99
		Run-Off (m^3)	14769.91	10257.32	65.51	0.00	0.00	0.00	0.00	0.00	12704.51	17257.58	15439.42	14217.38	84711.63
	Development - Impervious Area	**Catchment Area (m^2) = 1277392.80**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	9542.12	13125.21	14236.54	13700.04	14504.80	14964.66	14274.86	11707.31	14389.83	11094.16	9925.34	9139.75	**150604.61**
		Run-Off from Imperv. (m^3) - with 15% evap.	54072.04	74376.20	80673.74	77633.55	82193.84	84799.72	80890.90	66341.40	81542.37	62866.89	56243.60	51791.89	**853426.13**
	Total Catchment Volumes														
	Total ET (m^3)		9542.12	13125.21	14236.54	13700.04	14504.80	14964.66	14274.86	11707.31	14389.83	11094.16	9925.34	9139.75	**150604.61**
	Total AET (m^3)		132.87	18393.33	39974.59	56254.25	50019.30	43918.69	40387.21	20981.89	6378.60	0.00	0.00	0.00	**276440.72**
	Total Infiltration (m^3)		8585.94	5962.71	38.08	0.00	0.00	0.00	0.00	0.00	5444.79	9704.71	8975.13	8264.75	**46976.11**
	Total Runoff (m^3)		72225.92	86983.59	80754.26	77633.55	82193.84	84799.72	80890.90	66341.40	94246.88	83587.38	75220.38	69266.65	**954144.45**

NOTES:

1) PET and P Taken from Table 1

2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET

3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March

4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
Pre-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W1	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 5160.60	**Monthly Volumes**												
		AET (m^3)	1.27	175.91	382.30	570.70	578.34	483.52	392.90	200.66	61.00	0.00	0.00	0.00	2846.60
		Infiltration (m^3)	102.29	71.04	0.45	0.00	0.00	0.00	0.00	0.00	0.00	104.68	106.93	98.46	483.85
		Run-Off (m^3)	153.44	106.56	0.68	0.00	0.00	0.00	0.00	0.00	0.00	157.02	160.39	147.70	725.78
	Moderately Rooted Crop, Silty Clay Soils	**Soil Moisture Storage (mm)**	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = 4002.93	**Monthly Volumes**												
		AET (m^3)	0.99	136.44	296.54	436.24	421.06	343.49	299.28	155.65	47.32	0.00	0.00	0.00	2137.01
		Infiltration (m^3)	69.43	48.21	0.31	0.00	0.00	0.00	0.00	0.00	14.78	81.12	72.57	66.83	353.25
		Run-Off (m^3)	128.93	89.54	0.57	0.00	0.00	0.00	0.00	0.00	27.45	150.65	134.78	124.11	656.04
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 1881.07	**Monthly Volumes**												
		AET (m^3)	0.46	64.12	139.35	192.91	164.62	146.91	140.14	73.14	22.24	0.00	0.00	0.00	943.90
		Infiltration (m^3)	27.96	19.42	0.12	0.00	0.00	0.00	0.00	0.00	24.05	32.67	29.23	26.92	160.39
		Run-Off (m^3)	65.25	45.31	0.29	0.00	0.00	0.00	0.00	0.00	56.13	76.24	68.21	62.81	374.23
	Impervious Development	**Catchment Area (m^2) = 2357.31**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	17.61	24.22	26.27	25.28	26.77	27.62	26.34	21.60	26.56	20.47	18.32	16.87	**277.93**
		Run-Off from Imperv. (m^3) - with 15% evap.	99.79	137.25	148.88	143.27	151.68	156.49	149.28	122.43	150.48	116.02	103.79	95.58	**1574.92**
	Total Catchment Volumes														
	Total ET (m^3)		17.61	24.22	26.27	25.28	26.77	27.62	26.34	21.60	26.56	20.47	18.32	16.87	**277.93**
	Total AET (m^3)		2.72	376.47	818.19	1199.86	1164.02	973.92	832.33	429.45	130.55	0.00	0.00	0.00	**5927.50**
	Total Infiltration (m^3)		199.68	138.67	0.89	0.00	0.00	0.00	0.00	0.00	38.84	218.47	208.73	192.21	**997.49**
	Total Runoff to W1 (m^3)		447.41	378.67	150.42	143.27	151.68	156.49	149.28	122.43	234.06	499.92	467.17	430.19	**3330.98**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
Pre-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W2	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 31904.05	**Monthly Volumes**												
		AET (m^3)	7.86	1087.49	2363.46	3528.20	3575.41	2989.26	2429.02	1240.53	377.13	0.00	0.00	0.00	17598.36
		Infiltration (m^3)	632.39	439.18	2.80	0.00	0.00	0.00	0.00	0.00	0.00	647.14	661.05	608.73	2991.29
		Run-Off (m^3)	948.58	658.76	4.21	0.00	0.00	0.00	0.00	0.00	0.00	970.71	991.58	913.09	4486.93
	Moderately Rooted Crop, Silty Clay Soils	**Soil Moisture Storage (mm)**	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = 22855.93	**Monthly Volumes**												
		AET (m^3)	5.63	779.07	1693.17	2490.87	2404.16	1961.24	1708.86	888.71	270.17	0.00	0.00	0.00	12201.89
		Infiltration (m^3)	396.41	275.30	1.76	0.00	0.00	0.00	0.00	0.00	84.41	463.18	414.38	381.58	2017.01
		Run-Off (m^3)	736.19	511.26	3.27	0.00	0.00	0.00	0.00	0.00	156.76	860.18	769.56	708.65	3745.87
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 3366.60	**Monthly Volumes**												
		AET (m^3)	0.83	114.75	249.40	345.26	294.63	262.93	250.81	130.90	39.80	0.00	0.00	0.00	1689.32
		Infiltration (m^3)	50.05	34.76	0.22	0.00	0.00	0.00	0.00	0.00	43.05	58.48	52.32	48.18	287.05
		Run-Off (m^3)	116.78	81.10	0.52	0.00	0.00	0.00	0.00	0.00	100.45	136.45	122.07	112.41	669.78
	Impervious Development	**Catchment Area (m^2) = 6143.56**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	45.89	63.13	68.47	65.89	69.76	71.97	68.65	56.31	69.21	53.36	47.74	43.96	**724.33**
		Run-Off from Imperv. (m^3) - with 15% evap.	260.06	357.71	388.00	373.38	395.31	407.84	389.04	319.07	392.17	302.36	270.50	249.09	**4104.52**
	Total Catchment Volumes														
	Total ET (m^3)		45.89	63.13	68.47	65.89	69.76	71.97	68.65	56.31	69.21	53.36	47.74	43.96	**724.33**
	Total AET (m^3)		14.31	1981.31	4306.03	6364.34	6274.20	5213.44	4388.69	2260.15	687.10	0.00	0.00	0.00	**31489.57**
	Total Infiltration (m^3)		1078.84	749.23	4.78	0.00	0.00	0.00	0.00	0.00	127.46	1168.79	1127.75	1038.49	**5295.34**
	Total Runoff to W2 (m^3)		2061.60	1608.84	395.99	373.38	395.31	407.84	389.04	319.07	649.38	2269.70	2153.71	1983.24	**13007.10**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

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Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W3	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 35599.24	**Monthly Volumes**												
		AET (m^3)	8.77	1213.44	2637.20	3936.85	3989.52	3335.49	2710.35	1384.22	420.81	0.00	0.00	0.00	19636.64
		Infiltration (m^3)	705.63	490.04	3.13	0.00	0.00	0.00	0.00	0.00	0.00	722.09	737.62	679.23	3337.75
		Run-Off (m^3)	1058.45	735.06	4.69	0.00	0.00	0.00	0.00	0.00	0.00	1083.14	1106.42	1018.85	5006.62
	Moderately Rooted Crop, Silty Clay Soils	**Soil Moisture Storage (mm)**	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = 163349.82	**Monthly Volumes**												
		AET (m^3)	40.22	5567.97	12100.99	17802.10	17182.37	14016.87	12213.07	6351.58	1930.91	0.00	0.00	0.00	87206.08
		Infiltration (m^3)	2833.11	1967.52	12.57	0.00	0.00	0.00	0.00	0.00	603.27	3310.28	2961.53	2727.13	14415.41
		Run-Off (m^3)	5261.49	3653.97	23.34	0.00	0.00	0.00	0.00	0.00	1120.36	6147.67	5499.99	5064.66	26771.47
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 21469.99	**Monthly Volumes**												
		AET (m^3)	5.29	731.83	1590.50	2201.86	1878.98	1676.81	1599.51	834.82	253.79	0.00	0.00	0.00	10773.39
		Infiltration (m^3)	319.18	221.66	1.42	0.00	0.00	0.00	0.00	0.00	274.54	372.93	333.64	307.24	1830.61
		Run-Off (m^3)	744.74	517.20	3.30	0.00	0.00	0.00	0.00	0.00	640.60	870.18	778.50	716.88	4271.41
	Impervious Development	**Catchment Area (m^2) = 5181.01**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	38.70	53.23	57.74	55.57	58.83	60.70	57.90	47.48	58.36	45.00	40.26	37.07	**610.84**
		Run-Off from Imperv. (m^3) - with 15% evap.	219.31	301.66	327.21	314.88	333.37	343.94	328.09	269.08	330.73	254.98	228.12	210.06	**3461.43**
	Total Catchment Volumes														
	Total ET (m^3)		38.70	53.23	57.74	55.57	58.83	60.70	57.90	47.48	58.36	45.00	40.26	37.07	**610.84**
	Total AET (m^3)		54.27	7513.25	16328.69	23940.80	23050.87	19029.17	16522.94	8570.61	2605.51	0.00	0.00	0.00	**117616.12**
	Total Infiltration (m^3)		3857.92	2679.22	17.11	0.00	0.00	0.00	0.00	0.00	877.81	4405.31	4032.79	3713.59	**19583.76**
	Total Runoff to W3 (m^3)		7283.99	5207.90	358.54	314.88	333.37	343.94	328.09	269.08	2091.69	8355.97	7613.03	7010.46	**39510.93**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
Pre-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W4	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 8313.13	**Monthly Volumes**												
		AET (m^3)	2.05	283.36	615.84	919.33	931.63	778.90	632.92	323.24	98.27	0.00	0.00	0.00	4585.54
		Infiltration (m^3)	164.78	114.43	0.73	0.00	0.00	0.00	0.00	0.00	0.00	168.62	172.25	158.61	779.43
		Run-Off (m^3)	247.17	171.65	1.10	0.00	0.00	0.00	0.00	0.00	0.00	252.93	258.37	237.92	1169.14
	Moderately Rooted Crop, Silty Clay Soils	**Soil Moisture Storage (mm)**	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = 52370.92	**Monthly Volumes**												
		AET (m^3)	12.90	1785.13	3879.65	5707.46	5508.77	4493.89	3915.58	2036.35	619.06	0.00	0.00	0.00	27958.78
		Infiltration (m^3)	908.31	630.80	4.03	0.00	0.00	0.00	0.00	0.00	193.41	1061.30	949.48	874.33	4621.66
		Run-Off (m^3)	1686.86	1171.48	7.48	0.00	0.00	0.00	0.00	0.00	359.19	1970.98	1763.33	1623.76	8583.09
	Impervious Development	**Catchment Area (m^2) = 1355.74**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	10.13	13.93	15.11	14.54	15.39	15.88	15.15	12.43	15.27	11.77	10.53	9.70	**159.84**
		Run-Off from Imperv. (m^3) - with 15% evap.	57.39	78.94	85.62	82.40	87.24	90.00	85.85	70.41	86.54	66.72	59.69	54.97	**905.77**
	Total Catchment Volumes														
	Total ET (m^3)		10.13	13.93	15.11	14.54	15.39	15.88	15.15	12.43	15.27	11.77	10.53	9.70	**159.84**
	Total AET (m^3)		14.94	2068.49	4495.49	6626.79	6440.40	5272.79	4548.50	2359.59	717.33	0.00	0.00	0.00	**32544.33**
	Total Infiltration (m^3)		1073.09	745.23	4.76	0.00	0.00	0.00	0.00	0.00	193.41	1229.92	1121.73	1032.95	**5401.09**
	Total Runoff to W4 (m^3)		1991.42	1422.07	94.20	82.40	87.24	90.00	85.85	70.41	445.74	2290.64	2081.39	1916.65	**10658.01**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
Pre-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
		PET - Adjusted Potential Evapotranspiration (mm)	0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
		P - Total Precipitation (mm)	49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
		P-PET (mm)	49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
		Soil Moisture Deficit (mm)	0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W5	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 19470.82	**Monthly Volumes**												
		AET (m^3)	4.79	663.69	1442.40	2153.24	2182.05	1824.33	1482.41	757.09	230.16	0.00	0.00	0.00	10740.16
		Infiltration (m^3)	385.94	268.03	1.71	0.00	0.00	0.00	0.00	0.00	0.00	394.95	403.44	371.50	1825.56
		Run-Off (m^3)	578.91	402.04	2.57	0.00	0.00	0.00	0.00	0.00	0.00	592.42	605.15	557.25	2738.34
	Moderately Rooted Crop, Silty Clay Soils	**Soil Moisture Storage (mm)**	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	**533.86**
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = 50497.92	**Monthly Volumes**												
		AET (m^3)	12.43	1721.28	3740.90	5503.33	5311.75	4333.17	3775.55	1963.52	596.92	0.00	0.00	0.00	26958.86
		Infiltration (m^3)	875.83	608.24	3.88	0.00	0.00	0.00	0.00	0.00	186.49	1023.34	915.53	843.06	4456.37
		Run-Off (m^3)	1626.54	1129.59	7.21	0.00	0.00	0.00	0.00	0.00	346.35	1900.49	1700.26	1565.69	8276.12
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 3330.87	**Monthly Volumes**												
		AET (m^3)	0.82	113.54	246.75	341.60	291.51	260.14	248.15	129.52	39.37	0.00	0.00	0.00	1671.39
		Infiltration (m^3)	49.52	34.39	0.22	0.00	0.00	0.00	0.00	0.00	42.59	57.86	51.76	47.66	284.00
		Run-Off (m^3)	115.54	80.24	0.51	0.00	0.00	0.00	0.00	0.00	99.38	135.00	120.78	111.22	662.67
	Impervious Development	**Catchment Area (m^2) = 1025.45**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	7.66	10.54	11.43	11.00	11.64	12.01	11.46	9.40	11.55	8.91	7.97	7.34	**120.90**
		Run-Off from Imperv. (m^3) - with 15% evap.	43.41	59.71	64.76	62.32	65.98	68.07	64.94	53.26	65.46	50.47	45.15	41.58	**685.11**
	Total Catchment Volumes														
	Total ET (m^3)		7.66	10.54	11.43	11.00	11.64	12.01	11.46	9.40	11.55	8.91	7.97	7.34	**120.90**
	Total AET (m^3)		18.05	2498.50	5430.05	7998.17	7785.31	6417.64	5506.11	2850.13	866.45	0.00	0.00	0.00	**39370.41**
	Total Infiltration (m^3)		1311.28	910.65	5.82	0.00	0.00	0.00	0.00	0.00	229.09	1476.14	1370.72	1262.23	**6565.94**
	Total Runoff to W5 (m^3)		2364.39	1671.57	75.06	62.32	65.98	68.07	64.94	53.26	511.19	2678.37	2471.35	2275.74	**12362.24**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 4
Pre-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
		PET - Adjusted Potential Evapotranspiration (mm)	0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	604.83
		P - Total Precipitation (mm)	49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	786.00
		P-PET (mm)	49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	181.17
		Soil Moisture Deficit (mm)	0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W6	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	551.60
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 16702.36	Monthly Volumes												
		AET (m^3)	4.11	569.32	1237.31	1847.08	1871.79	1564.93	1271.64	649.44	197.43	0.00	0.00	0.00	9213.07
		Infiltration (m^3)	331.07	229.92	1.47	0.00	0.00	0.00	0.00	0.00	0.00	338.79	346.07	318.68	1565.99
		Run-Off (m^3)	496.60	344.88	2.20	0.00	0.00	0.00	0.00	0.00	0.00	508.19	519.11	478.02	2348.99
	Moderately Rooted Crop, Silty Clay Soils	Soil Moisture Storage (mm)	150.00	150.00	150.00	106.09	49.08	9.83	4.09	26.31	89.58	147.48	150.00	150.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	108.98	105.19	85.81	74.77	38.88	11.82	0.00	0.00	0.00	533.86
		P-AET (mm)	49.55	34.41	0.22	-37.48	-29.49	-7.71	-0.27	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-37.48	-66.97	-74.68	-74.94	-52.73	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	37.48	29.49	7.71	0.27	-22.22	-52.73	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	10.55	57.90	51.80	47.70	252.14
		Infiltration Factor	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	-
		Run-Off Coefficient	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	-
		Infiltration (mm)	17.34	12.04	0.08	0.00	0.00	0.00	0.00	0.00	3.69	20.27	18.13	16.70	88.25
		Run-Off (mm)	32.21	22.37	0.14	0.00	0.00	0.00	0.00	0.00	6.86	37.64	33.67	31.01	163.89
		Catchment Area (m^2) = 27498.16	Monthly Volumes												
		AET (m^3)	6.77	937.31	2037.07	2996.79	2892.46	2359.59	2055.94	1069.22	325.05	0.00	0.00	0.00	14680.20
		Infiltration (m^3)	476.92	331.21	2.12	0.00	0.00	0.00	0.00	0.00	101.55	557.25	498.54	459.08	2426.68
		Run-Off (m^3)	885.71	615.11	3.93	0.00	0.00	0.00	0.00	0.00	188.60	1034.89	925.86	852.58	4506.69
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	501.79
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 1988.73	Monthly Volumes												
		AET (m^3)	0.49	67.79	147.33	203.95	174.05	155.32	148.16	77.33	23.51	0.00	0.00	0.00	997.92
		Infiltration (m^3)	29.56	20.53	0.13	0.00	0.00	0.00	0.00	0.00	25.43	34.54	30.90	28.46	169.57
		Run-Off (m^3)	68.98	47.91	0.31	0.00	0.00	0.00	0.00	0.00	59.34	80.60	72.11	66.40	395.65
	Impervious Development	Catchment Area (m^2) = 1307.38	Monthly Volumes												
		Evaporation from Imperv. (m^3) - 15% of P.	9.77	13.43	14.57	14.02	14.85	15.32	14.61	11.98	14.73	11.35	10.16	9.35	154.14
		Run-Off from Imperv. (m^3) - with 15% evap.	55.34	76.12	82.57	79.46	84.12	86.79	82.79	67.90	83.46	64.34	57.56	53.01	873.46
	Total Catchment Volumes														
	Total ET (m^3)		9.77	13.43	14.57	14.02	14.85	15.32	14.61	11.98	14.73	11.35	10.16	9.35	154.14
	Total AET (m^3)		11.37	1574.42	3421.71	5047.82	4938.30	4079.84	3475.73	1795.99	545.99	0.00	0.00	0.00	24891.19
	Total Infiltration (m^3)		837.55	581.66	3.71	0.00	0.00	0.00	0.00	0.00	126.98	930.58	875.52	806.22	4162.24
	Total Runoff to W6 (m^3)		1506.64	1084.01	89.00	79.46	84.12	86.79	82.79	67.90	331.39	1688.02	1574.65	1450.01	8124.79

