BEACON ENVIRONMENTAL

GUIDING SOLUTIONS IN THE NATURAL ENVIRONMENT

Millcroft Golf Club
Scoped Environmental Evaluation Report

Prepared For:

Millcroft Greens Corporation

Prepared By:

Beacon Environmental Limited

Date: *Project:*

November 2020 **216081.2**

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1. Introduction

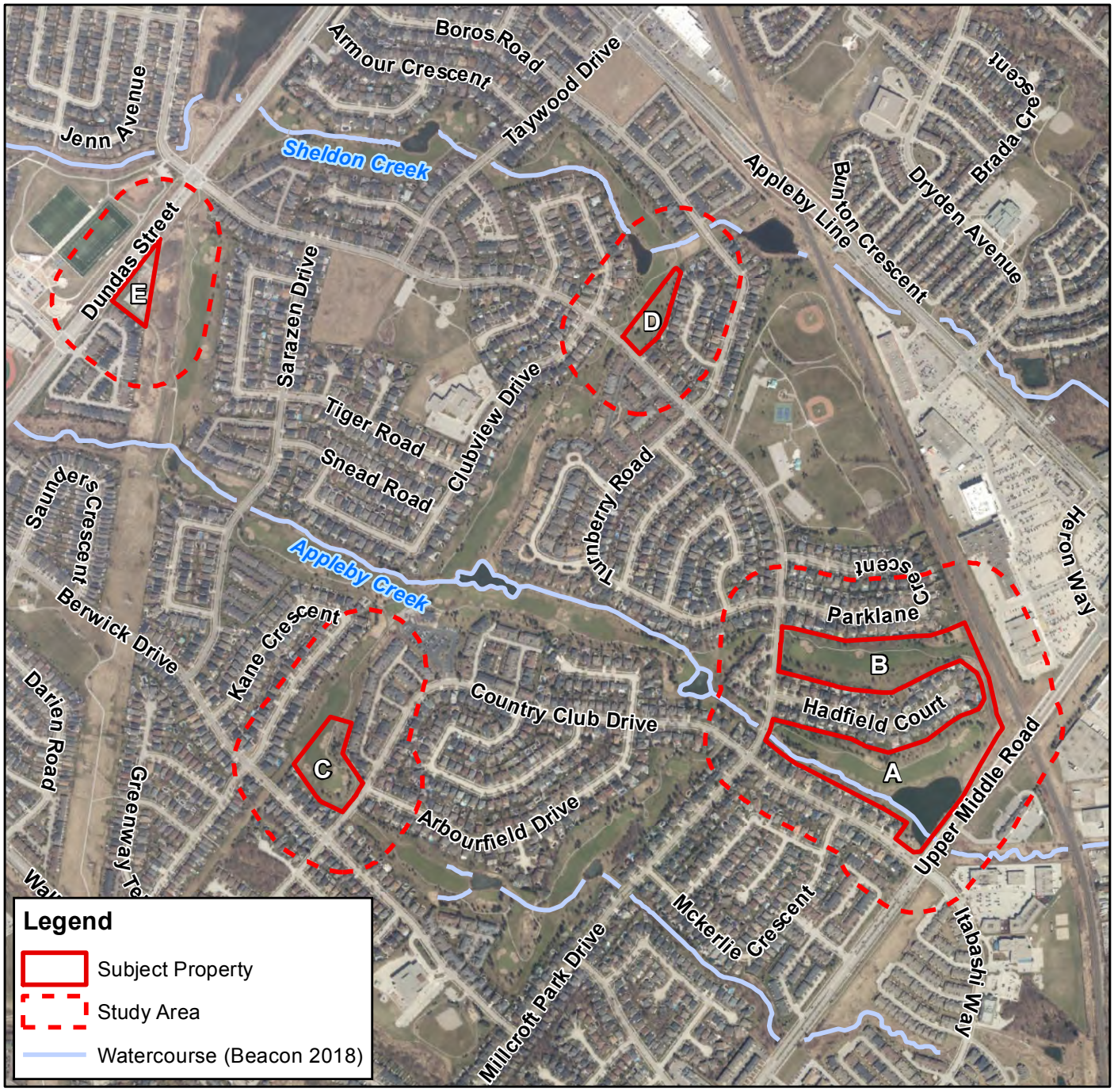
Beacon Environmental Limited (Beacon) was retained by Millcroft Greens Corporation (the proponent) to prepare a Scoped Environmental Evaluation Report (EER) for the property located at 2155 Country Club Drive and 4274 Dundas Street in the City of Burlington (**Figure 1**). The subject property corresponds with proposed development areas located in golf course holes #1, #6, #7, #16 and the operations and maintenance yard north of Hole #12 of the Millcroft Golf Club and includes an area of 13.40 hectares. For ease of reference, these proposed development parcels/areas have been ascribed the alphabetical identifiers A - E. The subject property is currently designated as Major Parks and Open Space in the City of Burlington Official Plan and is zoned Open Space. The subject property is designated Urban Area and Regional Natural Heritage System (RNHS) in the Region of Halton Official Plan (ROP). The proponent is proposing to redevelop the subject property for residential uses. This EER is required to support applications for an Official Plan Amendment, Zoning By-law Amendment and Draft Plan of Subdivision.