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W1	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 4253.00	**Monthly Volumes**												
		AET (m^3)	1.05	144.97	315.06	470.33	476.62	398.49	323.80	165.37	50.27	0.00	0.00	0.00	2345.97
		Infiltration (m^3)	84.30	58.54	0.37	0.00	0.00	0.00	0.00	0.00	0.00	86.27	88.12	81.15	398.76
		Run-Off (m^3)	126.45	87.82	0.56	0.00	0.00	0.00	0.00	0.00	0.00	129.40	132.18	121.72	598.13
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 819.00	**Monthly Volumes**												
		AET (m^3)	0.20	27.92	60.67	83.99	71.68	63.96	61.02	31.85	9.68	0.00	0.00	0.00	410.96
		Infiltration (m^3)	12.18	8.46	0.05	0.00	0.00	0.00	0.00	0.00	10.47	14.23	12.73	11.72	69.83
		Run-Off (m^3)	28.41	19.73	0.13	0.00	0.00	0.00	0.00	0.00	24.44	33.19	29.70	27.35	162.94
	Impervious Development (existing road)	**Catchment Area (m^2) = 1184.00**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	8.84	12.17	13.20	12.70	13.44	13.87	13.23	10.85	13.34	10.28	9.20	8.47	**139.59**
		Run-Off from Imperv. (m^3) - with 15% evap.	50.12	68.94	74.78	71.96	76.18	78.60	74.98	61.49	75.58	58.27	52.13	48.01	**791.03**
	Total Catchment Volumes														
	Total ET (m^3)		8.84	12.17	13.20	12.70	13.44	13.87	13.23	10.85	13.34	10.28	9.20	8.47	**139.59**
	Total AET (m^3)		1.25	172.89	375.73	554.32	548.30	462.45	384.82	197.22	59.95	0.00	0.00	0.00	**2756.93**
	Total Infiltration (m^3)		96.48	67.00	0.43	0.00	0.00	0.00	0.00	0.00	10.47	100.49	100.85	92.87	**468.59**
	Total Runoff to W1 (m^3)		204.98	176.48	75.46	71.96	76.18	78.60	74.98	61.49	100.02	220.87	214.01	197.07	**1552.10**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
		PET - Adjusted Potential Evapotranspiration (mm)	0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
		P - Total Precipitation (mm)	49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
		P-PET (mm)	49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
		Soil Moisture Deficit (mm)	0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W2	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 28376.00	**Monthly Volumes**												
		AET (m^3)	6.99	967.23	2102.10	3138.04	3180.03	2658.70	2160.41	1103.35	335.42	0.00	0.00	0.00	15652.28
		Infiltration (m^3)	562.46	390.61	2.49	0.00	0.00	0.00	0.00	0.00	0.00	575.58	587.95	541.41	2660.50
		Run-Off (m^3)	843.68	585.92	3.74	0.00	0.00	0.00	0.00	0.00	0.00	863.37	881.93	812.12	3990.75
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 5463.00	**Monthly Volumes**												
		AET (m^3)	1.35	186.21	404.70	560.26	478.10	426.66	406.99	212.42	64.58	0.00	0.00	0.00	2741.27
		Infiltration (m^3)	81.21	56.40	0.36	0.00	0.00	0.00	0.00	0.00	69.86	94.89	84.90	78.18	465.79
		Run-Off (m^3)	189.50	131.60	0.84	0.00	0.00	0.00	0.00	0.00	163.00	221.42	198.09	182.41	1086.85
	Impervious Development (existing road)	**Catchment Area (m^2) = 3307.00**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	24.70	33.98	36.86	35.47	37.55	38.74	36.96	30.31	37.25	28.72	25.70	23.66	**389.90**
		Run-Off from Imperv. (m^3) - with 15% evap.	139.99	192.55	208.85	200.98	212.79	219.54	209.42	171.75	211.10	162.75	145.61	134.08	**2209.41**
	Total Catchment Volumes														
	Total ET (m^3)		24.70	33.98	36.86	35.47	37.55	38.74	36.96	30.31	37.25	28.72	25.70	23.66	**389.90**
	Total AET (m^3)		8.33	1153.44	2506.80	3698.30	3658.13	3085.36	2567.40	1315.77	400.00	0.00	0.00	0.00	**18393.55**
	Total Infiltration (m^3)		643.67	447.01	2.85	0.00	0.00	0.00	0.00	0.00	69.86	670.47	672.85	619.59	**3126.30**
	Total Runoff to W2 (m^3)		1173.17	910.07	213.44	200.98	212.79	219.54	209.42	171.75	374.10	1247.54	1225.62	1128.61	**7287.01**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
		PET - Adjusted Potential Evapotranspiration (mm)	0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
		P - Total Precipitation (mm)	49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
		P-PET (mm)	49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
		Soil Moisture Deficit (mm)	0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W3	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 23518.00	**Monthly Volumes**												
		AET (m^3)	5.79	801.64	1742.22	2600.81	2635.60	2203.53	1790.55	914.46	278.00	0.00	0.00	0.00	12972.59
		Infiltration (m^3)	466.16	323.74	2.07	0.00	0.00	0.00	0.00	0.00	0.00	477.04	487.29	448.72	2205.02
		Run-Off (m^3)	699.24	485.61	3.10	0.00	0.00	0.00	0.00	0.00	0.00	715.56	730.94	673.09	3307.53
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 7354.00	**Monthly Volumes**												
		AET (m^3)	1.81	250.67	544.79	754.19	643.60	574.35	547.87	285.95	86.93	0.00	0.00	0.00	3690.15
		Infiltration (m^3)	109.33	75.92	0.48	0.00	0.00	0.00	0.00	0.00	94.04	127.74	114.28	105.24	627.03
		Run-Off (m^3)	255.09	177.16	1.13	0.00	0.00	0.00	0.00	0.00	219.42	298.06	266.66	245.55	1463.06
	Impervious Development	**Catchment Area (m^2) = 0.00**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
		Run-Off from Imperv. (m^3) - with 15% evap.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	Total Catchment Volumes														
	Total ET (m^3)		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
	Total AET (m^3)		7.60	1052.31	2287.00	3355.00	3279.20	2777.88	2338.42	1200.40	364.93	0.00	0.00	0.00	**16662.75**
	Total Infiltration (m^3)		575.49	399.66	2.55	0.00	0.00	0.00	0.00	0.00	94.04	604.78	601.57	553.96	**2832.05**
	Total Runoff to W3 (m^3)		954.34	662.76	4.23	0.00	0.00	0.00	0.00	0.00	219.42	1013.62	997.60	918.64	**4770.60**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	604.83
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	786.00
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	181.17
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W4	Pasture/Shrub, Silty Clay Soils	Soil Moisture Storage (mm)	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	551.60
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 10099.00	Monthly Volumes												
		AET (m^3)	2.49	344.24	748.14	1116.83	1131.77	946.23	768.89	392.68	119.38	0.00	0.00	0.00	5570.64
		Infiltration (m^3)	200.18	139.02	0.89	0.00	0.00	0.00	0.00	0.00	0.00	204.85	209.25	192.69	946.87
		Run-Off (m^3)	300.27	208.53	1.33	0.00	0.00	0.00	0.00	0.00	0.00	307.27	313.88	289.03	1420.31
	Urban Lawn - Pervious Development	Soil Moisture Storage (mm)	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	501.79
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 6378.00	Monthly Volumes												
		AET (m^3)	1.57	217.40	472.48	654.10	558.18	498.12	475.16	248.00	75.39	0.00	0.00	0.00	3200.41
		Infiltration (m^3)	94.82	65.85	0.42	0.00	0.00	0.00	0.00	0.00	81.56	110.79	99.11	91.27	543.81
		Run-Off (m^3)	221.24	153.64	0.98	0.00	0.00	0.00	0.00	0.00	190.30	258.50	231.27	212.96	1268.89
	Impervious Development	Catchment Area (m^2) = 785.00	Monthly Volumes												
		Evaporation from Imperv. (m^3) - 15% of P.	5.86	8.07	8.75	8.42	8.91	9.20	8.77	7.19	8.84	6.82	6.10	5.62	92.55
		Run-Off from Imperv. (m^3) - with 15% evap.	33.23	45.71	49.58	47.71	50.51	52.11	49.71	40.77	50.11	38.63	34.56	31.83	524.46
	Total Catchment Volumes														
	Total ET (m^3)		5.86	8.07	8.75	8.42	8.91	9.20	8.77	7.19	8.84	6.82	6.10	5.62	92.55
	Total AET (m^3)		4.06	561.64	1220.62	1770.92	1689.95	1444.35	1244.05	640.68	194.77	0.00	0.00	0.00	8771.04
	Total Infiltration (m^3)		294.99	204.87	1.31	0.00	0.00	0.00	0.00	0.00	81.56	315.63	308.37	283.96	1490.68
	Total Runoff to W4 (m^3)		554.73	407.88	51.89	47.71	50.51	52.11	49.71	40.77	240.41	604.41	579.71	533.82	3213.66

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
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Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W5	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 13883.00	**Monthly Volumes**												
		AET (m^3)	3.42	473.22	1028.46	1535.29	1555.83	1300.77	1056.98	539.82	164.11	0.00	0.00	0.00	7657.90
		Infiltration (m^3)	275.18	191.11	1.22	0.00	0.00	0.00	0.00	0.00	0.00	281.60	287.66	264.89	1301.65
		Run-Off (m^3)	412.77	286.66	1.83	0.00	0.00	0.00	0.00	0.00	0.00	422.40	431.48	397.33	1952.48
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 2947.00	**Monthly Volumes**												
		AET (m^3)	0.73	100.45	218.31	302.23	257.91	230.16	219.55	114.59	34.84	0.00	0.00	0.00	1478.77
		Infiltration (m^3)	43.81	30.43	0.19	0.00	0.00	0.00	0.00	0.00	37.68	51.19	45.80	42.17	251.27
		Run-Off (m^3)	102.22	70.99	0.45	0.00	0.00	0.00	0.00	0.00	87.93	119.44	106.86	98.40	586.30
	Impervious Development	**Catchment Area (m^2) = 592.00**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	4.42	6.08	6.60	6.35	6.72	6.94	6.62	5.43	6.67	5.14	4.60	4.24	**69.80**
		Run-Off from Imperv. (m^3) - with 15% evap.	25.06	34.47	37.39	35.98	38.09	39.30	37.49	30.75	37.79	29.14	26.07	24.00	**395.52**
	Total Catchment Volumes														
	Total ET (m^3)		4.42	6.08	6.60	6.35	6.72	6.94	6.62	5.43	6.67	5.14	4.60	4.24	**69.80**
	Total AET (m^3)		4.14	573.67	1246.77	1837.52	1813.75	1530.93	1276.54	654.41	198.94	0.00	0.00	0.00	**9136.67**
	Total Infiltration (m^3)		318.99	221.53	1.41	0.00	0.00	0.00	0.00	0.00	37.68	332.79	333.45	307.06	**1552.93**
	Total Runoff to W5 (m^3)		540.06	392.12	39.67	35.98	38.09	39.30	37.49	30.75	125.72	570.98	564.41	519.73	**2934.30**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 5
Post-development Wetland Water Balance
Bolton LOPA Submission for Option 3 Lands

Catchments and Hydrologic Components			Month												Total
			March	April	May	June	July	August	September	October	November	December	January	February	
PET - Adjusted Potential Evapotranspiration (mm)			0.25	34.09	74.08	115.41	132.71	117.35	80.24	38.88	11.82	0.00	0.00	0.00	**604.83**
P - Total Precipitation (mm)			49.80	68.50	74.30	71.50	75.70	78.10	74.50	61.10	75.10	57.90	51.80	47.70	**786.00**
P-PET (mm)			49.55	34.41	0.22	-43.91	-57.01	-39.25	-5.74	22.22	63.28	57.90	51.80	47.70	**181.17**
Soil Moisture Deficit (mm)			0.00	0.00	0.00	-43.91	-100.92	-140.17	-145.91	-123.69	-60.42	-2.52	0.00	0.00	-
Wetland W6	Pasture/Shrub, Silty Clay Soils	**Soil Moisture Storage (mm)**	200.00	200.00	200.00	156.09	99.08	59.83	54.09	76.31	139.58	197.48	200.00	200.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	110.59	112.07	93.70	76.14	38.88	11.82	0.00	0.00	0.00	**551.60**
		P-AET (mm)	49.55	34.41	0.22	-39.09	-36.37	-15.60	-1.64	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-39.09	-75.46	-91.05	-92.69	-70.47	-7.19	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	39.09	36.37	15.60	1.64	-22.22	-63.28	-7.19	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	0.00	50.71	51.80	47.70	234.40
		Infiltration Factor	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	-
		Run-Off Coefficient	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	-
		Infiltration (mm)	19.82	13.77	0.09	0.00	0.00	0.00	0.00	0.00	0.00	20.28	20.72	19.08	93.76
		Run-Off (mm)	29.73	20.65	0.13	0.00	0.00	0.00	0.00	0.00	0.00	30.43	31.08	28.62	140.64
		Catchment Area (m^2) = 8731.00	**Monthly Volumes**												
		AET (m^3)	2.15	297.61	646.79	965.54	978.46	818.05	664.74	339.49	103.21	0.00	0.00	0.00	4816.04
		Infiltration (m^3)	173.06	120.19	0.77	0.00	0.00	0.00	0.00	0.00	0.00	177.10	180.91	166.59	818.61
		Run-Off (m^3)	259.59	180.28	1.15	0.00	0.00	0.00	0.00	0.00	0.00	265.65	271.36	249.88	1227.91
	Urban Lawn - Pervious Development	**Soil Moisture Storage (mm)**	75.00	75.00	75.00	31.09	0.00	0.00	0.00	22.22	75.00	75.00	75.00	75.00	-
		Actual Evapotranspiration (mm)	0.25	34.09	74.08	102.56	87.52	78.10	74.50	38.88	11.82	0.00	0.00	0.00	**501.79**
		P-AET (mm)	49.55	34.41	0.22	-31.06	-11.82	0.00	0.00	22.22	63.28	57.90	51.80	47.70	-
		Actual Soil Moisture Deficit (mm)	0.00	0.00	0.00	-31.06	-42.87	-42.87	-42.87	-20.66	0.00	0.00	0.00	0.00	-
		Change in Soil Moisture Deficit (mm)	0.00	0.00	0.00	31.06	11.82	0.00	0.00	-22.22	-20.66	0.00	0.00	0.00	-
		Precipitation Surplus (mm)	49.55	34.41	0.22	0.00	0.00	0.00	0.00	0.00	42.62	57.90	51.80	47.70	284.21
		Infiltration Factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	-
		Run-Off Coefficient	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
		Infiltration (mm)	14.87	10.32	0.07	0.00	0.00	0.00	0.00	0.00	12.79	17.37	15.54	14.31	85.26
		Run-Off (mm)	34.69	24.09	0.15	0.00	0.00	0.00	0.00	0.00	29.84	40.53	36.26	33.39	198.95
		Catchment Area (m^2) 2803.00	**Monthly Volumes**												
		AET (m^3)	0.69	95.54	207.65	287.46	245.31	218.91	208.82	108.99	33.13	0.00	0.00	0.00	1406.51
		Infiltration (m^3)	41.67	28.94	0.18	0.00	0.00	0.00	0.00	0.00	35.84	48.69	43.56	40.11	238.99
		Run-Off (m^3)	97.23	67.52	0.43	0.00	0.00	0.00	0.00	0.00	83.63	113.61	101.64	93.59	557.65
	Impervious Development	**Catchment Area (m^2) = 427.00**	**Monthly Volumes**												
		Evaporation from Imperv. (m^3) - 15% of P.	3.19	4.39	4.76	4.58	4.85	5.00	4.77	3.91	4.81	3.71	3.32	3.06	**50.34**
		Run-Off from Imperv. (m^3) - with 15% evap.	18.07	24.86	26.97	25.95	27.48	28.35	27.04	22.18	27.26	21.01	18.80	17.31	**285.28**
	Total Catchment Volumes														
	Total ET (m^3)		3.19	4.39	4.76	4.58	4.85	5.00	4.77	3.91	4.81	3.71	3.32	3.06	**50.34**
	Total AET (m^3)		2.84	393.15	854.44	1253.01	1223.77	1036.97	873.56	448.48	136.34	0.00	0.00	0.00	**6222.56**
	Total Infiltration (m^3)		214.73	149.13	0.95	0.00	0.00	0.00	0.00	0.00	35.84	225.79	224.46	206.70	**1057.60**
	Total Runoff to W6 (m^3)		374.90	272.67	28.55	25.95	27.48	28.35	27.04	22.18	110.89	400.27	391.80	360.79	**2070.84**

NOTES:
1) PET and P Taken from Table 1
2) Soil Moisture Deficit (mm) is a function of P-Pet, once there is a shortage of P to satisfy PET
3) Water Holding Capacity (mm) of soils types taken from Table 3.1, SWM Planning & Design Manual (MOE, March 2003) and applied to March
4) Actual Evapotranspiration (AET) is a function of Adjusted Potential Evapotranspiration (PET) and change in Groundwater Storage (Δ ST) for a given soil type

TABLE 6
Water Balance Summary
Bolton LOPA Submission for Option 3 Lands

Total Runoff (m^3)	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**January**	**February**	**Annual Total**
W1													
Pre-development	447	379	150	143	152	156	149	122	234	500	467	430	3331
Post-development no Mitigation	205	176	75	72	76	79	75	61	100	221	214	197	1552
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	242	202	75	71	75	78	74	61	134	279	253	233	1779
W2													
Pre-development	2062	1609	396	373	395	408	389	319	649	2270	2154	1983	13007
Post-development no Mitigation	1173	910	213	201	213	220	209	172	374	1248	1226	1129	7287
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	888	699	183	172	183	188	180	147	275	1022	928	855	5720
W3													
Pre-development	7284	5208	359	315	333	344	328	269	2092	8356	7613	7010	39511
Post-development no mitigation	954	663	4	0	0	0	0	0	219	1014	998	919	4771
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	6330	4545	354	315	333	344	328	269	1872	7342	6615	6092	34740
W4													
Pre-development	1991	1422	94	82	87	90	86	70	446	2291	2081	1917	10658
Post-development no Mitigation	555	408	52	48	51	52	50	41	240	604	580	534	3214
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	1437	1014	42	35	37	38	36	30	205	1686	1502	1383	7444
W5													
Pre-development	2364	1672	75	62	66	68	65	53	511	2678	2471	2276	12362
Post-development no Mitigation	540	392	40	36	38	39	37	31	126	571	564	520	2934
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	1824	1279	35	26	28	29	27	23	385	2107	1907	1756	9428
W6													
Pre-development	1507	1084	89	79	84	87	83	68	331	1688	1575	1450	8125
Post-development no Mitigation	375	273	29	26	27	28	27	22	111	400	392	361	2071
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	1132	811	60	54	57	58	56	46	221	1288	1183	1089	6054
Total Study Area													
Pre-development	58572	41584	2240	1911	2024	2088	1991	1633	15089	67532	61221	56375	312260
Post-development no Mitigation	72226	86984	80754	77634	82194	84800	80891	66341	94247	83587	75220	69267	954144
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	-13654	-45400	-78514	-75722	-80170	-82712	-78899	-64708	-79158	-16055	-14000	-12892	-641884

NOTES:
1) - ve implies net gain

TABLE 6
Water Balance Summary
Bolton LOPA Submission for Option 3 Lands

Total Infiltration (m^3)	March	April	May	June	July	August	September	October	November	December	January	February	Annual Total
W1													
Pre-development	200	139	1	0	0	0	0	0	39	218	209	192	997
Post-development no Mitigation	96	67	0	0	0	0	0	0	10	100	101	93	469
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	103	72	0	0	0	0	0	0	28	118	108	99	529
W2													
Pre-development	1079	749	5	0	0	0	0	0	127	1169	1128	1038	5295
Post-development no Mitigation	644	447	3	0	0	0	0	0	70	670	673	620	3126
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	435	302	2	0	0	0	0	0	58	498	455	419	2169
W3													
Pre-development	3858	2679	17	0	0	0	0	0	878	4405	4033	3714	19584
Post-development no mitigation	575	400	3	0	0	0	0	0	94	605	602	554	2832
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	3282	2280	15	0	0	0	0	0	784	3801	3431	3160	16752
W4													
Pre-development	1073	745	5	0	0	0	0	0	193	1230	1122	1033	5401
Post-development no Mitigation	295	205	1	0	0	0	0	0	82	316	308	284	1491
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	778	540	3	0	0	0	0	0	112	914	813	749	3910
W5													
Pre-development	1311	911	6	0	0	0	0	0	229	1476	1371	1262	6566
Post-development no Mitigation	319	222	1	0	0	0	0	0	38	333	333	307	1553
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	992	689	4	0	0	0	0	0	191	1143	1037	955	5013
W6													
Pre-development	838	582	4	0	0	0	0	0	127	931	876	806	4162
Post-development no Mitigation	215	149	1	0	0	0	0	0	36	226	224	207	1058
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	623	433	3	0	0	0	0	0	91	705	651	600	3105
Total Study Area													
Pre-development	31240	21695	139	0	0	0	0	0	6721	35903	32656	30071	158425
Post-development no Mitigation	8586	5963	38	0	0	0	0	0	5445	9705	8975	8265	46976
Post-development with Mitigation													
Post-development Deficit (no Mitigation)	22654	15733	100	0	0	0	0	0	1276	26199	23681	21806	111449

Catchment Area Name	Pre-development Catchment Area (m^2)	Post-development Catchment Area (m^2)	% Reduction in Catchment Area	Pre-development Impervious Area	Post-development Impervious Area (m^2)	% Increase in Impervious Area
W1	13402	6256	53.3	2357.31	1184.00	-49.8
W2	64270	37146	42.2	6143.56	3307.00	-46.2
W3	225600	30872	86.3	5181	0	-100.0
W4	62040	17262	72.2	1356	785	-42.1
W5	74325	17422	76.6	1025.45	592.00	-42.3
W6	47497	11961	74.8	1307.38	427.00	-67.3

NOTES:
* - ve implies net reduction

Appendix C

Headwater Drainage Feature Assessment Photolog

Appendix C

HDFA Photolog

Photograph 1.
Reach WHT6-A (June 8, 2020)
Facing west (upstream). Feature flowing at time of assessment. Wetland riparian vegetation.

Photograph 2.
Reach WHT6-B (June 8, 2020)
Facing north east (downstream). Feature was dry at the time of assessment. Wetland riparian vegetation.

Photograph 3.
Reach WHT6-C (June 8, 2020)
Facing east (upstream). Feature was dry at the time of assessment. Wetland riparian vegetation.

Photograph 4.
Reach WHT6-D (June 8, 2020)
Facing east (downstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 5.
Reach WHT6-E (June 8, 2020)
Facing west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 6.
Reach WHT6-F (June 8, 2020)
Facing north west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 7.
Reach WHT6-G (June 8, 2020)
Facing south west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 8.
Reach WHT6-H (June 8, 2020)
Facing north west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 9.
Reach WHT6-I (June 8, 2020)
Facing west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 10.
Reach WHT-J (June 8, 2020)
Facing north east (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 11.
Reach WHT6-K (June 8, 2020)
Facing south west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 12.
Reach WHT6-L (June 8, 2020)
Facing north west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 13.
Reach WHT6-M (June 8, 2020)
Facing west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 14.
Reach WHT6-N (June 8, 2020)
Facing north east (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 15.
Reach MHT7-C (June 8, 2020)
Facing north east (downstream). Feature was dry at the time of assessment. Meadow riparian vegetation.

Photograph 16.
Reach MHT7-D (June 8, 2020)
Facing east (downstream). Feature was dry at the time of assessment. Meadow riparian vegetation.

Photograph 17.
Reach MHT8-A (June 8, 2020)
Facing north east (downstream). Feature was dry at the time of assessment. Meadow riparian vegetation.

Photograph 18.
Reach WHT5-A (June 8, 2020)
Facing south west (upstream). Feature was dry at the time of assessment. Meadow riparian vegetation.

Photograph 19.
Reach WHT2-A (June 8, 2020)
Facing north west (upstream). Feature was dry at the time of assessment. Meadow marsh riparian vegetation.

Photograph 20.
Reach WHT2-B (June 8, 2020)
Facing north west (upstream). Feature was dry at the time of assessment. Meadow marsh riparian vegetation.

Photograph 21.
Reach WHT2-C (June 8, 2020)
Facing north west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 22.
Reach WHT2-E (June 8, 2020)
Facing south west (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation

Photograph 23.
Reach WHT2-G (June 8, 2020)
Facing north (upstream). Feature was dry at the time of assessment. Agricultural riparian vegetation.

Photograph 24.
Reach WHT3-A (June 8, 2020)
Facing north east (downstream). Feature was dry at the time of assessment. Wetland riparian vegetation.

Photograph 25.
Reach WHT3-B (June 8, 2020)
Facing north west (upstream). Feature was dry at the time of assessment. Wetland riparian vegetation.

Photograph 26.
Reach WHT3-C June 8, 2020
Facing north west (upstream). Feature was dry at the time of assessment. Meadow riparian vegetation.

Photograph 27.
Reach WHT1-A (June 8, 2020)
Facing north west (upstream). Feature was flowing at the time of assessment. Wetland riparian vegetation.

Photograph 28.
Reach WHT1-B (June 8, 2020)
Facing north east (upstream). Feature was flowing at the time of assessment. Wetland riparian vegetation.

Appendix D

Flora Checklist for Macville Community Secondary Plan

Appendix D

Flora Checklist for Macville Community Secondary Plan

Common Name	Scientific Name	S-Rank [a]	TRCA Rank [b]
Abies balsamea	Balsam Fir	S5	L3
Abutilon theophrasti	Velvetleaf	SE5	L+
Acer negundo	Manitoba Maple	S5	L+?
Acer platanoides	Norway Maple	SE5	L+
Acer x *freemanii*	(Acer rubrum X Acer saccharinum)	SNA	L4
Aesculus hippocastanum	Horse Chestnut	SE2	L+
Agrostis gigantea	Redtop	SE5	L+
Agrostis stolonifera	Creeping Bentgrass	SE5	L+?
Alisma triviale	Northern Water-plantain	S5	L5
Alliaria petiolata	Garlic Mustard	SE5	L+
Alnus glutinosa	European Black Alder	SE4	L+
Alnus incana ssp. rugosa	Speckled Alder	S5	L3
Arctium lappa	Great Burdock	SE5	L+
Asclepias syriaca	Common Milkweed	S5	L5
Betula alleghaniensis	Yellow Birch	S5	L4
Betula papyrifera	Paper Birch	S5	L4
Betula pendula	Weeping Birch	SE4	L+
Bidens frondosa	Devil's Beggarticks	S5	L5
Bromus inermis	Smooth Brome	SE5	L+
Caltha palustris	Yellow Marsh Marigold	S5	L4
Carex bebbii	Bebb's Sedge	S5	L5
Carex hystericina	Porcupine Sedge	S5	L4
Carex laevivaginata	Smooth-sheathed Sedge	S4	L3
Carex pseudocyperus	Cyperus-like Sedge	S5	L5
Carex stipata	Awl-fruited Sedge	S5	L5
Carex vulpinoidea	Fox Sedge	S5	L5
Catalpa speciosa	Northern Catalpa	SE1	L+
Cichorium intybus	Wild Chicory	SE5	L+

Common Name	Scientific Name	S-Rank [a]	TRCA Rank [b]
Cicuta bulbifera	Bulbous Water-hemlock	S5	L5
Circaea canadensis ssp. *canadensis*	Canada Enchanter's Nightshade	S5	L5
Cirsium arvense	Canada Thistle	SE5	L+
Clematis virginiana	Virginia Clematis	S5	L5
Cornus sericea	Red-osier Dogwood	S5	L5
Crataegus monogyna	English Hawthorn	SE4	L+
Crataegus punctata	Dotted Hawthorn	S5	L5
Dactylis glomerata	Orchard Grass	SE5	L+
Daucus carota	Wild Carrot	SE5	L+
Digitaria sanguinalis	Hairy Crabgrass	SE5	L+
Echinochloa crus-galli	Large Barnyard Grass	SE5	L+
Echinocystis lobata	Wild Cucumber	S5	L5
Eleocharis erythropoda	Red-stemmed Spikerush	S5	L5
Elymus repens	Quackgrass	SE5	L+
Epilobium ciliatum ssp. *ciliatum*	Northern Willowherb	S5	L5
Epilobium coloratum	Purple-veined Willowherb	S5	L5
Epilobium hirsutum	Hairy Willowherb	SE5	L+
Epilobium leptophyllum	Narrow-leaved Willowherb	S5	L3
Epilobium parviflorum	Small-flowered Hairy Willowherb	SE4	L+
Equisetum arvense	Field Horsetail	S5	L5
Equisetum sylvaticum	Woodland Horsetail	S5	L3
Erigeron philadelphicus var. *philadelphicus*	Philadelphia Fleabane	S5	L5
Eupatorium perfoliatum	Common Boneset	S5	L5
Euthamia graminifolia	Grass-leaved Goldenrod	S5	L5
Eutrochium maculatum var. *maculatum*	Spotted Joe Pye Weed	S5	L5
Fraxinus pennsylvanica	Red Ash	S4	L5
Galium palustre	Common Marsh Bedstraw	S5	L5
Galium verum	Yellow Bedstraw	SE4	L+
Geum aleppicum	Yellow Avens	S5	L5
Geum canadense	Canada Avens	S5	L5
Geum urbanum	Wood Avens	SE3	L+
Glechoma hederacea	Ground-ivy	SE5	L+
Glyceria grandis	Tall Mannagrass	S5	L5
Glyceria striata	Fowl Mannagrass	S5	L5
Hesperis matronalis	Dame's Rocket	SE5	L+

Common Name	Scientific Name	S-Rank [a]	TRCA Rank [b]
Impatiens capensis	Spotted Jewelweed	S5	L5
Inula helenium	Elecampane	SE5	L+
Juglans nigra	Black Walnut	S4?	L5
Juncus dudleyi	Dudley's Rush	S5	L5
Juncus effusus	Soft Rush	S5	L5
Juniperus virginiana	Eastern Red Cedar	S5	L5
Larix laricina	Tamarack	S5	L3
Leersia oryzoides	Rice Cutgrass	S5	L5
Lemna minor	Small Duckweed	S5?	L5
Leonurus cardiaca ssp. *cardiaca*	Common Motherwort	SE5	L+
Leucanthemum vulgare	Oxeye Daisy	SE5	L+
Lolium perenne	Perennial Ryegrass	SE4	L+
Lolium pratense	Meadow Ryegrass	SE5	L+
Lonicera tatarica	Tatarian Honeysuckle	SE5	L+
Lotus corniculatus	Garden Bird's-foot Trefoil	SE5	L+
Lycopus americanus	American Water-horehound	S5	L4
Lycopus uniflorus	Northern Water-horehound	S5	L5
Lysimachia arvensis	Scarlet Pimpernel	SE4	L+
Lysimachia nummularia	Creeping Yellow Loosestrife	SE5	L+
Lythrum salicaria	Purple Loosestrife	SE5	L+
Malus pumila	Common Apple	SE4	L+
Malva neglecta	Common Mallow	SE5	L+
Matteuccia struthiopteris var. *pensylvanica*	Ostrich Fern	S5	L5
Medicago lupulina	Black Medick	SE5	L+
Medicago sativa ssp. *sativa*	Alfalfa	SE5	L+
Melilotus albus	White Sweet-clover	SE5	L+
Mentha aquatica	Water Mint	SE1	L+
Morus alba	White Mulberry	SE5	L+
Nepeta cataria	Catnip	SE5	L+
Onoclea sensibilis	Sensitive Fern	S5	L5
Panicum capillare	Common Panicgrass	S5	L5
Parthenocissus vitacea	Thicket Creeper	S5	L5
Phalaris arundinacea	Reed Canarygrass	S5	L+?
Phleum pratense	Common Timothy	SE5	L+
Phragmites australis ssp. *australis*	European Reed	SE5	L+

Common Name	Scientific Name	S-Rank [a]	TRCA Rank [b]
Picea abies	Norway Spruce	SE3	L+
Picea glauca	White Spruce	S5	L3
Picea pungens	Blue Spruce	SE1	L+
Pilosella caespitosa	Meadow Hawkweed	SE5	L+
Pinus nigra	Austrian Pine	SE3	L+
Pinus sylvestris	Scots Pine	SE5	L+
Poa palustris	Fowl Bluegrass	S5	L5
Poa pratensis ssp. *pratensis*	Kentucky Bluegrass	SE5	L+
Polygonum aviculare ssp. *aviculare*	Prostrate Knotweed	SE5	L+
Populus deltoides	Eastern Cottonwood	S5	L5
Populus tremuloides	Trembling Aspen	S5	L5
Potentilla recta	Sulphur Cinquefoil	SE5	L+
Prunella vulgaris ssp. *lanceolata*	Lance-leaved Self-heal	S5	L5
Prunus avium	Sweet Cherry	SE4	L+
Prunus virginiana var. *virginiana*	Chokecherry	S5	L5
Pyrus communis	Common Pear	SE4	L+
Quercus rubra	Northern Red Oak	S5	L4
Ranunculus acris	Common Buttercup	SE5	L+
Ranunculus sceleratus	Cursed Buttercup	S5	L5
Rhamnus cathartica	European Buckthorn	SE5	L+
Ribes americanum	American Black Currant	S5	L5
Ribes rubrum	European Red Currant	SE5	L+
Robinia pseudoacacia	Black Locust	SE5	L+
Rubus idaeus ssp. *strigosus*	North American Red Raspberry	S5	L5
Rubus occidentalis	Black Raspberry	S5	L5
Rumex crispus	Curled Dock	SE5	L+
Salix bebbiana	Bebb's Willow	S5	L4
Salix discolor	Pussy Willow	S5	L4
Salix x *fragilis*	(Salix alba X Salix euxina)	SNA	L+
Salix x *sepulcralis*	(Salix alba X Salix babylonica)	SNA	L+
Scirpus atrovirens	Dark-green Bulrush	S5	L5
Scirpus microcarpus	Red-tinged Bulrush	S5	L5
Scutellaria galericulata	Marsh Skullcap	S5	L5
Setaria faberi	Giant Foxtail	SE4	L+
Setaria pumila	Yellow Foxtail	SE5	L+

Common Name	Scientific Name	S-Rank [a]	TRCA Rank [b]
Setaria verticillata	Bristly Foxtail	SE4	L+
Setaria viridis	Green Foxtail	SE5	L+
Solanum dulcamara	Bittersweet Nightshade	SE5	L+
Solidago altissima	Tall Goldenrod	S5	L5
Solidago canadensis var. *canadensis*	Canada Goldenrod	S5	L5
Solidago flexicaulis	Zigzag Goldenrod	S5	L5
Sonchus arvensis ssp. *arvensis*	Glandular Sow-thistle	SE5	L+
Sonchus asper	Prickly Sow-thistle	SE5	L+
Spiraea alba	White Meadowsweet	S5	L4
Spirodela polyrhiza	Great Duckweed	S5	L4
Symphyotrichum lanceolatum ssp. *lanceolatum*	Eastern Panicled Aster	S5	L5
Syringa vulgaris	Common Lilac	SE5	L+
Taraxacum officinale	Common Dandelion	SE5	L+
Thuja occidentalis	Eastern White Cedar	S5	L5
Tilia americana	Basswood	S5	L5
Trifolium hybridum	Alsike Clover	SE5	L+
Trifolium pratense	Red Clover	SE5	L+
Trifolium repens	White Clover	SE5	L+
Triosteum aurantiacum	Orange-fruit Horse-gentian	S4S5	L3
Tripleurospermum inodorum	Scentless Chamomile	SE	L+
Tussilago farfara	Coltsfoot	SE5	L+
Typha angustifolia	Narrow-leaved Cattail	SE5	L+
Typha latifolia	Broad-leaved Cattail	S5	L4
Ulmus americana	White Elm	S5	L5
Urtica dioica ssp. *gracilis*	Slender Stinging Nettle	S5	L5
Verbena hastata	Blue Vervain	S5	L5
Veronica americana	American Speedwell	S5	L4
Viburnum lentago	Nannyberry	S5	L5
Vicia cracca	Tufted Vetch	SE5	L+
Vitis riparia	Riverbank Grape	S5	L5

a – S-Rank (from Natural Heritage Information Centre) for breeding status: S1 (Extremely Rare), S2 (Very Rare), S3 (Rare to Uncommon) (S4 (Common), S5 (Very Common) SNA (Not applicable…'because the species is not a suitable target for conservation activities'; includes non-native species)

b – TRCA Rank (Toronto and Region Conservation Authority) for breeding status: L5 (Able to withstand high levels of disturbance; generally secure throughout the jurisdiction, including the urban matrix; may be of very localized concern in highly degraded areas), L4 (Able to withstand some disturbance; generally secure in rural matrix; of concern in urban matrix), and L+ (non-native species)

Appendix E

Tree Inventory for Macville Community Secondary Plan

Appendix E

Tree Inventory for Macville Community Secondary Plan

Table X-1. Tree Inventory of Individual Trees for Macville Community Secondary Plan

Tag Number	Species	DBH (cm)	Condition	Structure			Comments	Preservation Priority
				Root Flare	Trunk	Crown/Branches		
71	*Acer negundo*	14	Good	Good	Good	Fair	None	Low
45	*Acer negundo*	20	Good	Good	Good	Fair	None	Low
43	*Acer negundo*	21	Good	Good	Good	Fair-Good	None	Low
42	*Acer negundo*	22	Good	Good	Good	Fair-Good	None	Low
55	*Acer negundo*	25	Good	Good	Fair	Poor	None	Low
44	*Acer negundo*	31	Good	Good	Good	Fair-Good	None	Low
37	*Acer negundo*	32	Good	Good	Good	Fair	None	Low
60	*Acer negundo*	78	Fair	Good	Good	Poor	Branch dieback, unbalanced crown	Low
74	*Acer negundo*	14,15,15,14,12	Good	Good	Fair	Fair	None	Low
41	*Acer negundo*	17,14,14	Fair	Fair	Good	Fair-Poor	None	Low
72	*Acer negundo*	20,10,10,10	Good	Good	Good	Fair	None	Low
62	*Acer negundo*	22,22	Good	Good	Good	Fair	None	Low
73	*Acer negundo*	32,31,20	Good	Good	Good	Fair	None	Low
68	*Acer negundo*	40,20	Good	Good	Good	Fair	None	Low
59	*Acer platanoides*	27	Good	Fair	Good	Fair-Good	Girdling root, included bark in some unions	Moderate
54	*Acer platanoides*	17,14	Poor	Good	Good	Poor	Branch dieback, trunk half dead	Low
21	*Aesculus hippocastanea*	50	Fair	Fair	Poor	Poor	Top cut off, hollow trunk with extensive decay	Low
22	*Aesculus hippocastanea*	50	Fair	Fair	Poor	Poor	Top cut off, hollow trunk with extensive decay	Low
20	*Aesculus hippocastanea*	52	Good	Good	Good	Poor	Top cut off due to overhead wires	Low
15	*Aesculus hippocastanea*	53	Good	Good	Fair	Fair	Several cavities with decay in trunk, uneven crown due to pruning for adjacent power lines	Low
16	*Aesculus hippocastanea*	62	Good	Good	Good	Good	Several cavities at branch stubs	Moderate
17	*Aesculus hippocastanea*	65	Fair	Good	Fair	Fair	Minor dieback, cavities at branch stubs	Moderate
18	*Aesculus hippocastanea*	48,48	Fair	Fair	Poor	Poor	Branch dieback, hollow trunk with multiple cavities, poor form	Low
53	*Betula papyrifera*	19,20	Good	Good	Fair	Good	Fused trunks	Moderate
58	*Betula* sp.	22,27	Good	Good	Good	Good	None	Moderate
38	*Catalpa* sp.	63	Good	Good	Good	Fair-Good	Slight lean	Low
23	*Crataegus* sp.	40,20	Fair	Good	Good	Fair	Branch dieback	Low
36	*Fraxinus americana*	43	Dead	N/A	N/A	N/A	None	Low
40	*Juglans nigra*	52	Good	Good	Good	Fair-Good	3 leaders	Moderate
19	*Picea abies*	78	Good	Good	Good	Fair	Codominant leaders with included bark	Moderate
50	*Picea glauca*	20	Good	Good	Good	Good	None	Moderate
51	*Picea glauca*	20	Good	Good	Good	Good	None	Moderate
33	*Picea glauca*	28	Fair	Good	Good	Good	Twig dieback, lean	Moderate
56	*Picea glauca*	28	Good	Good	Good	Good	None	Moderate
49	*Picea pungens*	16	Good	Good	Good	Good	None	Moderate
57	*Picea pungens*	16	Good	Good	Good	Good	None	Moderate
48	*Picea pungens*	21	Good	Good	Good	Good	None	Moderate
46	*Picea pungens*	22	Good	Good	Good	Good	None	Moderate