The subject property consists predominantly of existing golf greens and associated landscaping. Appleby Creek flanks the western boundary of the subject property and flows into a large dug online pond (Mill Pond) at the corner of Country Club Drive and Upper Middle Road (Area A). Sheldon Creek flanks the eastern boundary of Area D and flows through a series of dug ponds, including a large pond at the Canadian National Rail line overpass of Appleby Line near Millcroft Park. The Mill Pond is used for golf course irrigation and, although not designed for stormwater management, likely provides some limited stormwater management functions for portions of the adjoining residential development near Areas A and B.

Prior to consideration of the redevelopment of portions of the golf course for residential uses, Millcroft Golf Club's Permit to Take Water (PTTW) required renewal. The current PTTW is for the use of water from the Mill Pond to irrigate the golf course. Through the PTTW renewal process, the Ministry of Environment, Conservation and Parks (MECP) identified the need for the golf club to take the pond offline and reinstate a portion of the Appleby Creek channel. The works associated with the PTTW application relate to the proposed residential development in Areas A and B in that the reconfigured, offline Mill Pond is proposed to accept stormwater flows from both Areas A and B and some adjacent residential lands; the updated flood mapping influences the proposed development; the crossing of the realigned channel proposed as part of the PTTW works will be integrated into the trail network associated with the proposed development; and, landscape design associated with the PTTW works will be coordinated to compliment the vision for open space areas proposed for the development. The Mill Pond is still proposed to support the Millcroft Golf Club's irrigation needs post-development.

Appleby Creek, Sheldon Creek and their associated floodplains are designated as part of the RNHS and regulated by Conservation Halton (CH) pursuant to Ontario Regulation 162/06. Section 2.5 within Part II of City of Burlington Official Plan (OP) contains policies requiring that an EER be prepared in support of development or site alteration applications that are located within or adjacent to watercourses and fish habitat as well as CH regulated features such as valleylands, floodplains and wetlands. The purpose of the EER is to demonstrate that the proposed development and/or site alteration will not have a negative impact on significant natural heritage features and functions.

For the purposes of this report, an EER has been deemed equivalent to, and synonymous with the following:





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Subject Property	Figure 1
Millcroft Golf Club	
BEACON ENVIRONMENTAL	Project: 216081.2 Last Revised: November, 2020
Client: Millcroft Greens Corporation	Prepared by: DU Checked by: AB
N	1:12,000 / Inset Map:1:50,000

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- Region of Halton Environmental Impact Assessment (EIA) - The requirement for an EIA is specified within section 141 of Regional Official Plan Amendment (ROPA) 38 Part IV Healthy Communities Policies. The purpose of an EIA is to demonstrate that a proposed development will result in no overall negative impacts to the functions and features of that portion of the RNHS affected by the development. This is completed by identifying natural features, functions and values and assessing the potential environmental impacts, requirements for impact avoidance and mitigation measures, and opportunities for enhancement.