Tag Number	Species	DBH (cm)	Condition	Structure			Comments	Preservation Priority
				Root Flare	Trunk	Crown/Branches		
47	*Picea pungens*	22	Good	Good	Good	Good	None	Moderate
52	*Picea pungens*	40	Fair	Fair	Good	Good	Large exposed surface roots	Moderate
35	*Picea pungens*	29,34	Good	Good	Good	Fair-Good	Codominant trunks	Moderate
61	*Prunus avium*	38	Good	Good	Good	Fair-Good	3 codominant leaders	Low
39	*Quercus rubra*	47	Good	Good	Good	Good	Small dead branches	High
63	*Salix alba*	100	Good	Poor	Poor	Fair	Massive wound in lower trunk with extensive decay as a result of fallen trunk	Low
65	*Salix alba*	19,15,10,10,8	Good	Good	Good	Fair	None	Low
69	*Tilia americana*	74	Poor	Poor	Poor	Poor	Branch dieback, brown leaves, poor form, hollow trunk	Low
70	*Ulmus americana*	28	Fair-Poor	Good	Fair	Fair	In decline, sparse foliage	Low
64	*Ulmus americana*	50	Good	Good	Fair-Good	Fair-Good	Embedded fence, codominant leaders with included bark	Moderate
66	*Ulmus americana*	35,32,38,36	Good	Good	Good	Fair	Stems fused at base, branch unions with included bark	Moderate
67	*Ulmus americana*	35,40	Fair-Good	Good	Good	Fair-Good	None	Moderate

Table X-2. Tree Inventory of Tree Grouping for Macville Community Secondary Plan

Species	DBH (cm)	Condition	Form/Structure	Comments
Tree Group A				
Juninperus sp.	20	Good	Good	None
Juninperus sp.	15	Good	Fair	Significant lean
Juninperus sp.	20	Good	Poor	No leader, bushy
Tree Group B1				
Thuja occidentalis	59	Good	Poor	Codominant leaders with included bark, split in crotch between leaders
Thuja occidentalis	20	Good	Fair	Crowded
Thuja occidentalis	21	Fair	Fair	Crowded
Thuja occidentalis	64	Good	Poor	Codominant leaders with included bark, crack below crotch
Thuja occidentalis	30,35	Good	Poor	Cavity in crotch with decay into trunk
Tree Group B2				
Thuja occidentalis	26,26	Good	Fair	None
Thuja occidentalis	32	Fair	Fair	None
Thuja occidentalis	23,17,14	Fair	Fair	None
Thuja occidentalis	27,26	Fair	Fair	Rocks piled against base
Thuja occidentalis	30,19	Fair	Fair-Good	Split in crotch, rocks piled against base
Thuja occidentalis	16	Fair	Fair	Rocks piled against base
Thuja occidentalis	16,18	Fair	Fair	Rocks piled against base
Thuja occidentalis	15,10	Fair	Fair	Rocks piled against base
Thuja occidentalis	17,29	Good	Poor	Large open wound in root flare/lower trunk
Thuja occidentalis	50	Good	Fair	Codominant leaders with included bark
Thuja occidentalis	22	Good	Fair	Crowded
Thuja occidentalis	43	Good	Fair	Codominant leaders with included bark
Thuja occidentalis	35	Good	Fair	None
Thuja occidentalis	27,27	Fair	Fair-Good	None
Thuja occidentalis	22,22	Good	Fair	None
Thuja occidentalis	21	Fair	Poor	None
Thuja occidentalis	32,32	Fair	Poor	Codominant leaders, split in crotch
Thuja occidentalis	59	Good	Fair	Multiple codominant leaders
Thuja occidentalis	22	Fair	Poor	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Thuja occidentalis	26,26	Poor	Poor	Codominant leaders , split in crotch through trunk
Thuja occidentalis	30,35	Fair	Poor	Large old wound in trunk, poor form
Thuja occidentalis	25,14	Fair	Fair	None
Thuja occidentalis	16	Fair	Poor	None
Thuja occidentalis	20,24,24,20	Fair	Poor	None
Prunus avium	16	Good	Fair	Lean
Thuja occidentalis	30	Fair	Poor	Large decaying stump at base
Thuja occidentalis	30,35	Fair	Fair	Multiple codominant leaders
Thuja occidentalis	26,26	Good	Fair	None
Thuja occidentalis	27	Fair	Good	None
Thuja occidentalis	24,21	Fair	Fair	None
Prunus avium	13,11	Good	Fair-Good	Twisted trunk, lean
Thuja occidentalis	17	Good	Fair	Lean, uneven crown
Thuja occidentalis	16,18,18	Good	Fair	Codominant stems with included bark
Thuja occidentalis	25,25	Good	Fair-Poor	None
Thuja occidentalis	18	Fair	Poor	None
Thuja occidentalis	20	Fair	Poor	Large wound in trunk
Thuja occidentalis	11,13,13,14	Good	Fair	None
Acer negundo	18	Good	Poor	None
Thuja occidentalis	32,19	Good	Fair	Codominant
Thuja occidentalis	30	Good	Fair	Large wound in trunk
Thuja occidentalis	32	Good	Fair	Lean
Tree Group B3				
Thuja occidentalis	22,14	Good	Fair	None
Robinia psuedo-acacia	10	Good	Fair	None
Thuja occidentalis	11	Good	Good	None
Thuja occidentalis	17,14,12	Good	Fair	None
Thuja occidentalis	10	Fair	Fair	None
Thuja occidentalis	11	Fair	Fair	None
Thuja occidentalis	15	Good	Fair	None
Thuja occidentalis	17	Fair	Fair	None
Thuja occidentalis	14	Good	Fair	None
Thuja occidentalis	13	Good	Fair	None
Thuja occidentalis	15	Good	Fair	None
Thuja occidentalis	13	Good	Fair	None
Thuja occidentalis	13	Good	Fair	None
Thuja occidentalis	13	Good	Fair	None
Thuja occidentalis	15	Good	Fair	None
Thuja occidentalis	11,13	Good	Fair	None
Thuja occidentalis	13	Good	Fair	None
Robinia psuedo-acacia	39	Good	Fair	None
Thuja occidentalis	11	Good	Fair	None
Thuja occidentalis	10	Good	Fair	None
Thuja occidentalis	13	Good	Fair	None
Acer platanoides	16	Good	Fair	None
Thuja occidentalis	13	Good	Fair	None
Thuja occidentalis	10	Good	Fair	None
Thuja occidentalis	12	Good	Fair	None
Populus deltoides	55	Dead	N/A	None
Thuja occidentalis	10	Good	Fair	None
Thuja occidentalis	11	Good	Fair	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Thuja occidentalis	12	Good	Fair	None
Thuja occidentalis	14	Good	Fair	None
Thuja occidentalis	15	Good	Fair	None
Thuja occidentalis	12	Good	Fair	None
Thuja occidentalis	15	Good	Fair	None
Thuja occidentalis	12	Good	Fair	None
Thuja occidentalis	10	Good	Fair	None
Populus deltoides	65	Fair	Fair	None
Thuja occidentalis	21	Good	Fair	None
Thuja occidentalis	20	Good	Fair	None
Thuja occidentalis	17	Good	Fair	None
Thuja occidentalis	17	Good	Fair	None
Robinia psuedo-acacia	41	Fair	Fair	None
Thuja occidentalis	19	Fair	Fair	None
Thuja occidentalis	15	Fair	Fair	None
Thuja occidentalis	29	Good	Fair	None
Thuja occidentalis	17	Good	Fair	None
Thuja occidentalis	27	Good	Fair	None
Thuja occidentalis	21	Good	Fair	None
Thuja occidentalis	22	Good	Fair	None
Thuja occidentalis	15	Good	Fair	None
Thuja occidentalis	29	Good	Fair	None
Thuja occidentalis	16	Good	Fair	None
Thuja occidentalis	16	Good	Fair	None
Thuja occidentalis	23	Good	Fair	None
Thuja occidentalis	41	Good	Fair	None
Thuja occidentalis	42	Fair	Fair	None
Thuja occidentalis	40	Good	Fair	None
Thuja occidentalis	30,12,18,15	Good	Fair	None
Thuja occidentalis	40	Good	Fair	None
Thuja occidentalis	32,13,13	Good	Fair	None
Tree Group B4				
Thuja occidentalis	18,12	Good	Fair	None
Thuja occidentalis	14	Good	Fair	None
Thuja occidentalis	16	Good	Good	None
Thuja occidentalis	12	Good	Good	None
Thuja occidentalis	11	Good	Good	None
Thuja occidentalis	12	Good	Good	None
Thuja occidentalis	14	Good	Good	None
Thuja occidentalis	16	Good	Good	None
Thuja occidentalis	10	Good	Good	None
Thuja occidentalis	12	Good	Good	None
Thuja occidentalis	11	Good	Good	None
Thuja occidentalis	17	Good	Good	None
Thuja occidentalis	19,15	Good	Good	None
Tree Group B5				
Thuja occidentalis	19,20,13	Good	Fair	None
Thuja occidentalis	21,11	Good	Good	None
Thuja occidentalis	15	Good	Good	None
Thuja occidentalis	20,12	Good	Good	None
Thuja occidentalis	20	Good	Good	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Thuja occidentalis	15	Good	Good	None
Thuja occidentalis	13	Good	Good	None
Thuja occidentalis	18	Good	Good	None
Thuja occidentalis	15	Good	Poor	None
Thuja occidentalis	15	Good	Good	None
Thuja occidentalis	16	Good	Good	None
Thuja occidentalis	29	Good	Good	None
Thuja occidentalis	17	Good	Good	None
Thuja occidentalis	18	Good	Good	None
Thuja occidentalis	23	Good	Good	None
Thuja occidentalis	15	Good	Good	None
Acer platanoides	15,21	Good	Fair-Poor	None
Acer negundo	22	Good	Poor	None
Acer negundo	27,24	Good	Poor	None
Tree Group C1				
Malus pumila	20,20,15,15	Fair	Fair	None
Malus pumila	50	Good	Poor	Crack in branch unions, cavity at base
Malus pumila	12	Good	Fair	None
Tree Group C2				
Pyrus communis	14,14	Good	Fair	None
Fraxinus pennsylvanica	30	Dead	N/A	None
Malus pumila	25,24,25,20	Good	Poor	None
Crataegus sp.	15	Good	Fair	None
Crataegus sp.	25	Poor	N/A	Nearly dead
Fraxinus pennsylvanica	50	Dead	N/A	None
Crataegus sp.	40,22,20	Good	Poor	Split at base
Crataegus sp.	28	Good	Fair	Bulges in root flare
Crataegus sp.	15,20	Fair	Poor	Cavities in lower trunk
Malus pumila	50	Fair	Poor	Twisted trunk, dead branches, poor form
Malus pumila	25,20	Poor	Poor	None
Crataegus sp.	40,20	Fair	Poor	Poor form, cavities in trunk
Fraxinus pennsylvanica	38	Dead	N/A	None
Crataegus sp.	15,15,16,18	Good	Fair	None
Crataegus sp.	12	Poor	Poor	None
Malus pumila	20	Fair	Poor	None
Malus pumila	40	Poor	Poor	None
Crataegus sp.	14,12	Good	Fair	None
Malus pumila	50,35,25,30,25	Fair	Poor	None
Crataegus sp.	40	Fair	Poor	Cavities in trunk large broken branches
Malus pumila	35,45	Fair-Good	Poor	Branch dieback, poor form, extensive epicormics
Malus pumila	25,25,20,28	Fair	Poor	None
Crataegus sp.	11,14,15,12	Good	Poor	None
Malus pumila	45	Poor	Poor	Extensive dieback, poor form
Crataegus sp.	15	Fair	Poor	None
Crataegus sp.	20,22,14	Good	Fair	None
Malus pumila	30,30	Poor	Poor	One stem broken
Malus pumila	13	Poor	Poor	None
Crataegus sp.	20,12,20,18	Good	Fair	None
Crataegus sp.	18,15,22	Good	Fair	None
Malus pumila	17,20,15	Fair	Fair-Good	None
Ulmus americana	16	Good	Fair	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Crataegus sp.	22	Good	Fair	None
Quercus macrocarpa	10	Good	Good	None
Crataegus sp.	27	Poor	Poor	None
Crataegus sp.	20,25,35	Poor	Poor	Poor form, large cavities, extensive decay
Malus pumila	38	Fair	Fair	Damage to base
Malus pumila	25	Fair	Fair	None
Crataegus sp.	25	Poor	Poor	None
Malus pumila	20,18,20,20	Good	Poor	None
Crataegus sp.	20,18,30,20,20	Fair	Poor	Fused trunks
Crataegus sp.	20,35,22,20	Good	Fair	None
Crataegus sp.	45,26,30	Good	Fair	None
Crataegus sp.	25,20,17	Good	Fair-Good	None
Crataegus sp.	26,25	Good	Fair	None
Malus pumila	40,40	Fair	Fair-Good	None
Malus pumila	25	Good	Poor	None
Prunus serotina	30	Good	Fair	Damage to trunk, codominant stems
Prunus serotina	20,20	Good	Fair	Codominant stems with included bark
Crataegus sp.	20,25,22,20	Good	Fair	None
Tree Group C3				
Crataegus sp.	18,18,14	Good	Fair	None
Malus pumila	15,12	Good	Poor	None
Malus pumila	20	Good	Fair	None
Malus pumila	17	Good	Fair	None
Malus pumila	45,30	Fair	Fair-Good	None
Tree Group C4				
Crataegus sp.	12,8,8,8	Good	Fair-Poor	None
Crataegus sp.	25,15,10,25,10,10	Good	Fair-Good	None
Crataegus sp.	8,8,12	Good	Good	None
Crataegus sp.	11,11	Good	Good	None
Crataegus sp.	11,9	Good	Good	None
Crataegus sp.	13	Good	fair	None
Crataegus sp.	10,10,10,10	Good	fair	None
Crataegus sp.	13,15	Good	Fair	None
Crataegus sp.	15,10	Good	Fair	None
Malus pumila	22,16	Fair	Poor	None
Crataegus sp.	14,10	Fair	Poor	None
Crataegus sp.	20	Good	Good	None
Tree Group C5				
Malus pumila	20,20,25	Good	Fair	None
Malus pumila	47,20,40	Fair	Poor	Large dead branch
Crataegus sp.	30	Fair	Fair-Good	Wound in lower trunk, dead branches
Malus pumila	35,25,25	Good	Poor	None
Malus pumila	25,20,20	Fair	Poor	None
Ulmus americana	10	Fair	Fair-Good	None
Ulmus americana	15	Good	Fair-Poor	None
Tree Group C6				
Crataegus sp.	16,13,20	Good	Fair	None
Crataegus sp.	11,12,12,10	Good	Fair	None
Ulmus americana	18	Good	Good	None
Crataegus sp.	14,10,10	Good	Fair	None
Crataegus sp.	12,10,10	Good	Fair	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Acer negundo	12,15	Fair	Poor	None
Crataegus sp.	14,14,10	Good	Fair	None
Ulmus americana	55	Fair	Fair-Good	None
Crataegus sp.	15,16	Good	Poor	None
Crataegus sp.	18, 21,14,14,	Poor	Poor	None
Crataegus sp.	10,10,10,10	Good	Fair	None
Tilia americana	16	Good	Good	None
Ulmus americana	50	Good	Fair-Poor	None
Tilia americana	11	Good	Fair-Poor	None
Tilia americana	28,15,16	Good	Poor	None
Crataegus sp.	20,20,11	Good	Fair	None
Tree Group C7				
Malus pumila	14,10,10	Fair	Fair-Good	None
Crataegus sp.	26,13,14,12,18	Poor	Poor	None
Malus pumila	20,25,20	Fair	Fair	None
Malus pumila	15,16,18,13	Good	Fair	None
Malus pumila	15,16	Good	Fair	None
Malus pumila	13,15,20	Good	Fair-Good	None
Malus pumila	16,16,22	Fair	Fair	None
Tree Group C8				
Fraxinus americana	30,25	Dead	N/A	None
Fraxinus americana	13	Poor	Poor	None
Fraxinus americana	10	Poor	Poor	None
Fraxinus americana	15	Dead	N/A	None
Crataegus sp.	20	Fair	Fair	None
Crataegus sp.	20	Fair	Fair	None
Crataegus sp.	12,10,10,12	Fair	Poor	None
Fraxinus americana	20,26	Dead	N/A	None
Fraxinus americana	24	Dead	N/A	None
Malus pumila	22	Poor	Poor	None
Fraxinus americana	35	Dead	N/A	None
Crataegus sp.	10	Fair	Fair	None
Crataegus sp.	14	Fair	Fair	None
Fraxinus americana	12	Dead	N/A	None
Crataegus sp.	20	Fair	Poor	None
Crataegus sp.	18	Fair	Poor	None
Fraxinus americana	30	Dead	N/A	None
Quercus macrocarpa	20	Fair	Fair	None
Fraxinus americana	27	Dead	N/A	None
Fraxinus americana	12	Dead	N/A	None
Fraxinus americana	35	Dead	N/A	None
Ulmus americana	25	Dead	N/A	None
Fraxinus americana	30	Dead	N/A	None
Crataegus sp.	14	Good	Fair	None
Fraxinus americana	32.24	Dead	N/A	None
Crataegus sp.	10	Fair	Fair	None
Crataegus sp.	20	Fair	Fair	None
Fraxinus americana	32	Dead	N/A	None
Fraxinus americana	32	Dead	N/A	None
Fraxinus americana	14	Dead	N/A	None
Crataegus sp.	20,20,20	Fair	Poor	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Fraxinus americana	28	Dead	N/A	None
Crataegus sp.	17,20,17	Fair	Fair	None
Malus pumila	25,22,30	Fair	Poor	None
Crataegus sp.	14,18	Fair	Poor	None
Crataegus sp.	10,10,10,10	Fair	Fair	None
Fraxinus americana	14	Dead	N/A	None
Fraxinus americana	10	Dead	N/A	None
Fraxinus americana	17,17	Dead	N/A	None
Fraxinus americana	14	Dead	N/A	None
Fraxinus americana	15	Dead	N/A	None
Fraxinus americana	38	Dead	N/A	None
Malus pumila	15	Dead	N/A	None
Malus pumila	16,17,34,20	Dead	N/A	None
Fraxinus americana	10	Dead	N/A	None
Malus pumila	40	Fair	Poor	None
Fraxinus americana	10	Dead	N/A	None
Fraxinus americana	15	Dead	N/A	None
Crataegus sp.	10,16	Fair	Poor	None
Crataegus sp.	15,15,15,15	Fair	Fair	None
Crataegus sp.	23,23,20	Fair	Poor	None
Fraxinus americana	10	Fair	Fair	None
Crataegus sp.	14,15,11,11,15	Good	Fair	None
Tree Group C9				
Malus pumila	50	Dead	N/A	None
Prunus serotina	15	Fair	Poor	None
Fraxinus americana	22,14	Dead	N/A	None
Malus pumila	50	Poor	Poor	None
Fraxinus americana	31	Dead	N/A	None
Malus pumila	46,38	Fair	Poor	None
Malus pumila	28, 28,34	Poor	Poor	None
Crataegus sp.	22,16,15	Fair	Poor	None
Malus pumila	23,27,32	Poor	Poor	None
Malus pumila	20	Dead	N/A	None
Crataegus sp.	17,20,14,14,15	Poor	Poor	None
Malus pumila	25	Fair	Poor	None
Crataegus sp.	30	Poor	Poor	None
Malus pumila	43	Poor	Poor	None
Crataegus sp.	16	Fair	Poor	None
Crataegus sp.	20	Fair	Poor	None
Malus pumila	26,26,14	Poor	Poor	None
Malus pumila	29,18	Poor	Poor	None
Malus pumila	26,25,32,30	Poor	Poor	None
Crataegus sp.	15,28	Poor	Poor	None
Crataegus sp.	22,15	Fair	Fair	None
Prunus serotina	25	Poor	Poor	None
Crataegus sp.	30,30	Poor	Poor	None
Malus pumila	28,50	Fair	Poor	None
Crataegus sp.	17,10	Fair	Fair	None
Malus pumila	28	Poor	Poor	None
Crataegus sp.	11	Fair	Fair	None
Crataegus sp.	16,16,20	Fair	Poor	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Malus pumila	60	Poor	Poor	None
Crataegus sp.	12	Fair	Poor	None
Prunus serotina	17	Good	Fair	None
Crataegus sp.	33,22,30	Fair	Poor	None
Prunus serotina	25	Good	Fair	None
Crataegus sp.	26,30	Fair	Fair	None
Malus pumila	30	Fair	Fair	None
Crataegus sp.	20,20	Fair	Poor	None
Fraxinus americana	15	Dead	N/A	None
Prunus serotina	65,50	Fair	Poor	None
Crataegus sp.	24,22,22,20	Fair	Fair	None
Crataegus sp.	11	Fair	Fair	None
Crataegus sp.	12,15	Fair	Fair	None
Prunus serotina	15	Good	Fair	None
Prunus serotina	25,40,34,28	Fair	Poor	None
Prunus serotina	12	Poor	Poor	None
Prunus serotina	22	Fair	Fair	None
Prunus serotina	20	Dead	Poor	None
Malus pumila	20	Poor	Poor	None
Malus pumila	37,28,37	Poor	Poor	None
Malus pumila	24,24,40	Fair	Poor	None
Crataegus sp.	22,22	Fair	Poor	None
Crataegus sp.	28,23,24,20	Fair	Poor	None
Malus pumila	38,32,36,26,26	Poor	Poor	None
Crataegus sp.	18,14,17	Fair	Fair	None
Malus pumila	22,25,20	Poor	Poor	None
Crataegus sp.	12	Dead	N/A	None
Crataegus sp.	24	Poor	Poor	None
Crataegus sp.	15,16,18,19,21	Fair	Poor	None
Crataegus sp.	22,15,14	Fair	Poor	None
Crataegus sp.	17,18	Fair	Poor	None
Crataegus sp.	22,14,14,14	Fair	Fair	None
Crataegus sp.	19	Fair	Fair	None
Crataegus sp.	24	Fair	Poor	None
Malus pumila	30,16,22,15	Fair	Poor	None
Acer negundo	40	Good	Fair	None
Tree Group D				
Juglans nigra	17	Good	Fair	None
Juglans nigra	13	Good	Fair-Good	Crowded
Juglans nigra	15	Good	Fair	Crowded
Juglans nigra	11	Good	Fair	Crowded
Juglans nigra	29	Good	Fair	None
Acer saccharinum	16,18	Fair	Poor	Large cavity at base, codominant stems with included bark
Acer saccharinum	32,22,40	Fair	Poor	Wound at base, leaning
Pinus sylvestris	20	Dead	N/A	None
Acer saccharinum	14,18	Fair	Fair	Smaller trunk dead
Acer saccharinum	20	Good	Fair	None
Acer saccharinum	36	Dead	N/A	None
Pinus sylvestris	22	Poor	Poor	Poor form, extensive dieback
Pinus sylvestris	36	Fair-Poor	Fair	Embedded fence
Pinus sylvestris	13	Fair-Poor	Fair	Embedded fence