- CH Environmental Impact Study (EIS) - An EIS is an objective assessment of a development proposal in or adjacent to significant natural areas or features of interest and whether the proposed development might reasonably be expected to change the biological and physical characteristics and/or integrity of an area and to what extent. An EIS is required to be conducted when a development is proposed within or adjacent to a significant natural area or feature and is reasonably expected to have adverse effects on the area or feature as a result of changes in land use. The EIS identifies anticipated adverse impacts of a proposal on the significant area or feature and recommends ways to avoid or minimize these effects and enhance the area if feasible.

This EER has been prepared in general accordance with the 2014 Halton Region Environmental Impact Assessment Guidelines and in consultation with the Region, City of Burlington and CH.

This EER summarizes the environmental policy framework, uses background information and field studies to characterize existing biophysical conditions and functions, evaluates the significance and sensitivity of Key Features, identifies constraints and opportunities, assesses impacts of the proposed redevelopment, recommends protection and impact avoidance measures as well as enhancements to the RNHS, and demonstrates conformity with applicable federal, provincial, conservation authority and municipal environmental policies and regulations.

1.1 Study Area

The Study Area includes the subject property as well as adjacent lands (i.e., those within 120 m of the subject property), including portions of the Appleby Creek corridor upstream and downstream of Area A and portions of the Sheldon Creek corridor adjacent to Area D (**Figure 1**).

1.2 Study Objectives

The general objectives of this scoped EER are as follows:

a) To characterize existing natural heritage features and functions using background information and site-specific investigations;
b) To evaluate the significance of natural heritage features and functions;
c) To identify natural heritage and natural hazard constraints to future redevelopment;
d) To assess potential impacts to natural heritage features and functions that may result from the proposed development and related site alterations;
e) To assess potential impacts to natural hazards through collaboration with other technical disciplines including engineering and fluvial geomorphology;

f) To recommend measures for mitigating impacts and for restoring and enhancing natural heritage features and functions; and
g) To assess whether the proposed redevelopment is in conformity with applicable environmental protection policies, regulations and legislation at the federal, provincial, conservation authority and municipal scales.

1.3 Study Requirements – Terms of Reference

Terms of Reference (TOR) for the EER were prepared and circulated to the City of Burlington, Halton Region and CH on February 7, 2020 and were finalized on July 9, 2020. Notably, extensive discussions regarding the TOR were had with CH between these dates. A copy of the final TOR is included in **Appendix A**.

1.4 Project Study Team

To ensure that the EER has been prepared using an integrated approach, the report includes reference to other technical reports and drawings prepared by members of the Project Study Team. Members of the multi-disciplinary team and the studies prepared are listed below:

- Wellings Planning – planning report; draft plan;
- Jennifer Lawrence and Associates Inc. – environmental planning and study team coordination;
- Gerrard Design – concept plans;
- Beacon Environmental Limited – EER, geomorphic assessment, tree inventory and arborist report;
- Urbantech Consulting Engineering – hydrology, stormwater management, site servicing and grading;
- R.J. Burnside & Associates Limited (R. J. Burnside) – hydrogeology;
- DS Consultants Limited (DSCL) – geotechnical;
- Rady-Pentek and Edwards Surveying Ltd. – topographic survey, tree survey;
- Crozier and Associates – traffic impact study; and
- NAK Design Strategies – conceptual landscape design.

1.5 Report Outline

A description of the EER structure and section contents is provided below:

- **Section 1 – Introduction:** outlines the purpose, objectives and scope of work, and presents the study organization.
- **Section 2 – Environmental Policy Framework:** summarizes the applicable environmental planning policies, legislation and regulations that are directly relevant to the Study Area and proposed development.
- **Section 3 – Study Methodology:** describes the various methodologies used to characterize the biophysical environment.