Species	DBH (cm)	Condition	Form/Structure	Comments
Pinus sylvestris	15	Fair	Fair	None
Pinus sylvestris	22	Good	Fair-Good	None
Pinus sylvestris	30	Good	Good	None
Pinus sylvestris	34	Good	Fair-Poor	Uneven crown
Pinus sylvestris	25	Good	Fair-Poor	Uneven crown
Malus pumila	50	Good	Poor	Hollow trunk
Tree Group E1				
Acer negundo	10,10,10	Fair	Fair	None
Acer negundo	13	Fair	Fair	None
Acer negundo	17	Fair	Poor	None
Acer negundo	17,19	Fair	Fair	None
Acer negundo	10,13,8	Fair	Fair	None
Acer negundo	17,11	Fair	Fair	None
Acer negundo	23	Fair	Fair	None
Acer negundo	15,12,16	Fair	Fair	None
Acer negundo	19	Fair	Fair	None
Acer negundo	15,24	Fair	Fair	None
Fraxinus pennslyvanica	13,13,10	Dead	Fair	None
Acer negundo	15,13,19, 10,10	Fair	Fair	None
Tree Group E2				
Acer negundo	12	Fair	Fair	None
Acer negundo	10,11	Fair	Fair	None
Acer negundo	11	Fair	Fair	None
Acer negundo	16,14	Fair	Fair	None
Acer negundo	16	Fair	Fair	None
Tree Group E3				
Acer negundo	14,14	Good	Fair-Good	Severe bend at base of trunk
Acer negundo	11,8	Good	Fair	None
Acer negundo	9,9	Good	Fair	None
Acer negundo	15,15	Good	Fair	None
Acer negundo	12	Good	Fair	None
Acer negundo	14	Good	Fair-Poor	None
Acer negundo	18,18	Good	Fair-Poor	None
Acer negundo	20	Good	Fair	None
Acer negundo	8,8	Fair	Fair	None
Acer negundo	15	Good	Fair	None
Acer negundo	17	Good	Fair	None
Tree Group E4				
Acer negundo	13,12,26	Good	Poor	Damage at base, sprawling form
Acer negundo	30	Good	Fair	None
Acer negundo	24,19,12,13	Fair-Good	Fair-Good	None
Acer negundo	20	Fair	Fair	None
Tree Group E5				
Acer negundo	10	Good	Fair	Embedded fence
Acer negundo	16,18	Fair	Fair	None
Acer negundo	14	Fair	Fair	None
Acer negundo	12,15	Fair	Fair	Wound at base
Acer negundo	12,10	Fair	Fair	None
Acer negundo	12,10	Fair	Poor	Split in crotch
Acer negundo	23,20	Good	Fair	None
Acer negundo	12,12,11,10	Good	Fair	Embedded fence

Species	DBH (cm)	Condition	Form/Structure	Comments
Acer negundo	10,12	Fair	Fair	None
Acer negundo	11,10,14	Fair	Fair	None
Tree Group E6				
Acer negundo	16	Good	Fair	None
Acer negundo	12	Fair-Poor	Fair-Poor	None
Acer negundo	12	Good	Good	None
Acer negundo	10	Poor	Fair-Good	None
Acer negundo	11,11	Fair	Fair	None
Acer negundo	10	Fair	Fair	None
Acer negundo	14	Fair	Fair	None
Acer negundo	15,10,10	Good	Fair-Poor	None
Tree Group E7				
Acer negundo	12	Good	Poor	None
Acer negundo	15,16,16	Good	Fair	None
Acer negundo	24,15	Good	Fair	None
Acer saccharinum	11	Good	Fair	None
Acer negundo	12	Good	Fair	None
Acer negundo	22,16	Good	Fair	None
Acer negundo	20,15	Good	Fair	None
Acer negundo	20,20,23,14	Fair	Fair	None
Acer negundo	30	Good	Poor	None
Acer negundo	20	Good	Poor	None
Acer negundo	19,20	Good	Poor	None
Acer negundo	16,16	Fair	Poor	None
Acer negundo	18,16	Fair	Poor	None
Acer negundo	16	Good	Poor	None
Tree Group F				
Populus tremulodies	8	Good	Good	None
Populus tremulodies	8	Good	Fair	None
Populus tremulodies	8	Good	Good	None
Populus tremulodies	8	Poor	Fair	None
Populus tremulodies	8	Good	Poor	None
Populus tremulodies	8	Good	Fair	None
Populus tremulodies	8	Good	Fair	None
Populus tremulodies	8	Good	Good	None
Populus tremulodies	8	Good	Fair	None
Populus tremulodies	8	Good	Fair	None
Populus tremulodies	8	Poor	Poor	None
Populus tremulodies	9	Good	Good	None
Populus tremulodies	9	Good	Good	None
Populus tremulodies	9	Good	Fair	None
Populus tremulodies	9	Good	Poor	None
Populus tremulodies	9	Good	Fair	None
Populus tremulodies	9	Good	Fair	None
Populus tremulodies	9	Good	Fair	None
Populus tremulodies	9	Good	Good	None
Populus tremulodies	10	Good	Good	None
Populus tremulodies	10	Good	Fair	None
Populus tremulodies	10	Good	Fair	None
Populus tremulodies	10	Good	Fair	None
Populus tremulodies	10	Good	Fair-Good	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Populus tremulodies	10	Good	Good	None
Populus tremulodies	10	Good	Fair	None
Populus tremulodies	10	Good	Fair	None
Populus tremulodies	11	Good	Fair	None
Populus tremulodies	11	Good	Fair	None
Populus tremulodies	11	Fair	Poor	None
Populus tremulodies	11	Fair	Fair	None
Populus tremulodies	11	Good	Fair	None
Populus tremulodies	11	Good	Fair	None
Populus tremulodies	11	Good	Fair	None
Populus tremulodies	11	Good	Fair-Poor	None
Populus tremulodies	12	Good	Fair	None
Populus tremulodies	12	Good	Fair	None
Populus tremulodies	12	Good	Fair	None
Populus tremulodies	13	Good	Good	None
Populus tremulodies	13	Good	Good	None
Populus tremulodies	14	Dead	N/A	None
Populus tremulodies	14	Fair	Fair	None
Populus tremulodies	14	Good	Fair	None
Populus tremulodies	15	Good	Fair	None
Populus tremulodies	15	Fair	Fair	None
Populus tremulodies	15	Good	Good	None
Populus tremulodies	16	Good	Good	None
Populus tremulodies	16	Poor	Poor	None
Populus tremulodies	17	Good	Good	None
Populus tremulodies	17	Poor	Poor	None
Populus tremulodies	18	Dead	N/A	None
Populus tremulodies	18	Fair	Poor	None
Populus tremulodies	19	Fair-Good	Fair-Good	None
Populus tremulodies	20	Good	Fair	None
Populus tremulodies	20	Poor	Poor	None
Populus tremulodies	30	Fair	Fair	None
Tree Group G				
Acer x *fremanii*	11	Good	Fair	None
Acer x *fremanii*	8	Good	Fair	None
Acer x *fremanii*	14,10	Good	Fair	None
Acer x *fremanii*	12,10	Good	Fair	None
Acer x *fremanii*	11	Good	Fair	None
Acer x *fremanii*	8	Good	Fair	None
Tree Group H				
Tilia americana	15,15	Good	Fair-Poor	Codominant with included bark
Tilia americana	15	Good	Good	None
Tilia americana	20,29,29,35,35	Good	Fair-Poor	Codominant with included bark
Tilia americana	43	Good	Fair	None
Tilia americana	22,23,20,15,15	Good	Fair-Poor	Codominant with included bark
Tilia americana	21	Good	Good	None
Tilia americana	24	Good	Good	None
Crataegus sp.	14,10,10,10	Good	Good	None
Tilia americana	47,44,37,52	Good	Fair	Multiple stems with included bark, crossing trunks
Tilia americana	15	Good	Fair	None
Tilia americana	15	Good	Good	None

Species	DBH (cm)	Condition	Form/Structure	Comments
Tilia americana	15	Good	Good	None
Tilia americana	15	Good	Good	None
Tilia americana	18	Good	Good	None
Acer negundo	20,12,12	Good	Poor	None
Crataegus sp.	15,12	Good	Fair	None
Ulmus americana	70	Fair-Poor	Fair	Codominant leaders, unbalanced crown
Tilia americana	12	Good	Good	None
Ulmus americana	10	Good	Good	None
Ulmus americana	15	Good	Fair	None
Ulmus americana	20	Good	Fair-Poor	None
Crataegus sp.	10,10	Good	Fair	None
Crataegus sp.	15,12,10	Good	Good	None
Crataegus sp.	12,10,10	Good	Good	None
Tree Group I				
Salix x sepulcralis	100,60	Good	Poor	Main stem fallen, hollow trunk
Salix x sepulcralis	>100	Good	Poor	One stem fallen
Acer negundo	30	Good	Fair	None

Appendix F

Breeding Bird 2020 Field Notes for Macville Community Secondary Plan

Breeding Bird Survey Summary Form

Surveyor Name: Geoff Carpenter Date (use letters for mos.): May 28/20

Project Name: BOLTON- BRES Project #: 214476

Time of Survey (start and finish): 0445-0815

Weather (approx. temp., cloud cover, wind, precipitation): overcast, no wind

16-18°C

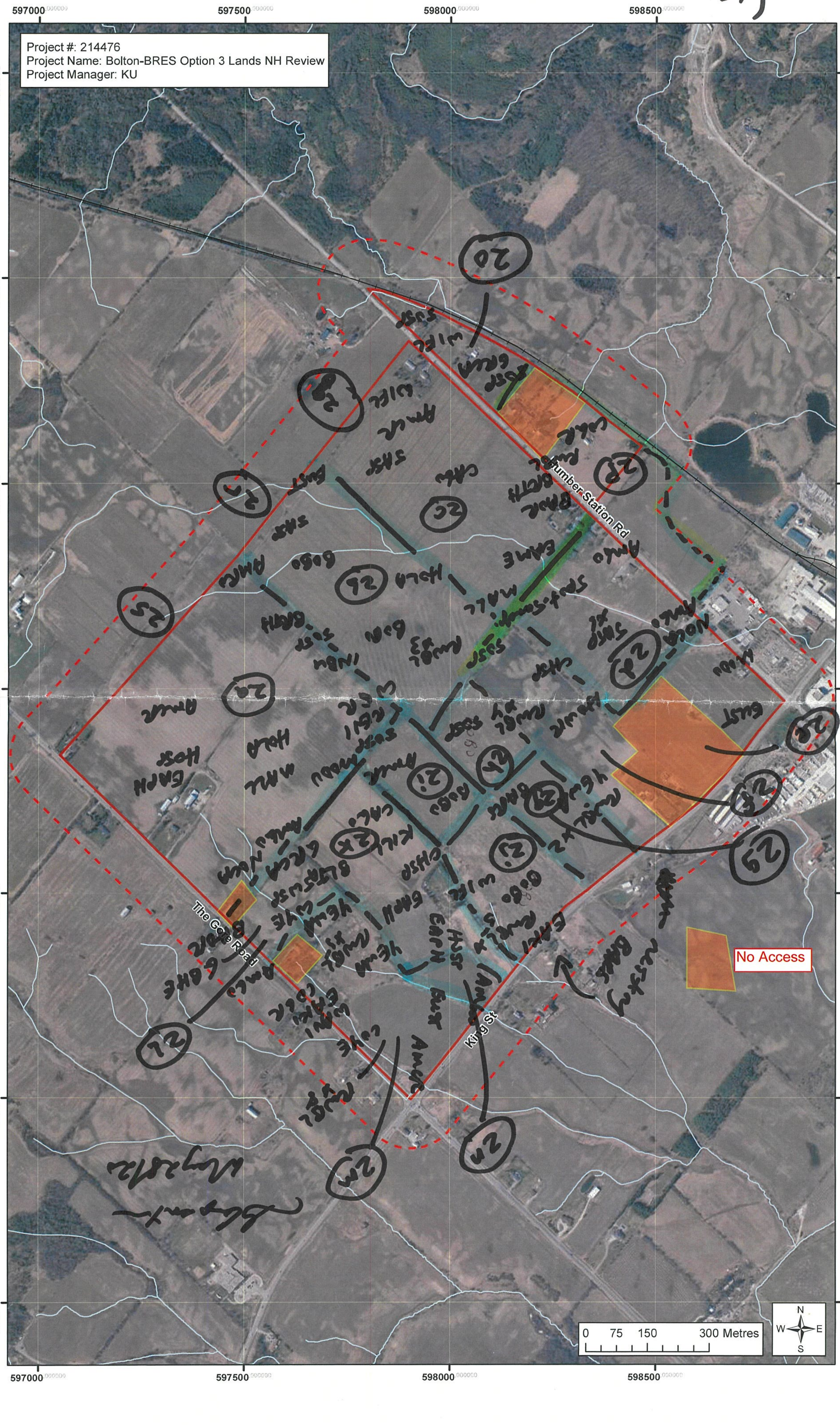
Additional notes on birds (nests, uncertainties, unusual observations, habitat comments etc.) :

Incidental Observations

Anything welcome (mammals, herps, fish presence, insects, plants esp. unusual spp. etc.). For herps, rare plants, occurrence of fish, please also mark location on map. For herps, number observed. Thanks!

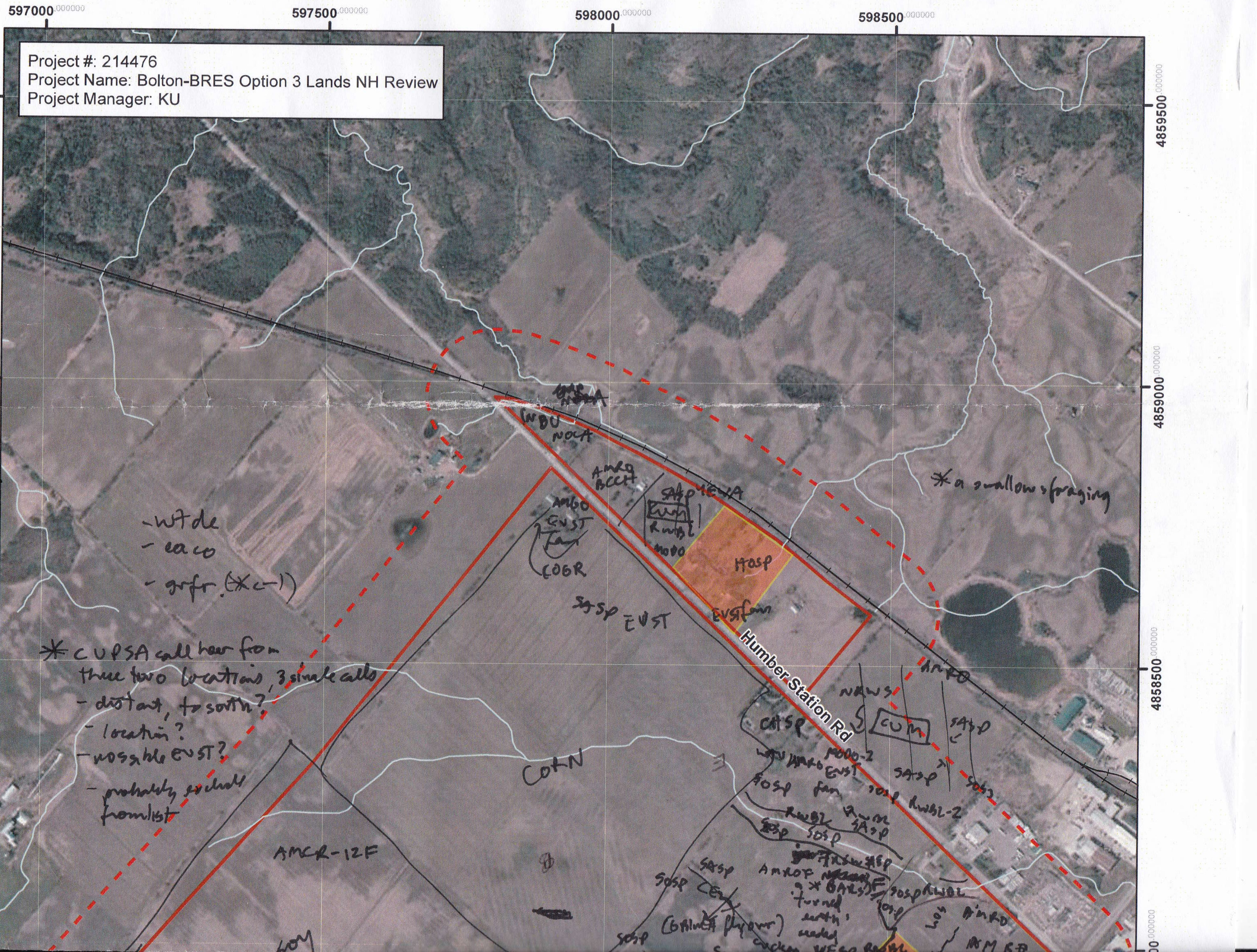
EUST	2-4	RWBL	28-30	EAPH	2
MALL - foraging		BRTH	2	AMCR	1-2
Canada Goose - forage		NOCA	2	AMRO	6-8
KILL	2			AMGO	3-4
Spot. Sandp	1			GRCA	1
SASP	7-9	COYE	1	BAOR	2
SOSP	10-12	YEWA	3	WAVI	1
BOBO	4 males	SWSP	1	REVI	1
EAME	1	EAKI	2	GBHE - forage	
CHSP	2	WIFL	3	HOLA	2
RLJA	1	COGR	2-3	MODO	2
HOWR	1	INBU	1		
BARS - foraging					

2 of 3 (Ros will do 1st)



Project #: 214476
Project Name: Bolton-BRES Option 3 Lands NH Review
Project Manager: KU

studies urban expansion for Option 3 606



H → s
Lukm

RFC June 19/20 Excellent conditions. We
6:20 am - 9:10 am
665 am

- earlier notes are ...
- F = foraging, ...

June 19/20
:20am – 9:10 am
665

Excellent conditions

Weather 19°C – 20°C Wind 0 → 0/1 still v. still CC: 20% → 75%

– earlier nesters are post-breeding
– F = foraging, but may have bred

* CUPSA call heard from three two locations, 3 single calls
– distant, to south?
– location?
– possible EVST?
– probably exclude from list

– grfr. (*c–)

* 6 2B 800004 in east, 2 others 33
– bird heard in field may be 1 of same 2B
probably displaced from north (cut) field to east

Breeding Bird Survey Summary Form

Surveyor Name: Graff Carpentier Date (use letters for mos.): July 4/20

Project Name: Bolton Project #: 214476

Time of Survey (start and finish): 0445 - 0830

Weather (approx. temp., cloud cover, wind, precipitation): Sunny no wind

18 - 21 °C

Additional notes on birds (nests, uncertainties, unusual observations, habitat comments etc.) :

Green Frog

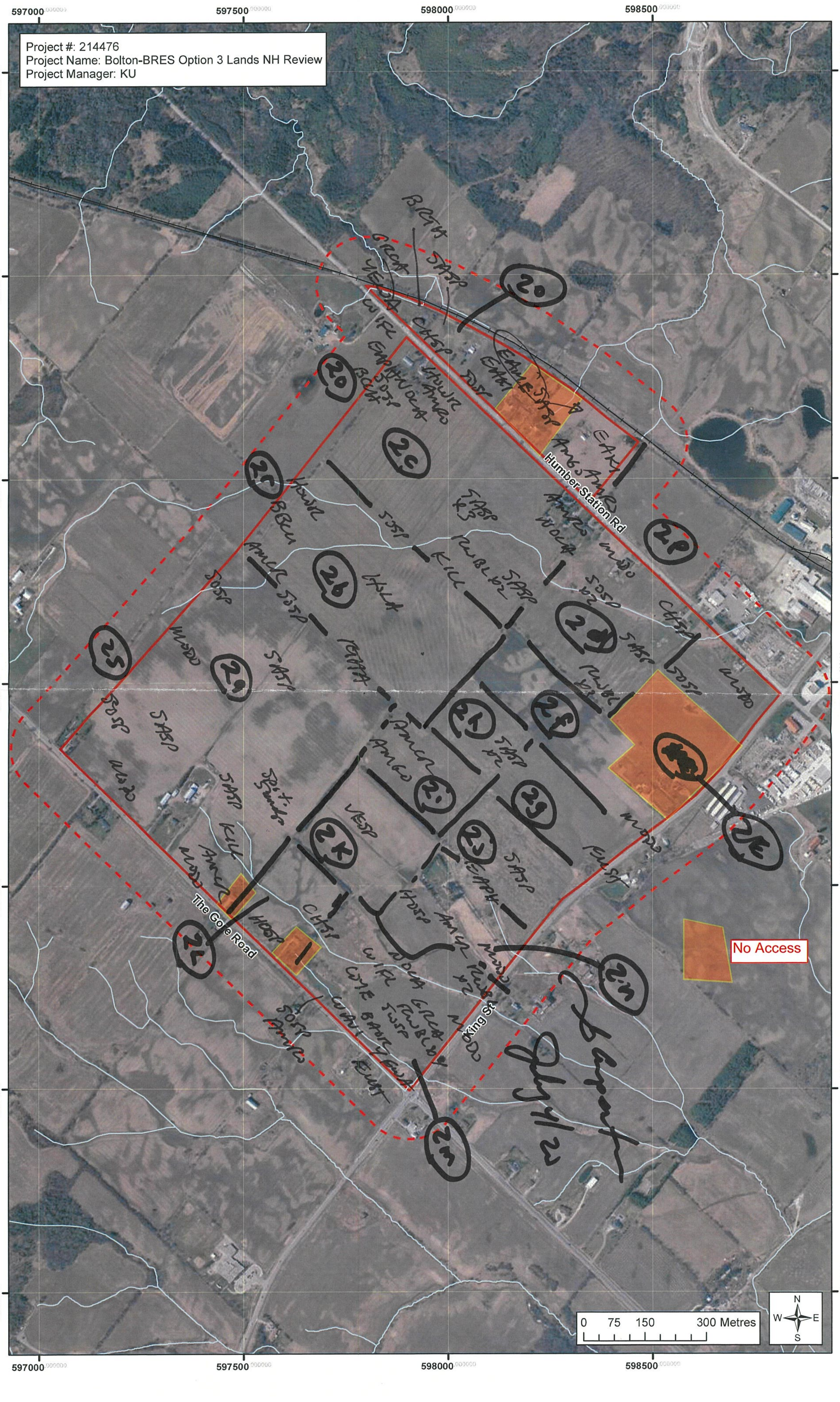
E. Cottontail.

Incidental Observations

Anything welcome (mammals, herps, fish presence, insects, plants esp. unusual spp. etc.). For herps, rare plants, occurrence of fish, please also mark location on map. For herps, number observed. Thanks!

SOSP	13 -14	AMCR	1	HOWR	2
SASP	11 -12	AMGO	2-3	BBCU	1
CHSP	4	EAKI	2	Spot. Sandp	1
HOSP	1-2	EAPH	2	VESP	1
WIFL	2	EUST	1 - 3	HOLA	- 1
YEWA	2	MODO	3 - 4	INBU	1
AMRO	6 - 7	KILL	2	RTHA	1
COGR	2 - 3	EAME	1	SWSP	1
RWBL	8	BRTH	1	BAOR	1
COYE	1	BCCH	1	[illegible]	
NOCA	3	GRCA	2	WAVI	-1

RFC Apr 2012



Project #: 214476
Project Name: Bolton-BRES Option 3 Lands NH Review
Project Manager: KU

Appendix G

Breeding Bird Checklist for Macville Community Secondary

Appendix G

Breeding Bird Checklist for Macville Community Secondary Plan

Common Name	Scientific Name	National Species at Risk COSEWIC[a]	Species at Risk in Ontario Listing [b]	Provincial breeding season SRANK [c]	TRCA Status [d]	Area-sensitive [d]	May 28, 2020		June 19, 2020		July 4, 2020	
							Subject Property	120 m Buffer Study Area	Subject Property	120 m Buffer Study Area	Subject Property	120 m Buffer Study Area
Great Blue Heron	*Ardea herodias*	-	-	S4	L3	-	1F	-	1F	-	-	-
Canada Goose	*Branta canadensis*	-	-	S5	L5	-	2	-	-	-	-	-
Mallard	*Anas platyrhynchos*	-	-	S5	L5	-	2	-	1	-	-	-
Red-tailed Hawk	*Buteo jamaicensis*	-	-	S5	L5	-	-	-	-	-	1	-
Peregrine Falcon	*Falco peregrinus*	-	SC	S3	L4	-	-	-	1F	-	-	-
Wild Turkey	*Meleagris gallopavo*	-	-	S5	L3	-	-	-	1	-	-	-
Killdeer	*Charadrius vociferus*	-	-	S5	L4	-	1	-	1	-	2	-
Spotted Sandpiper	*Actitis macularia*	-	-	S5	L4	-	1	-	1	-	1	-
Ring-billed Gull	*Larus delawarensis*	-	-	S5	L4	-	-	-	2F	-	-	-
Rock Pigeon	*Columba livia*	-	-	SNA	L+	-	-	-	3	-	-	-
Mourning Dove	*Zenaida macroura*	-	-	S5	L5	-	2	-	7 + 12F	-	4	-
Black-billed Cuckoo	*Coccyzus erythropthalmus*	-	-	S5	L3	-	-	-	-	-	1	-
Cuckoo sp.	*Coccyzus sp.*	-	-	n/a	n/a	-	-	-	1	-	-	-
Willow Flycatcher	*Empidonax traillii*	-	-	S5	L4	-	3	-	3	-	1	1
Eastern Phoebe	*Sayornis phoebe*	-	-	S5	L5	-	3	-	-	-	2	-
Eastern Kingbird	*Tyrannus tyrannus*	-	-	S4	L4	-	2	-	1	1	2	-
Horned Lark	*Eremophila alpestris*	-	-	S5	L3	-	2	-	3	-	1	-
Tree Swallow	*Tachycineta bicolor*	-	-	S4	L4	-	-	-	1F	-	-	-
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	-	-	S4	L4	-	-	-	-	1F	-	-
Barn Swallow	*Hirundo rustica*	THR	THR	S4	L4	-	1F (ELC Unit 2e)	1	1F (ELC Unit 2j)	1	-	-
Blue Jay	*Cyanocitta cristata*	-	-	S5	L5	-	1	-	1	-	-	-
American Crow	*Corvus brachyrhynchos*	-	-	S5	L5	-	4	-	2 + 12F	-	1	-
Black-capped Chickadee	*Poecile atricapillus*	-	-	S5	L5	-	-	-	2	-	1	-
House Wren	*Troglodytes aedon*	-	-	S5	L5	-	1	-	1	-	2	-
American Robin	*Turdus migratorius*	-	-	S5	L5	-	1	-	5+1F	2	6	1
Gray Catbird	*Dumetella carolinensis*	-	-	S4	L4	-	2	-	2	-	2	-
Brown Thrasher	*Toxostoma rufum*	-	-	S4	L3	-	2	-	-	-	1	-
Cedar Waxwing	*Bombycilla cedrorum*	-	-	S5	L5	-	-	-	5	-	-	-
European Starling	*Sturnus vulgaris*	-	-	SE	L+	-	3	-	9	2	2	1
Warbling Vireo	*Vireo gilvus*	-	-	S5	L5	-	1	-	1	-	1	-
Red-eyed Vireo	*Vireo olivaceus*	-	-	S5	L4	-	1	-	-	-	-	-
Yellow Warbler	*Setophaga petechia*	-	-	S5	L5	-	3	-	2	1	2	-
Common Yellowthroat	*Geothlyphis trichas*	-	-	S5	L4	-	2	-	1	-	1	-
Northern Cardinal	*Cardinalis cardinalis*	-	-	S5	L5	-	1	-	2	-	3	-
Indigo Bunting	*Passerina cyanea*	-	-	S4	L4	-	1	-	2	-	1	-
Chipping Sparrow	*Spizella passerina*	-	-	S5	L5	-	2	-	1	1	4	-
Vesper Sparrow	*Pooecetes gramineus*	-	-	S4	L3	-	-	-	1	-	1	-
Savannah Sparrow	*Passerculus sandwichensis*			S4	L4	A	8	-	14	3	12	-
Song Sparrow	*Melospiza melodia*			S5	L5		6	-	16	15	14	-
Swamp Sparrow	*Melospiza georgiana*			S5	L4		1	-	3	-	1	-
Bobolink	*Dolichonyx oryzivorus*	THR	THR	S4	L2	A	4 (ELC Unit 2b, 2i, 2j)	-	3 (ELC Unit 2j)	1	-	-

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							Subject Property	120 m Buffer Study Area	Subject Property	120 m Buffer Study Area	Subject Property	120 m Buffer Study Area
Red-winged Blackbird	*Agelaius phoeniceus*			S4	L5		31	-	21	7	8	-
Eastern Meadowlark	*Sturnella magna*	THR	THR	S4	L3	A	1 (ELC Unit 2c, 2d)	-	-	1	1 (ELC Unit 2o)	-
Common Grackle	*Quiscalus quiscula*			S5	L5		3	-	2	2	3	-
Baltimore Oriole	*Icterus galbula*			S4	L5		1	1		1	1	-
American Goldfinch	*Spinus tristis*			S5	L5		4	1	6	-	3	-
House Sparrow	*Passer domesticus*			SNA	L+		2	-	3	-	2	-

= Maximum number of breeding pairs recorded on subject property, F = species foraging on / flying over the subject property

a - COSEWIC = Committee on the Status of Endangered Wildlife in Canada: END = Endangered, THR = Threatened, SC = Special Concern

b - Species at Risk in Ontario List (as applies to ESA) as designated by COSSARO (Committee on the Status of Species at Risk in Ontario): END = Endangered, THR = Threatened, SC = Special Concern

c - SRANK (from Natural Heritage Information Centre) for breeding status if: S1 (Critically Imperiled), S2 (Imperiled),S3 (Vulnerable), S4 (Apparently Secure), S5 (Secure) SNA (Not applicable…'because the species is not a suitable target for conservation activities'; includes non-native species)

d - Toronto and Region Conservation Authority L rank (2016): L1 to L3 Regional species of concern from highest to lowest; L4 Urban concern; L5 Secure through region; L+ Non-native

e - Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide (Appendix G). 151 p plus appendices.

Appendix H

Significant Wildlife Habitat (SWH) Screening for Macville Community Secondary Plan

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Significant Wildlife Habitat (SWH) Screening for Macville Community Secondary Plan