- **Section 4 – Results:** includes detailed results of the background and/or field studies for each technical discipline/component of the EER. This section is organized by Area (i.e. Areas A – E).
- **Section 5 – Evaluation of Significance:** evaluation of natural heritage features and functions to determine their level of significance.
- **Section 6 – Description of the Proposed Development:** describes the proposed development plan and associated works (i.e. stormwater management and flood plain modifications, channel reinstatement, grading and servicing).
- **Section 7 – Impact Assessment and Mitigation**: presented in matrix format, the impact assessment assesses potential impacts of the proposed development on natural heritage features and functions by Area. Where impacts cannot be avoided, mitigation measures have been specified.
- **Section 8 – Constraints and Opportunities:** summarizes the natural heritage and natural hazard related constraints to future development, including application of buffers and setbacks prescribed by applicable policies and regulations.
- **Section 9 – Implementation Plans:** includes high-level summaries of the proposed Restoration and Enhancement Plan, Tree Preservation Plan and Erosion and Sediment Control Plan.
- **Section 10 – Policy Conformity:** includes a summary of how the recommendations of the EER ensure policy compliance with all the applicable policies and legislation.
- **Section 11 – Conclusions**: summarizes key study findings and provides a concluding statement.

2. Environmental Policy Framework

The following subsections summarize legislation, policies and regulations that may be applicable to the Study Area and the proposed development. The summary is not intended to be comprehensive but has been included here to provide context for the various environmental protection requirements that must be considered through the EER.

2.1 *Fisheries Act*

Appleby Creek and Sheldon Creek traverse the Study Area and are known to support fish habitat. Fish habitat is protected under the Federal *Fisheries Act* (1985). In Ontario, the Federal Department of Fisheries and Oceans Canada (DFO) manages fish habitat and the Ontario Ministry of Natural Resources and Forestry (MNRF – formerly known as MNR or OMNR) manages fisheries.

The *Fisheries Act* was updated through Bill C-38 which came into effect November 25th, 2013. Former prohibitions on killing fish and causing Harmful Alteration, Disruption or Destruction (HADD) of fish habitat are now combined within a single prohibition in s. 35 (1) which precludes “any work, undertaking or activity that results in serious harm to fish” that are part of a commercial, recreational or aboriginal fishery, or to fish that support such a fishery. S. 35(2) provides that s. 35(1) does not apply where the work, undertaking or activity has been authorized by the Minister and is carried on in accordance with conditions established by the Minister.

Compliance with the provisions of s. 35 of the *Fisheries Act* in regard to particular water bodies is now made on a case-by-case basis through a self-assessment process to determine impacts to fish and fish habitat and to identify appropriate responses. Where development activities taking place in or near water may affect fisheries by adversely affecting fish or fish habitat, the Policy Statement (DFO 2013) recommends that proponents of these activities should:

- 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.

As per the Policy Statement (2013), efforts should be made to avoid impacts first. When avoidance is not possible, efforts should be made to mitigate impacts caused by the project in question. After these actions, any residual impacts should then be addressed by offsetting. An offset measure is one that "counterbalances unavoidable serious harm to fish resulting from a project with the goal of maintaining or improving the productivity of the commercial, recreational or Aboriginal fishery". Offset measures should support available fisheries management objectives and local restoration priorities and can take a variety of forms. Proponents are required to submit an offsetting plan to demonstrate that the measures and standards above are adhered to and will also be required to demonstrate that the offsetting measures will maintain or improve the productivity of fisheries. Typically, this work is done at the detailed design stage of a project where impacts to fish habitat is anticipated.

Fish and fish habitat are protected under the federal *Fisheries Act* (1985) which was last amended on August 28, 2019. The protection provisions of the *Fisheries Act* apply to all fish and fish habitat throughout Canada and the Act sets out authorities for the regulation of works, undertakings or activities that risk harming fish and fish habitat. Specifically, the protection provisions include two core prohibitions. One is against persons carrying on works, undertakings or activities that result in the "death of fish by means other than fishing" (subsection 34.4[1]), and the other is "harmful alteration, disruption or destruction of fish habitat" (subsection 35[1]; also referred to as "HADD"). The protection provisions are applied in conjunction with other applicable federal laws and regulations related to aquatic ecosystems, including the *Species at Risk Act*.

Fish habitat is defined in subsection 2(1) of the *Fisheries Act* to include all waters frequented by fish and any other areas upon which fish depend directly or indirectly to carry out their life processes. The types of areas that can directly or indirectly support life processes include, but are not limited to, spawning grounds and nursery, rearing, food supply and migration areas.