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
Seasonal Concentration Areas					
1. Waterfowl Stopover and Staging Areas (Terrestrial)					
American Black Duck Wood Duck Mallard Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler	CUM1 CUT1 Plus evidence of annual spring flooding from malt water or run-off within these Ecosites.	*Suitable Habitat* • Fields with sheet water during Spring (mid-March to May) *Suggested Criteria* Studies carried out and verified presence of an annual concentration of any listed species	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘
2. Waterfowl Stopover and Staging Areas (Aquatic)					
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	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	*Suitable Habitat* • Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration • Sewage treatment ponds and storm water ponds do not qualify as 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) *Suggested Criteria* 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 • Wetland area and shorelines associated with sites identified within the Significant Wildlife Habitat Technical Guide (SWHTG) (MNRF 2000) Appendix K are SWH	All marshes with open water and shallow aquatic ecosites on the Subject Lands are too small to potentially support the required aggregations to be considered Confirmed SWH. Additionally, the Bolton PSW Complex within the Study Area is not productive or large enough to support considered suitable habitat.	✘	✘
3. Shorebird Migratory Stopover Area					
Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper	BBO1 BBO2 BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2	*Suitable Habitat* • Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats • 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 *Suggested Criteria*	No suitable habitat identified on the Subject Lands or within the Study Area, and none would be expected to occur.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	MAM3 MAM4 MAM5	- 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 (<24hrs) 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			
4. Raptor Wintering Area					
Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl 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 to adjacent to lakes with open water (hunting area).	*Suitable Habitat* - 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 with a combination of forest and upland *Suggested Criteria* Studies confirm the use of these habitats by: - One or more Short-eared Owls or; One of more Bald Eagles or at least 10 individuals and two listed hawk/owl species - To be significant a site must be used regularly (3 in 5 years) 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	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘
5. Bat Hibernacula					
Big Brown Bat Tri-colored Bat	Bat Hibernacula may be in the Ecosites: CCR1 CCR2 CCA1 CCA2	*Suitable Habitat* - Hibernacula may be found in caves, mine shafts, underground foundations and Karsts *Suggested Criteria* - All sites with confirmed hibernating bats are SWH - The area includes 200m radius around the entrance of the hibernaculum for most development types and for wind farms (Note: buildings are not to be considered SWH)	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘
6. Bat Maternity Colonies					
Big Brown Bat Silver-haired Bat	Maternity Colonies considered for SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	*Suitable Habitat* - Maternity colonies can be found in tree cavities, vegetation and often in buildings (buildings are not considered to be SWH) - Maternity colonies located in mature deciduous or mixed forest stands with >10/ha large diameter (>25cm dbh) wildlife trees - Female bats prefer wildlife tree (snags) in early stages of decay, class 1-3 or class 1 or 2 - 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 *Suggested Criteria* - Maternity colonies with confirmed use by; – >10 Big Brown Bats – >5 Adult Female Silver-haired Bats	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
		The area of the habitat includes the entire woodland or the forest stand ELC ecosite or an ecoelement containing the maternity colonies			
7. Turtle Wintering Areas					
Midland Painted Turtle 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 Turtles: Open Water areas such as deeper rivers, or streams and lakes with current can also be used as over-wintering habitat.	*Suitable 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 • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH *Suggested Criteria* • Presence of 5 over-wintering Midland Painted Turtles is significant • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant • 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	Midland Painted Turtle and Snapping Turtle have been documented in ponds near the Bolton PSW Complex (Dougan et al. 2014b) and west of the Bolton PSW Complex, east of the railroad tracks within the Study Area, although none have been observed on the Subject Lands. Candidate SWH includes the Bolton PSW Complex and other wetlands or ponds with permanent open water on the Subject Lands. Surveys for this category of SWH were not conducted as part of the CEISMP, and some wetlands were not accessible at the time of this CEISMP. Surveys will be conducted at the draft plan stage to confirm the status of this SWH category.	✓ **Wetlands with Permanent Open Water. While no turtles have been observed on the Subject Lands, we recommend conducting basking surveys in the future.**	✓ **Bolton PSW Complex**
8. Reptile Hibernaculum					
Eastern Gartersnake Northern Water Snake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake Milksnake Eastern Ribbonsnake Five-lined Skink	For all snakes, habitat may be found in any ecosite other than very wet ones. Talus, Tock Barren, Crevice, Cave and Alvar may be directly related to these habitats. Observations or congregations of snakes on sunny warm days in the spring or fall is a good indicator. For Five-lined Skink, ELC Community Series of FOD and FOM and ecosite: FOC1 and FOC3.	*Suitable Habitat* • For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural 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 • Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover • For five-lined Skink, Community Series FOD and FOM, and FOC1 and FOC3 should be considered. They prefer mixed forests with rock outcrop openings with cover rock overlaying granite bedrock with fissures *Suggested Criteria* 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 (e.g., foundation or rocky slope) on sunny warm days in spring	Suitable habitat may be present on the Subject Lands or within the Study Area in sites such as animal burrows within margins of agricultural fields and wetlands, and wetlands that go below the frost line. Additionally, suitable habitat may be present in areas with old, anthropogenic foundations (such as old barns or former railbeds. To date, no snakes have been incidentally recorded on the Subject Lands or within the Study Area. Surveys for this category of SWH were not conducted as part of the CEISMP. Surveys will be conducted at the draft plan stage to confirm the status of this SWH category.	✓ **Natural, Semi-Natural Communities and Areas with Old Anthropogenic Foundations. While no snakes have been observed on the Subject Lands, we recommend conducting basking surveys in the future.**	✓ **Natural and Semi-Natural Communities**
9. Colonially-Nesting Bird Breeding Habitat (Bank and Cliff)					
Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, steep slopes and sand piles. Cliff faces, bridge abutments, silos and barns. Habitat found in the following ecosites: CUM1 CLO1 CUT1 CLS1 CUS1 CLT1 BLO1 BLS1 BLT1	*Suitable Habitat* • 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 *Suggested Criteria* Studies confirming: • Presence of 1 or more nesting sites with 8 or more cliff swallow pairs or 50 Bank Swallow and/or Rough-winged Swallow pairs during the breeding season	No suitable habitat identified on the Subject Lands or within the Study Area. Bank Swallow was noted by Dougan et al. (2014b) in 2013/2014 within the Study Area, and they assumed that it was simply foraging due to lack of suitable nesting habitat.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
		A colony identified as SWH will include a 50m radius habitat area from the peripheral nests			
10. Colonially-Nesting Bird Breeding Habitat (Tree/Shrubs)					
Great Blue Heron Black-crowned Night-Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	*Suitable Habitat* • 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 *Suggested Criteria* Studies confirming: • Presence of 2 or more active nests of Great Blue Heron or other listed species The habitat extends from the edge of the colony and a minimum 300m radius or extent of the forest ecosite containing the colony or any island <15.0 ha with a colony is the SWH	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘
11. Colonially-Nesting Bird Breeding Habitat (Ground)					
Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island to peninsula (natural or artificial) with a lake or larger river. Close proximity or watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird). MAM1-6 MAS1-3 CUM CUT CUS	*Suitable Habitat* • 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 *Suggested Criteria* 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 • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant • Presence of 5 or more pairs for Brewer's Blackbird • The edge of the colony and a minimum 150m area of habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘
12. Migratory Butterfly Stopover Areas					
Painted Lady Red Admiral Monarch	Combination of ELC Community Series; need to have present one Community Series from each land class: <u>Field:</u> CUM CUT CUS <u>Forest:</u> FOC FOD COM CUP A candidate site will have a history of butterflies being observed.	*Suitable Habitat* • 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 Ontario or Lake Erie • 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 • 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 • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest *Suggested Criteria* Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct). 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 - significant variation can occur between years and multiple years of sampling should occur MUD of >5000 or >3000 with the presence of Painted Ladies or Red Admirals is to be considered significant	Suitable habitat not identified on the Subject Lands or the Study Area due to its distance from Lake Ontario and Lake Erie.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		**Provincial Guidance for SWH in Ecoregion 6E***	**Application to the Subject Lands and Study Area**	**Candidate SWH On Subject Lands**	**Candidate SWH Within Study Area**
13. Landbird Migratory Stopover Areas					
All migratory songbirds	All Ecosites associated with the ELC Community Series; FOC FOM FOD SWC SWM SWD	*Suitable Habitat* • Woodlots >10 ha in size and within 5 km of Lake Ontario and Lake Erie • If multiple woodlands are located along the shoreline those Woodlands <2 km from Lake Erie or Ontario are more significant • Sites have a variety of habitats; forest, grassland and wetland complexes • The largest sites are more significant • Woodlots and forest fragments are important habitats to migrating birds, these features located along the shore and located within 5km of Lake Ontario are Candidate SWH *Suggested Criteria* Studies confirm: • Use of the woodlot by >200 birds/day and with >35 species with at least 10 bird spp. recorded on at least 5 different survey dates This abundance and diversity of migrant bird species is considered above average and significant	Suitable habitat not identified on the Subject Lands or the Study Area due to its distance from Lake Ontario and Lake Erie.	✘	✘
14. Deer Yarding Areas					
White-tailed Deer	*Note: MNRF to determine this habitat.* ELC Community Series providing a thermal cover component for a deer yard would include: FOD, FOC, SWM and SWC. Or ELC Ecosites: CUP2, CUP3, FOD3 and CUT	*Suitable Habitat* • Deer yarding areas or winter concentration areas (yards) are areas deer move to in response to the onset of winter snow and cold. Deer establish traditional use areas with two areas called Stratum I and Stratum II • Stratum II covers entire winter yard and is usually in FOD or FOM (or agricultural lands) where browsing can occur. Deer move here in early winter, and will continue to stay here until snow depths reach about 30 cm. • Stratum I is the core of a deer yard, and is found within the Stratum II, and is critical for deer survival in areas where winter is severe. It is primarily coniferous trees with a canopy cover of at least 60% *Suggested Criteria* Studies confirm: • Snow depth and temperature or the greatest influence on deer use of winter yards. Snow depths of >40 cm for more than 60 days are minimum criteria for a deer yard to be considered as SWH • Deer management is an MNRF responsibility, and they field investigations (by aircraft over a series of winters to establish boundaries of Stratum I and II. Deer yarding areas considered significant will be mapped by MNRF If SWH is determined for deer wintering area or if a proposed development is within Stratum II yard areas, then movement corridors are to be considered	No suitable habitat identified on the Subject Lands or the Study Area by MNRF.	✘	✘
15. Deer Winter Congregation Areas					
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.	*Suitable Habitat* • Woodlots >100 ha in size. Woodlots <100 ha may be considered significant based on MNRF studies or assessment • Deer movement during winter in Ecoregion 6E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands • Large woodlots > 100 ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha • Woodlots with high densities of deer due to artificial feeding are not significant *Suggested Criteria* Studies confirm:	No suitable habitat identified on the Subject Lands or the Study Area by MNRF.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities	Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
	• Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF • 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 If SWH is determined for deer wintering area or if a proposed development is within Stratum II yard areas, then movement corridors are to be considered			
Rare Vegetation Communities				
16. Cliffs and Talus Slopes				
ELC Communities: TAO, TAS, TAT, CLO, CLS, CLT	• A Cliff is vertical to near vertical bedrock >3m in height • A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris • Most cliff and talus slopes occur along the Niagara Escarpment	Does not occur on the Subject Lands or within the Study Area.	✘	✘
17. Sand Barren				
ELC Communities: SBO1, SBS1, BT1	• 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% *Suggested Criteria* • A sand barren area >0.5ha in size • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics).	Does not occur on the Subject Lands or within the Study Area.	✘	✘
18. Alvar				
Field studies identify four of the five Alvar indicator species within ELC communities: ALO1, ALS, ALT1, FOC1, FOC2, CUM2, CUS2, CUT2-1, CUW2	• 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 plant • Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animal species • Vegetation cover varies from patchy to barren with a less than 60% tree cover *Suggested Criteria* • An Alvar site > 0.5 ha in size • Five indicator species specific to alvars within Ecoregion 6E: *1) Carex crawei 2) Panicum philadelphicum 3) Eleocharis compressa 4) Scutellaria parvula 5) Trichostema brachiatum* • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics) • The Alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses	Does not occur on the Subject Lands or within the Study Area.	✘	✘
19. Old Growth Forest				
ELC Communities: FOD FOC FOM SWD SWC SWM	• Old-growth forests are characterized by heavy mortality or turnover of over-storey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris *Suggested Criteria* • Woodland area is >30 ha with at least 10 ha of interior habitat • If dominant trees species of the ecosite are >140 years old, then stand is SWH • The-forested area containing the old growth characteristics will have experienced no recognizable forestry activities (cut stumps will not be present)	Does not occur on the Subject Lands or within the Study Area.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities	Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
	• The area of forest ecosites combined or an eco-element within an ecosite that contain the old growth characteristics is the SWH			
20. Savannah				
ELC Communities: TPS1 TPS2 TPW1 TPW2 CUS2	• A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60% *Suggested Criteria* • No minimum size to site. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH • Field studies confirm one or more of the Prairie indicator species listed in Appendix N should be present. Note: Savannah plant spp. list from Ecoregion 6E should be used • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics)	Does not occur on the Subject Lands or within the Study Area.	✘	✘
21. Tallgrass Prairie				
ELC Communities: TPO1 TPO2	• A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover • In ecoregion 6E, 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) *Suggested Criteria* • No minimum size to site. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH • ELC communities TPO1, TPO2 • Field studies confirm one or more of the Prairie indicator species listed in Appendix N in SWHTG (MNRF 2000) should be present. Prairie plant spp. list from Ecoregion 6E should be used • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics)	Does not occur on the Subject Lands or within the Study Area.	✘	✘
22. Other Rare Vegetation Communities				
	• Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG (MNRF 2000) • 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 SWHTG (MNRF 2000) Appendix M • The MNRF/NHIC will have up to date listing for rare vegetation communities	Does not occur on the Subject Lands or within the Study Area.	✘	✘
Specialized Habitat for Species				
23. Waterfowl Nesting Area				
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	*Suitable Habitat* • A waterfowl nesting area extends 120 m from a wetland (> 0.5 ha) or a wetland (>0.5 ha) with small wetlands (<0.5ha) 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 • Upland areas should be at least 120m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests *Suggested Criteria* Studies confirm: • 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	Suitable habitat is present on the Subject Lands and within the Study Area in the vicinity of ponds, however surveys conducted as part of the CEISMP did not document adequate numbers of listed species.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
		Wood Ducks and Hooded Mergansers utilize large diameter trees (>40 cm dbh) in woodlands for cavity nest sites			
24. Bald Eagle and Osprey Nesting, Foraging and Perching Habitat					
Osprey Bald Eagle	ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM, SWC directly adjacent to riparian areas - rivers, lakes, ponds and wetlands.	*Suitable Habitat* • 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) *Suggested Criteria Studies confirm the use of these nests by:* • One or more active Osprey or Bald Eagle nests in an area • 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 • For a Bald Eagle the active nest and a 400-800 m radius around the nest is the SWH. Area of the habitat from 400-800m is dependent on site lines from the nest to the development and inclusion of perching and foraging habitat To be significant a site must be used annually. When found inactive, the site must be known to be inactive for >3 years or suspected of not being used for >5 years before being considered not significant	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘
25. Woodland Raptor Nesting Habitat					
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 CUP3	*Suitable Habitat* • All natural or conifer plantation woodland/forest stands combined >30ha or with >4 ha of interior habitat; interior habitat determined with a 200 m buffer • 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 island • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest *Suggested Criteria* Studies confirm: • Presence of 1 or more active nests from species list is considered significant • Red-shouldered Hawk and Northern Goshawk – a 400m radius around the nest or 28 ha of suitable habitat is the SWH. (the 28 ha habitat area would be applied where optimal habitat is irregularly shaped around the nest)	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
		• Barred Owl – a 200m radius around the nest is the SWH • Broad-winged Hawk and Coopers Hawk,– a 100m radius around the nest is the SWH Sharp-Shinned Hawk – a 50m radius around the nest is the SWH			
26. Turtle Nesting Areas					
Midland Painted Turtle Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100 m) to within the following Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	*Suitable Habitat* • 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 *Suggested Criteria* Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles • One or more Northern Map Turtle or Snapping Turtle nesting • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependant on slope, riparian vegetation and adjacent land use is the SWH Travel routes from wetland to nesting area are to be considered within the SWH	Midland Painted Turtle and Snapping Turtle have been documented in ponds near the Bolton PSW Complex (Dougan et al. 2014b) and west of the Bolton PSW Complex, east of the railroad tracks within the Study Area, although none have been observed on the Subject Lands. Candidate SWH includes the exposed mineral soil adjacent to the Bolton PSW Complex and other wetlands or ponds with permanent open water on the Subject Lands. Surveys for this category of SWH were not conducted as part of the CEISMP, and some wetlands with open water were not accessible at the time of this CEISMP. Surveys will be conducted at the draft plan stage to confirm the status of this SWH category.	✓ **Wetlands with Permanent Open Water. While no turtles have been observed on the Subject Lands, we recommend conducting basking surveys and searches for turtle nests in the future.**	✓ **Bolton PSW Complex**
27. Seeps and Springs					
Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps and springs are areas where ground water comes to the surface. Often, they are found within headwater areas within forested habitats. Any forested Ecosite within headwater areas of a stream could have seeps/springs.	*Suitable Habitat* • Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system (could contain a seep or spring - areas where ground water comes to the surface) • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species • The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat *Suggested Criteria* Studies confirm: • Presence of a site with 2 or more seeps/springs should be considered SWH The area of an ELC forest ecosite containing the seeps/springs is the SWH	According to the work completed by DS Consultant Ltd. (2020), seepage has been observed in three areas within the subject lands. However, none of these seepage areas are associated with a forest. Please refer to DS Consultant Ltd. (2020) for more detail.	✗	✗

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
28. Amphibian Breeding Habitat (Woodland)					
Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated within these ELC Community Series: FOC, FOM, FOD, SWC, SWM, SWD Breeding pools within the woodland or the shortest distance from the forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians.	*Suitable Habitat* • Presence of a wetland, pond, or woodland pool within or adjacent (within 120m) to a woodland (no minimum size) • 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 *Suggested Criteria* Studies confirm: Presence of breeding population of 1 or more of the listed salamander species or 2 or more of the listed frog species with at least 20 individuals (adults, juveniles, eggs/larval masses) or 2 or more of the listed frog species with Call Level Codes of 3	No suitable habitat identified on the Subject Lands or within the Study Area.	✘	✘
29. Amphibian Breeding Habitat (Wetland)					
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	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 species (e.g. Bullfrog) may be adjacent to woodland.	*Suitable Habitat* • Wetlands >500 m^2 (about 25 m diameter) 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 • 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 • Bullfrogs require permanent water bodies with abundant emergent vegetation *Suggested Criteria* Studies confirm: • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog or toad species and with at least 20 individuals (adults, juveniles, eggs/larval masses) or 2 or more of the listed frog species with Call Level Codes of 3 The ELC ecosite wetland area and the shoreline are the SWH	Minimal suitable habitat is present in the southern and eastern portions of the Subject Lands and within the Study Area. Amphibian surveys completed to date have not observed the required threshold of breeding amphibians to classify the habitats as significant.	✘	✘
30. Woodland Area-Sensitive Bird Breeding Habitat					
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 Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	*Suitable Habitat* • Habitats where interior forest breeding birds are breeding • Typically large mature (>60 yrs old) forest stands or woodlots >30 ha • Interior forest habitat is at least 200 m from forest edge habitat *Suggested Criteria* Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species. Any site with breeding Cerulean Warblers or Canada Warblers is to be considered SWH	No suitable habitat or associated species identified on the Subject Lands or within the Study Area.	✘	✘
Habitat for Species of Conservation Concern					
31. Marsh Bird Breeding Habitat					

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
American Bittern Virginia Rail Sora Common Moorhen American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Sandhill Crane Green Heron Trumpeter Swan Black Tern Yellow Rail	MAM 1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	*Suitable Habitat* • Nesting occurs in wetlands • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present • 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 may be found in upland shrubs or forest a considerable distance from water *Suggested Criteria* 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 Trumpeter Swans, Black Terns or Yellow Rail is SWH • Area of the ELC ecosite is the SWH	Minimal suitable habitat is present in the southern and eastern portions of the Subject Lands; however, no listed species were recorded on the Subject Lands or within the Study Area.	✘	✘
32. Open Country Bird Breeding Habitat					
Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow Short-eared Owl	CUM1 CUM2	*Suitable Habitat* • Large grassland areas (includes natural and cultural fields and meadows) >30 ha • Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years) • 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 *Suggested Criteria* Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species • 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	No suitable habitat is present on the Subject Lands or within the Study Area. The majority of the Study Area is row cropped and rotated on an annual basis.	✘	✘
33. Shrub/Early Successional Bird Breeding Habitat					
<u>Indicator Species</u>: Brown Thrasher Clay-coloured Sparrow <u>Common Species:</u> Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher <u>Special Concern:</u> 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.	*Suitable Habitat* • Large natural field areas succeeding to shrub and thicket habitats >10ha in size. Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live-stock pasturing in the last 5 years) • Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species • Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands *Suggested Criteria* Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species • A habitat with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat The area of the SWH is the contiguous ELC ecosite field/thicket area	No suitable habitat is present on the Subject Lands or within the Study Area. The majority of the Study Area is row cropped and rotated on an annual basis.	✘	✘

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities		Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
34. Terrestrial Crayfish					
Chimney or Digger Crayfish (<u>*Fallicambarus fodiens*</u>) Devil Crawfish or Meadow Crayfish (<u>*Cambarus Diogenes*</u>)	MAM1, MAM2, MAM3, MAM4, MAM5, MAM6 MAS1, MAS2, MAS3 SWD, SWT, SWM CUM1 within inclusions of above meadow marsh or swamp ecosites can be used by terrestrial crayfish.	*Suitable Habitat* • Wet meadow and edges of shallow marshes (no minimum size) identified should be surveyed for terrestrial crayfish • Constructs burrows in marshes, mudflats, meadows; the ground can't be too moist • Can often be found far from water • Both species are a 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 *Suggested Criteria* Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable marsh meadow or terrestrial sites Area of ELC Ecosite polygon is the SWH	No evidence of Terrestrial Crayfish was documented during field studies.	✗	✗
35. Special Concern and Rare Wildlife Species					
		• All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species • 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 *Suggested Criteria* Studies confirm: • Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable • Habitat form and function needs to be assessed from the assessment of ELC vegetation types and an area of significant habitat that protects the rare or special concern species identified • 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 be easily mapped and cover an important life stage component for a species (e.g. specific nesting habitat or foraging habitat)	Suitable habitat occurs on the Subject Lands and within the Study Area for several Special Concern and Provincially Rare (S1-S3, SH): • Snapping Turtle (Special Concern): Potentially suitable habitat is present within the wetland habitat on the Subject Lands and within the Bolton PSW Complex within the Study Area. • Monarch (Special Concern): Potentially suitable habitat may be present within the meadow habitat on the Subject Lands and within the Study Area. Surveys for this category of SWH were not conducted as part of the CEISMP. Surveys will be conducted at the draft plan stage to confirm the status of this SWH category.	✓ **Wetlands and meadows**	✓ **Bolton PSW Complex**
Animal Movement Corridors					
36. Amphibian Movement Corridors					
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		• Amphibian movement corridors should only be identified as SWH where a confirmed or Candidate SWH has been identified by MNRF or the planning authority • Movement corridors between breeding habitat and summer habitat • Movement corridors must be considered when amphibian breeding habitat is confirmed as SWH • 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 • Corridors should be at least 15 m of vegetation on both sides of waterway or be up to 200 m wide of woodland habitat and with gaps <20 m • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat	Amphibian breeding habitat (woodland and wetland) was not a Candidate SWH type found on the Subject Lands or within the Study Area.	✗	✗

Wildlife Habitat Category and Associated Species and Ecological Land Classification (ELC) Communities	Provincial Guidance for SWH in Ecoregion 6E*	Application to the Subject Lands and Study Area	Candidate SWH On Subject Lands	Candidate SWH Within Study Area
37. Deer Movement Corridors				
White-tailed Deer	• Deer movement corridors should only be identified as SWH where a confirmed or Candidate SWH has been identified by MNRF or the planning authority • Corridors follow riparian areas, woodlots, areas of physical geography (ravines or ridges) • Field Studies must be conducted at the time of year when species are expected to be migrating or moving to and from winter concentration areas • Corridors that lead deer to wintering habitat should be unbroken by roads or residential areas • Corridors should be at least 200 m wide with gaps less than 20 m, and if following a riparian area, there must be at least 15 m of vegetation on both sides of the waterway	No deer movement corridors meeting the SWH criteria have been identified by MNRF to date on the Subject Lands or within the Study Area.	✘	✘

* Adapted from the listed species and habitat criteria provided in the Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (MNRF 2015) but updated to reflect any relevant changes in species status. For example, Tri-coloured Bat (*Perimyotis subflavus*) is now listed as Threatened so needs to be addressed as a Species at Risk under the Endangered Species Act (2007) and not under SWH.