Under subsection 35(1) a person may carry on such works, undertakings or activities without contravening this prohibition, provided that they are carried on under the authority of one of the exceptions listed in subsection 35(2), and in accordance with the requirements of the appropriate exception. In most cases, this exception would be Ministerial authorizations granted to proponents in accordance with the *Authorizations Concerning Fish and Fish Habitat Protection Regulations* under the *Fisheries Act.*

Proponents are responsible for planning and implementing works, undertakings or activities in a manner that avoids harmful impacts, specifically the death of fish and HADD. Where proponents believe that their work, undertaking or activity will result in harmful impacts to fish and fish habitat, DFO will work with proponents to assess the risk of their proposed work, undertaking or activity resulting in the death of fish or HADD of fish habitat and provide advice and guidance on how to comply with the *Fisheries Act*.

2.2 *Species at Risk Act*

The Federal *Species at Risk Act* - SARA (2002) is intended to prevent federally endangered or threatened wildlife (including plants) from becoming extinct from the wild, and to help in the recovery of these species. This Act is also intended to help prevent species listed as Special Concern federally from becoming endangered or threatened. To ensure the protection of Species at Risk (SAR), SARA contains prohibitions that make it an offence to kill, harm, harass, capture, take, possess, collect, buy, sell or trade an individual of a species listed in Schedule 1 of SARA as endangered, threatened or extirpated.

SARA applies primarily to lands under Federal jurisdiction and relies upon provincial legislation to protect SAR habitat. On private lands, SARA prohibitions only apply to aquatic species and migratory birds that are also listed in the *Migratory Birds Convention Act* (1994). The intent of SARA is to protect critical habitat as much as possible through voluntary actions and stewardship measures.

2.3 Ontario *Endangered Species Act*

Species at Risk (SAR) in Ontario include those taxa that are listed as provincially endangered, threatened or special concern at the Provincial level. The *Endangered Species Act* – ESA (2007) regulates the habitat of those species that are endangered or threatened. Protection of special concern species is addressed through the category of Significant Wildlife Habitat (SWH) found in the Provincial Policy Statement, and the supporting Provincial guidelines.

The ESA provides legal protection to the habitats of endangered and threatened species where habitat has been confirmed on a site. Subsection 17(1) of the Act allows the Minster to issue a permit authorizing a person to engage in an activity that would otherwise be prohibited (under subsection 9(1) or 10(1) of the Act) provided the applicable legislative requirements of subsection 17(2) are satisfied. For context, relevant excerpts from the ESA are included below:

Subsection 9(1) states that:

> *No person shall,*
> *(a) kill, harm, harass, capture or take a living member of a species that is listed on the Species at Risk in Ontario List as an extirpated, endangered or threatened species;*
> *(b) possess, transport, collect, buy, sell, lease, trade or offer to buy, sell, lease or trade,*
> *(i) a living or dead member of a species that is listed on the Species at Risk in Ontario List as an extirpated, endangered or threatened species,*
> *(ii) any part of a living or dead member of a species referred to in subclause (i),*
> *(iii) anything derived from a living or dead member of a species referred to in subclause (i); or*
> *(c) sell, lease, trade or offer to sell, lease or trade anything that the person represents to be a thing described in subclause (b) (i), (ii) or (iii).*

Subsection 10(1)(a) of the Act states that:

> *No person shall damage or destroy the habitat of a species that is listed on the Species at Risk in Ontario list as an endangered or threatened species.*

The ESA Submission Standards for Activity Review and 17(2)(c) Overall Benefit Permits (MNRF 2012) is a document that provides guidance regarding permitting requirements under the ESA. Relevant excerpts are provided below:

> *There are four types of permits that may be issued for authorizing activities where the activity:*
> - *is necessary for the protection of human health or safety - clause 17(2)(a);*
> - *has the main purpose to assist, and would assist, in the protection or recovery of the species - clause 17(2)(b);*
> - *has the main purpose not to assist in the protection or recovery of the species, but through specific and mandatory conditions outlined in the permit will result in an overall benefit to the species within a reasonable time - clause 17(2)(c); and*
> - *will result in significant social or economic benefit to Ontario, but will not jeopardize the survival or recovery of species at risk - clause 17(2)(d).*
>
> *Permits may be issued where the following legislated requirements are satisfied:*
>
> *The Minister is of the opinion that the main purpose of the activity authorized by the permit is not to assist in the protection or recovery of the species specified in the permit; but,*
> - *(i) the Minister is of the opinion that an overall benefit to the species will be achieved within a reasonable time through requirements imposed by conditions of the permit,*
> - *(ii) the Minister is of the opinion that reasonable alternatives have been considered, including alternatives that would not adversely affect the species, and the best alternative has been adopted, and*
> - *(iii) the Minister is of the opinion that reasonable steps to minimize adverse effects on individual members of the species are required by conditions of the permit.*

The Minister is not obligated to issue an Overall Benefit Permit to a proponent. An Overall Benefit Permit may only be issued where the legislated requirements in clause 17(2)(c) of the Act will be met by the conditions in the permit.

2.4 Provincial Policy Statement

The Provincial Policy Statement (PPS) (MMAH 2020) 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. Development governed by the *Planning Act* must be consistent with the policy statements issued under the PPS.

Land use planning must be undertaken in a manner that is consistent with the PPS policies relating to the natural environment, while also being consistent with policies guiding efficient development and

land use patterns (Section 1.1) and integration of infrastructure and public service facilities (Section 1.6). Key excerpts from the natural environment policies found in Section 2.1 - Natural Heritage, Section 2.2 – Water, and Section 3.1 - Natural Hazards of the PPS are provided below.

2.4.1 Natural Heritage Policies

The PPS includes policies that speak to the identification and protection of natural heritage systems, as well as levels of protection for the various components that comprise such systems. The policies specific to natural heritage are found in Section 2.1 of the PPS and are provided in their entirety below. The Study Area falls within Ecoregion 7E.

2.1.1 Natural features and areas shall be protected for the long term.

2.1.2 The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.

2.1.3 Natural heritage systems shall be identified in Ecoregions 6E and 7E, recognizing that natural heritage systems will vary in size and form in settlement areas, rural areas, and prime agricultural areas.

2.1.4. Development and site alteration shall not be permitted in:
- *a) significant wetlands in Ecoregions 5E, 6E and 7E; and*
- *b) significant coastal wetlands.*

2.1.5 Development and site alteration shall not be permitted in:
- *a) significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E;*
- *b) significant woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River);*
- *c) significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River);*
- *d) significant wilidlife habitat;*
- *e) significant areas of natural and scientific interest; and*
- *f) coastal wetland in Ecoregions 5E, 6E and 7E that are not subject to policy 2.1.4(b);*

unless it has been demonstrated that there will be no *negative impacts* on the natural features or their *ecological functions*.

2.1.6 Development *and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements.*

2.1.7 Development *and site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements.*

2.1.8 Development *and site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.4, 2.1.5 and 2.1.6 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.*

2.1.9 Nothing in policy 2.1 is intended to limit the ability of agricultural uses to continue.

In terms of implementation, identification of the various natural heritage features noted above is a responsibility shared by the Province and the municipal planning authority. The Province is responsible for the confirmation of habitat of endangered and threatened species, and for its regulation under the ESA (as described in **Section 2.3**), as well as for the identification of Provincially Significant Wetlands (PSWs) and Areas of Natural and Scientific Interest (ANSIs). Local and regional planning authorities are responsible for the identification of Significant Woodlands, Significant Valleylands, and Significant Wildlife Habitat (SWH), with support from applicable guidance documents (i.e., Natural Heritage Reference Manual, MNRF 2010; Significant Wildlife Habitat Technical Guidelines, MNRF 2000; Significant Wildlife Habitat Criteria for Ecoregion 7E, MNRF 2015). Local and regional planning authorities in southern Ontario also typically work with the local conservation authority to identify and confirm non-PSWs that may have significance at the local or regional level. As described in **Section 2.1** above, identification and verification of fish habitat is now self-regulated although enforcement of the related policies and regulations is still managed by MNRF and regulated by DFO.

2.4.2 Water

Section 2.2 of the PPS directs planning authorities to protect, improve or restore the quality and quantity of surface and groundwater water resources through watershed and land use planning, as per the policies below cited in their entirety.