Appendix I

Species at Risk (SAR) Screening for Macville Community Secondary Plan

Appendix I

Species at Risk (SAR) Screening for Macville Community Secondary Plan

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Potentially Suitable Habitat Present within the Subject Lands or Study Area	Likelihood of Presence
Western Chorus Frog *Pseudacris triseriata*	No Status	THR Schedule 1	THR	Western Chorus Frogs inhabit lowland areas such as marshes and wooded wetland areas. Like most frogs, it needs terrestrial and aquatic habitats near each other to carry out its life cycle. For breeding purposes, Western Chorus Frog utilizes seasonally dry, temporary ponds devoid of predators, such as fish. They are rarely found in permanent ponds. This species hibernates in terrestrial habitats under rocks, dead trees or leaves, loose soil or animal burrows.	In southern Ontario, Western Chorus Frog's range is bounded by the United States border in the south, Georgian Bay in the northwest, and south of Algonquin Park and up the Ottawa River valley to the vicinity of Eganville in the east. This species is divided into two distinct populations: the Carolinian population (southwestern Ontario) and the Great Lakes/St. Lawrence–Canadian Shield population (other regions of Ontario). Only the Canadian Shield population as been listed as Threatened federally.	**Yes** Potentially suitable habitat is present within the wetland habitat on the Subject Lands and within the Bolton PSW complex/other wetlands within the Study Area.	**Not present** (species not located on Subject Lands or within the Study Area during targeted field surveys in 2013, 2014 and 2020)
Acadian Flycatcher *Empidonax virescens*	END	END Schedule 1	END	In Ontario, the Acadian Flycatcher primarily lives in the warmer climate of southern Ontario's Carolinian forests. It needs large, undisturbed forests, often more than 40 hectares in size. It is typically found in mature, shady forests with ravines, or in forested swamps with lots of maple and beech trees. The nest is placed near the tip of a lower limb on a tree, and is loosely woven, with strands of plant material hanging down.	In Canada, the Acadian Flycatcher nests only in southwestern Ontario, mostly in large forests and forested ravines near the shore of Lake Erie. It has also been known to nest at a few sites in the Greater Toronto Area, but this is unusual. The Acadian Flycatcher population in Ontario is very small, with 25 to 75 breeding pairs recorded in 2010.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Bank Swallow *Riparia riparia*	THR	THR Schedule 1	THR	Bank Swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable. The birds breed in colonies ranging from several to a few thousand pairs.	The Bank Swallow is found across southern Ontario, with sparser populations scattered across northern Ontario. The largest populations are found along the Lake Erie and Lake Ontario shorelines, and the Saugeen River (which flows into Lake Huron).	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Barn Swallow *Hirundo rustica*	THR	THR Schedule 1	THR	Barn Swallows often live in close association with humans, building their cup-shaped mud nests almost exclusively on human-made structures such as open barns, under bridges and in culverts. The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood, since the mud does not adhere as well to smooth surfaces.	The Barn Swallow may be found throughout southern Ontario and can range as far north as Hudson Bay, wherever suitable locations for nests exist.	**Yes** Potentially suitable habitat is present within the buildings on the Subject Lands and within the Study Area.	**Not Present** (species located on the Subject Lands and within the Study Area during targeted field surveys in 2013, 2014 and 2020, and was nesting within the Study Area in 2020; however, no breeding was confirmed on the Subject Lands in 2020)
Bobolink *Dolichonyx oryzivorus*	THR	THR Schedule 1	THR	Historically, Bobolinks lived in North American tallgrass prairie and other open meadows. With the clearing of native prairies, Bobolinks moved to living in hayfields. Bobolinks often build their small nests on the ground in dense grasses. Both parents usually tend to their young, sometimes with a third Bobolink helping.	The Bobolink breeds across North America. In Ontario, it is widely distributed throughout most of the province south of the boreal forest, although it may be found in the north where suitable habitat exists.	**Yes** Potentially suitable habitat may be present within the field habitat on the Subject Lands or within the Study Area.	**Present** (species located on the Subject Lands and within the Study Area during targeted

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Potentially Suitable Habitat Present within the Subject Lands or Study Area	Likelihood of Presence
							field surveys in 2013, 2014 and 2020; however, no breeding was confirmed on the Subject Lands during the final survey in 2020)
Canada Warbler *Wilsonia canadensis*	SC	THR Schedule 1	THR	The Canada Warbler breeds in a range of deciduous and coniferous, usually wet forest types, all with a well- developed, dense shrub layer. Dense shrub and understory vegetation help conceal Canada Warbler nests that are usually located on or near the ground on mossy logs or roots, along stream banks or on hummocks.	The Canada Warbler only breeds in North America and 80 per cent of its known breeding range is in Canada. Its primary breeding range is in the Boreal Shield, extending north into the Hudson Plains and south into the Mixedwood Plains. Although the Canada Warbler breeds at low densities across its range, in Ontario, it is most abundant along the Southern Shield.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Cerulean Warbler *Dendroica cerulea*	THR	END Schedule 1	END	Cerulean Warblers spend their summers (breeding seasons) in mature, deciduous forests with large, tall trees and an open under storey. In late summer, they begin their long migration to wintering grounds in the Andes Mountains in South America.	In Canada, the Cerulean Warbler's breeding range extends from extreme southwestern Quebec to southern Ontario. In southern Ontario, populations appear to be separated into two distinct bands: one from southern Lake Huron to western Lake Ontario, and further north, the other from the Bruce Peninsula and Georgian Bay area to the Ottawa River.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Chimney Swift *Chaetura pelagica*	THR	THR Schedule 1	THR	Before European settlement Chimney Swifts mainly nested on cave walls and in hollow trees or tree cavities in old growth forests. Today, they are more likely to be found in and around urban settlements where they nest and roost (rest or sleep) in chimneys and other manmade structures. They also tend to stay close to water as this is where the flying insects they eat congregate.	The Chimney Swift breeds in eastern North America, possibly as far north as southern Newfoundland. In Ontario, it is most widely distributed in the Carolinian zone in the south and southwest of the province but has been detected throughout most of the province south of the 49th parallel. It winters in northwestern South America.	**Yes** Potentially suitable habitat is present within the buildings on the Subject Lands and within the Study Area.	**Not present** (species not located on Subject Lands or within the Study Area during targeted field surveys in 2013, 2014 and 2020)
Common Nighthawk *Chordeiles minor*	SC	THR Schedule 1	SC	Traditional Common Nighthawk habitat consists of open areas with little to no ground vegetation, such as logged or burned-over areas, forest clearings, rock barrens, peat bogs, lakeshores, and mine tailings. Although the species also nests in cultivated fields, orchards, urban parks, mine tailings and along gravel roads and railways, they tend to occupy natural sites.	The range of the Common Nighthawk spans most of North and Central America. In Canada, the species is found in all provinces and territories except Nunavut. In Ontario, the Common Nighthawk occurs throughout the province except for the coastal regions of James Bay and Hudson Bay.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Eastern Meadowlark *Sturnella magna*	THR	THR Schedule 1	THR	Eastern Meadowlarks breed primarily in moderately tall grasslands, such as pastures and hayfields, but are also found in alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields, or other open areas. Small trees, shrubs or fence posts are used as elevated song perches.	In Ontario, the Eastern Meadowlark is primarily found south of the Canadian Shield, but it also inhabits the Lake Nipissing, Timiskaming and Lake of the Woods areas.	**Yes** Potentially suitable habitat may be present within the field habitat on the Subject Lands and within the Study Area.	**Present** (species located on the Subject Lands and within the Study Area during targeted field surveys in 2013, 2014 and 2020; breeding confirmed on the Subject Lands during the final survey in 2020)

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Potentially Suitable Habitat Present within the Subject Lands or Study Area	Likelihood of Presence
Eastern Whip-poor-will *Caprimulgus vociferus*	THR	THR Schedule 1	THR	The Eastern Whip-poor-will is usually found in areas with a mix of open and forested areas, such as savannahs, open woodlands, or openings in more mature, deciduous, coniferous and mixed forests. It forages in these open areas and uses forested areas for roosting (resting and sleeping) and nesting. It lays its eggs directly on the forest floor, where its colouring means it will easily remain undetected by visual predators.	The Eastern Whip-poor-will's breeding range includes two widely separate areas. It breeds throughout much of eastern North America, reaching as far north as southern Canada and also from the southwest United States to Honduras. In Canada, the Whip-poor-will can be found from east-central Saskatchewan to central Nova Scotia and in Ontario they breed as far north as the shore of Lake Superior.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Eastern Wood-Pewee *Contopus virens*	SC	SC Schedule 1	SC	The Eastern Wood-pewee lives in the mid-canopy layer of forest clearings and edges of deciduous and mixed forests. It is most abundant in intermediate-age mature forest stands with little understory vegetation.	The eastern wood-pewee is found across most of southern and central Ontario, and in northern Ontario as far north as Red Lake, Lake Nipigon and Timmins.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Golden-winged Warbler *Vermivora chrysoptera*	SC	THR Schedule 1	THR	Golden-winged Warblers prefer to nest in areas with young shrubs surrounded by mature forest – locations that have recently been disturbed, such as field edges, hydro or utility right-of-ways, or logged areas.	In Ontario the Golden-winged Warbler breed in central-eastern Ontario, as far south as Lake Ontario and the St. Lawrence River, and as far north as the northern edge of Georgian Bay. Golden-winged Warblers have also been found in the Lake of the Woods area near the Manitoba border, and around Long Point on Lake Erie.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Grasshopper Sparrow *Ammodramus savannarum*	SC	SC Schedule 1	SC	It lives in open grassland areas with well-drained, sandy soil. It will also nest in hayfields and pasture, as well as alvars, prairies and occasionally grain crops such as barley. It prefers areas that are sparsely vegetated. Its nests are well-hidden in the field and woven from grasses in a small cup-like shape.	The Grasshopper Sparrow can be found throughout southern Ontario, but only occasionally on the Canadian Shield. It is most common where grasslands, hay or pasture dominate the landscape.	**Yes** Potentially suitable habitat may be present within the field habitat on the Subject Lands and within the Study Area.	**Not present** (species not located on Subject Lands or within the Study Area during targeted field surveys in 2013, 2014 and 2020)
Least Bittern *Ixobrychus exilis*	THR	THR Schedule 1	THR	In Ontario, the Least Bittern is found in a variety of wetland habitats, but strongly prefers cattail marshes with a mix of open pools and channels. This bird builds its nest above the marsh water in stands of dense vegetation, hidden among the cattails. The nests are almost always built near open water, which is needed for foraging. This species eats mostly frogs, small fish, and aquatic insects.	In Ontario, the Least Bittern is mostly found south of the Canadian Shield, especially in the central and eastern part of the province. Small numbers also breed occasionally in northwest Ontario. This species has disappeared from much of its former range, especially in southwestern Ontario, where wetland loss has been most severe. In winter, Least Bitterns migrate to the southern United States, Mexico and Central America.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Prothonotary Warbler *Protonotaria citrea*	END	END Schedule 1	END	In Ontario, the Prothonotary Warbler is found in the warmer climate of the Carolinian deciduous forests. It nests in small, shallow holes, found low in the trunks of dead or dying trees standing in or near flooded woodlands or swamps. They will also readily use properly placed artificial nest boxes. Silver maple, ash, and yellow birch are common trees in these habitats. The Prothonotary is the only warbler in eastern North America that nests in tree cavities, where it typically lays four to six eggs on a cushion of moss, leaves and plant fibres.	In Canada, the Prothonotary Warbler is only known to nest in southwestern Ontario, primarily along the north shore of Lake Erie. Over half of the small and declining population is found in Rondeau Provincial Park. In 2005, it was estimated that there were only between 28-34 individuals in Ontario.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Red-headed Woodpecker *Melanerpes erythrocephalus*	SC	THR Schedule 1	END	The Red-headed Woodpecker lives in open woodland and woodland edges, and is often found in parks, golf courses and cemeteries. These areas typically have many dead trees, which the bird uses for nesting and perching. This woodpecker regularly winters in the United States, moving to locations where it can find sufficient acorns and beechnuts to eat. A few of these	The Red-headed Woodpecker is found across southern Ontario, where it is widespread but rare. Outside Ontario, it lives in Alberta, Saskatchewan, Manitoba and Quebec, and is relatively common in the United States.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Potentially Suitable Habitat Present within the Subject Lands or Study Area	Likelihood of Presence
				birds will stay the winter in woodlands in southern Ontario if there are adequate supplies of nuts.			
Short-eared Owl *Asio flammeus*	SC	SC Scheudle 1	SC	The Short-eared Owl lives in open areas such as grasslands, marshes and tundra where it nests on the ground and hunts for small mammals, especially voles.	The Short-eared Owl has a world-wide distribution, and in North America its range extends from the tundra south to the central United States. In Ontario, the species has a scattered distribution, found along the James Bay and Hudson Bay coastlines, along the Ottawa River in eastern Ontario, in the far west of the Rainy River District, and elsewhere in southern Ontario, at places such as Wolfe and Amherst Islands near Kingston. Most northern populations are migratory, moving southward in the winter.	**Yes** Potentially suitable habitat may be present within the field and wetland habitat on the Subject Lands and within the Study Area.	**Not present** (species not located on Subject Lands or within the Study Area during day/night field surveys in 2013, 2014 and 2020)
Wood Thrush *Hylocichla mustelina*	SC	THR Schedule 1	THR	The Wood Thrush lives in mature deciduous and mixed (conifer-deciduous) forests. They seek moist stands of trees with well-developed undergrowth and tall trees for singing perches. These birds prefer large forests, but will also use smaller stands of trees. They build their nests in living saplings, trees or shrubs, usually in sugar maple or American beech.	The wood thrush is found all across southern Ontario. It is also found, but less common, along the north shore of Lake Huron, as far west as the southeastern tip of Lake Superior. There is a very small population near Lake of the Woods in northwestern Ontario, and there have been scattered sightings in the mixed forest of northern Ontario.	**No** Potentially suitable habitat is not present on the Subject Lands or within the Study Area.	-
Redside Dace *Clinostomus elongatus*	END	END Schedule 1	END	The Redside Dace is found in pools and slow-moving areas of small streams and headwaters with a gravel bottom. They are generally found in areas with overhanging grasses and shrubs, and can leap up to 10 cm out of the water to catch insects. During spawning, they can be found in shallow parts of streams, which are also popular spawning areas for other minnow species.	In Canada, Redside Dace are found in a few tributaries of Lake Huron, in streams flowing into western Lake Ontario, the Holland River (which flows into Lake Simcoe), and Irvine Creek of the Grand River system (which flows into Lake Erie).	**Yes** Potential suitable habitat is present within the watercourses on the Subject Lands and within the Study Area.	**Present** (Contributing Redside Dace habitat is mapped on the Subject Lands and within the Study Area by the MNRF)
Monarch *Danaus plexippus*	SC	SC Schedule 1	END	Throughout their life cycle, Monarchs use three different types of habitat. Only the caterpillars feed on milkweed plants and are confined to meadows and open areas where milkweed grows. Adult butterflies can be found in more diverse habitats where they feed on nectar from a variety of wildflowers.	The Monarch's range extends from Central America to southern Canada. In Canada, Monarchs are most abundant in southern Ontario and Quebec where milkweed plants and breeding habitat are widespread. During late summer and fall, Monarchs from Ontario migrate to central Mexico where they spend the winter months. During migration, groups of Monarchs numbering in the thousands can be seen along the north shores of Lake Ontario and Lake Erie.	**Yes** Potentially suitable habitat may be present within the meadow habitat on the Subject Lands and within the Study Area.	**Moderate** (Milkweed is present on the Subject Lands and within the Study Area)
Eastern Small-footed Myotis (Bat) *Myotis leibii*	END	No Status	No Status	In the spring and summer, eastern small-footed bats will roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees. These bats often change their roosting locations every day. At night, they hunt for insects to eat, including beetles, mosquitos, moths, and flies. In the winter, these bats hibernate, most often in caves and abandoned mines. They seem to choose colder and drier sites than similar bats and will return to the same spot each year.	The Eastern Small-footed bat has been found from south of Georgian Bay to Lake Erie and east to the Pembroke area. There are also records from the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park. Most documented sightings are of bats in their winter hibernation sites.	**Yes** Potentially suitable habitat is present within the swamp and buildings on the Subject Lands and within the buildings in the Study Area.	**Very Low**
Little Brown Myotis (Bat) *Myotis lucifugus*	END	END Schedule 1	END	Bats are nocturnal. During the day they roost in trees and buildings. They often select attics, abandoned buildings and barns for summer colonies where they can raise their young. Bats can squeeze through very tiny spaces (as small as six millimetres across) and this is how they access many roosting areas. Little brown bats hibernate from October or November to	The Little Brown Myotis is widespread in southern Ontario and found as far north as Moose Factory and Favourable Lake. Outside Ontario, this bat is found across Canada (except in Nunavut) and most of the United States.	**Yes** Potentially suitable habitat is present within the swamp and buildings on the Subject Lands and within the buildings in the Study Area.	**Moderate**

Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Potentially Suitable Habitat Present within the Subject Lands or Study Area	Likelihood of Presence
				March or April, most often in caves or abandoned mines that are humid and remain above freezing. This species can typically be associated with any community where suitable roosting (i.e. cavity trees, houses, abandoned buildings, barns, etc.) habitat is available.			
Northern Myotis *(Bat)* *Myotis septentrionalis*	END	END Schedule 1	END	Northern Myotis bats are associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. These bats hibernate from October or November to March or April, most often in caves or abandoned mines.	The Northern Myotis is found throughout forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon.	**Yes** Potentially suitable habitat is present within the swamp and buildings on the Subject Lands and within the buildings in the Study Area.	**Low**
Tricoloured Bat *Perimyotis subflavus*	END	END Schedule 1	END	Tricoloured Bat inhabits a variety of forested communities, and will roost older forests and barns (or other structures). Foraging habitats include areas over water and streams. They hibernate in cave where they typically roost independently rather than in groups.	Tricoloured Bat is found in southern Ontario, where its northern limit is in proximity to Sudbury. Due to its rarity, their distribution is scattered.	**Yes** Potentially suitable habitat is present within the swamp and buildings on the Subject Lands and within the buildings in the Study Area.	**Very Low**
Butternut *Juglans cinerea*	END	END Schedule 1	END	In Ontario, Butternut usually grows alone or in small groups in deciduous forests. It prefers moist, well-drained soil and is often found along streams. It is also found on well-drained gravel sites and rarely on dry rocky soil. This species does not do well in the shade, and often grows in sunny openings and near forest edges.	Butternut can be found throughout central and eastern North America. In Canada, Butternut occurs in Ontario, Quebec and New Brunswick. In Ontario, this species is found throughout the southwest, north to the Bruce Peninsula, and south of the Canadian Shield.	**Yes** Potentially suitable habitat is present within the woodland and hedgerow habitat on the Subject Lands and within the Study Area.	**Not present** (species not located on Subject Lands or within the Study Area during targeted field surveys in 2013, 2014 and 2020)
Blanding's Turtle *Emydoidea blandingii*	THR	THR Schedule 1	END	Blanding's Turtles live in shallow water, usually in large wetlands and shallow lakes with lots of water plants. It is not unusual, though, to find them hundreds of metres from the nearest water body, especially while they are searching for a mate or traveling to a nesting site. Blanding's Turtles hibernate in the mud at the bottom of permanent water bodies from late October until the end of April.	The Blanding's Turtle is found in and around the Great Lakes Basin, with isolated populations elsewhere in the United States and Canada. In Canada, the Blanding's Turtle is separated into the Great Lakes-St. Lawrence population and the Nova Scotia population. Blanding's Turtles can be found throughout southern, central and eastern Ontario.	**Yes** Potentially suitable habitat is present within the Bolton PSW complex in the Study Area and could potentially transverse the Subject Lands.	**Not Present** (Species record located far from Study Area; Blanding's Turtle would not be able to travel to Study Area)
Eastern Ribbonsnake *Thamnophis sauritus*	SC	SC Schedule 1	SC	The Eastern Ribbonsnake is usually found close to water, especially in marshes, where it hunts for frogs and small fish. A good swimmer, it will dive in shallow water, especially if it is fleeing from a potential predator. At the onset of cold weather, these snakes congregate in underground burrows or rock crevices to hibernate together.	In Ontario the eastern Ribbonsnake occurs throughout southern and eastern Ontario and is locally common in parts of the Bruce Peninsula, Georgian Bay and eastern Ontario.	**Yes** Potentially suitable habitat is present within the wetland habitat on the Subject Lands and within the Bolton PSW complex within the Study Area.	**Not Present** Species record from 1984.
Snapping Turtle *Chelydra serpentina*	SC	SC Schedule 1	SC	Snapping Turtles spend most of their lives in water. They prefer shallow waters so they can hide under the soft mud and leaf litter, with only their noses exposed to the surface to breathe. During the nesting season, from early to mid summer, females travel overland in search of a suitable nesting site, usually gravelly or sandy areas along streams. Snapping Turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.	The Snapping Turtle's range extends from Ecuador to Canada. In Canada this turtle can be found from Saskatchewan to Nova Scotia. It is primarily limited to the southern part of Ontario. The Snapping Turtle's range is contracting.	**Yes** Potentially suitable habitat is present within the wetland habitat on the Subject Lands and within the Bolton PSW complex in the Study Area.	**Moderate** (species located within the Study Area close to the Bolton PSW complex by Dougan *et al*. (2014b); species not located in 2020)

Glossary

EXP	ESA - Extirpated - a species that no longer exists in the wild in Ontario but still occurs elsewhere.
	SARA - Extirpated - a wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
END	ESA - Endangered - a species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's Endangered Species Act.
	SARA - Endangered - a wildlife species that is facing imminent extirpation or extinction.
THR	ESA - Threatened - a species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
	SARA - Threatened - a wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.
SC	ESA - Special Concern (formerly Vulnerable) - a species with characteristics that make it sensitive to human activities or natural events.
	SARA - Special Concern - a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
MNRF	Ontario Ministry of Natural Resources and Forestry
ESA	Endangered Species Act (Provincial)
SARA	Species at Risk Act (Federal)
Schedule 1	The official list of species that are classified as extirpated, endangered, threatened, and of special concern.
Schedule 2	Species listed in Schedule 2 are species that had been designated as endangered or threatened, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.
Schedule 3	Species listed in Schedule 3 are species that had been designated as special concern, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.
COSEWIC	Committee on the Status of Endangered Wildlife in Canada - a committee of experts that assesses and designates which wild species are in some danger of disappearing from Canada.

References

1 - Species at Risk. Ontario Ministry of Natural Resources and Forestry. http://www.mnr.gov.on.ca/en/Business/Species/index.html. © Queens Printer for Ontario, 2013.

2 - Species at Risk Status Reports. Committed on the Status of Endangered Wildlife in Canada. Ottawa. http://www.sararegistry.gc.ca/search/advSearchResults_e.cfm?stype=doc&docID=18.