2.2.1 Planning authorities shall protect, improve or restore the quality and quantity of water by:

- *a. using the watershed as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development;*
- *b. minimizing potential negative impacts, including cross-jurisdictional and cross-watershed impacts;*
- *c. evaluating and preparing for the impacts of a changing climate to water resource systems at the watershed level;*
- *d. identifying water resource systems consisting of ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas, which are necessary for the ecological and hydrological integrity of the watershed;*
- *e. maintaining linkages and related functions among ground water features, hydrologic functions, natural heritage features and areas, and surface water features including shoreline areas;*
- *f. implementing necessary restrictions on development and site alteration to:*
  - *a. protect all municipal drinking water supplies and designated vulnerable areas; and*

b. protect, improve or restore vulnerable surface and ground water, sensitive surface water features and sensitive ground water features, and their hydrologic functions;

g. planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality;

h. ensuring consideration of environmental lake capacity, where applicable; and

i. ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.

2.2.2 Development and site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored.

Mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore sensitive surface water features, sensitive ground water features, and their hydrologic functions.

Water resources in the Study Area, including Appleby Creek and Sheldon Creek, are a key consideration of the EER. As with natural heritage, compliance with these policies requires a multi-disciplinary and integrated approach.

2.4.3 Natural Hazards

In addition to protection of natural heritage and water resources, the PPS also includes policy direction regarding "reducing the potential for public cost or risk to Ontario's residents from natural or human-made hazards". Section 3.1 of the PPS generally discourages development within identified natural hazards (i.e., areas that are at risk of flooding and / or erosion) as follows:

3.1.1 Development shall generally be directed, in accordance with guidance developed by the Province (as amended from time to time), to areas outside of:

a) Hazardous lands adjacent to the shorelines of the Great Lakes – St. Lawrence River System and large inland lakes which are impacted by flooding hazards, erosion hazards and/or dynamic beach hazards;

b) Hazardous lands adjacent to river, stream and small inland lake systems which are impacted by flooding hazards and/or erosion hazards; and

c) Hazardous sites.

3.1.2 Development and site alteration shall not be permitted within:

c) Areas that would be rendered inaccessible to people and vehicles during times of flooding hazards, erosion hazards and/or dynamic beach hazards, unless it has been demonstrated that the site has safe access appropriate for the nature of the development and the natural hazard; and

d) A floodway regardless of whether the area of inundation contains high points of land not subject to flooding.

3.1.3 Planning authorities shall prepare for the impacts of a changing climate that may increase the risk associated with natural hazards.

Natural hazards in the Study Area are associated with Appleby Creek and Sheldon Creek and include both flooding and erosion hazards.

2.5 Halton Region Official Plan

The ROP (2018) includes policies related to natural heritage systems, water management, servicing, soil erosion / contamination, and trees which apply to this redevelopment application. Excerpts from policies that are relevant to the proposed redevelopment are presented in the subsections below.

2.5.1 Regional Natural Heritage System Policies

One of the key requirements for this EER is the identification, confirmation and refinement of the boundaries of the RNHS as it relates to the subject property. ROP sections 113 to 118 contain policies that provide direction for development and site alteration proposals within and adjacent to the RNHS.

Policy 115.2 states that the RNHS consists of areas that are designated as NHS on ROP Map 1 as well as significant habitats of endangered and threatened species that are not mapped. ROP Map 1 illustrates the limits of Key Features of the RNHS. Those Key Features within the Study Area are shown on **Figure 2**. While this mapping is provided at a coarse scale, the limits of the RNHS appear to be based primarily on the regional floodline mapping for Appleby Creek and Sheldon Creek.

Policy 115.3 describes the various components that constitute the RNHS as follows:

115.3(1) Key Features, which include:
a) significant habitat of endangered and threatened species,
b) significant wetlands,
c) significant coastal wetlands,
d) significant woodlands,
e) significant valleylands,
f) significant wildlife habitat,
g) significant areas of natural and scientific interest,
h) fish habitat,

115.3(2) enhancements to the Key Features including Centres for Biodiversity,

115.3(3) linkages,

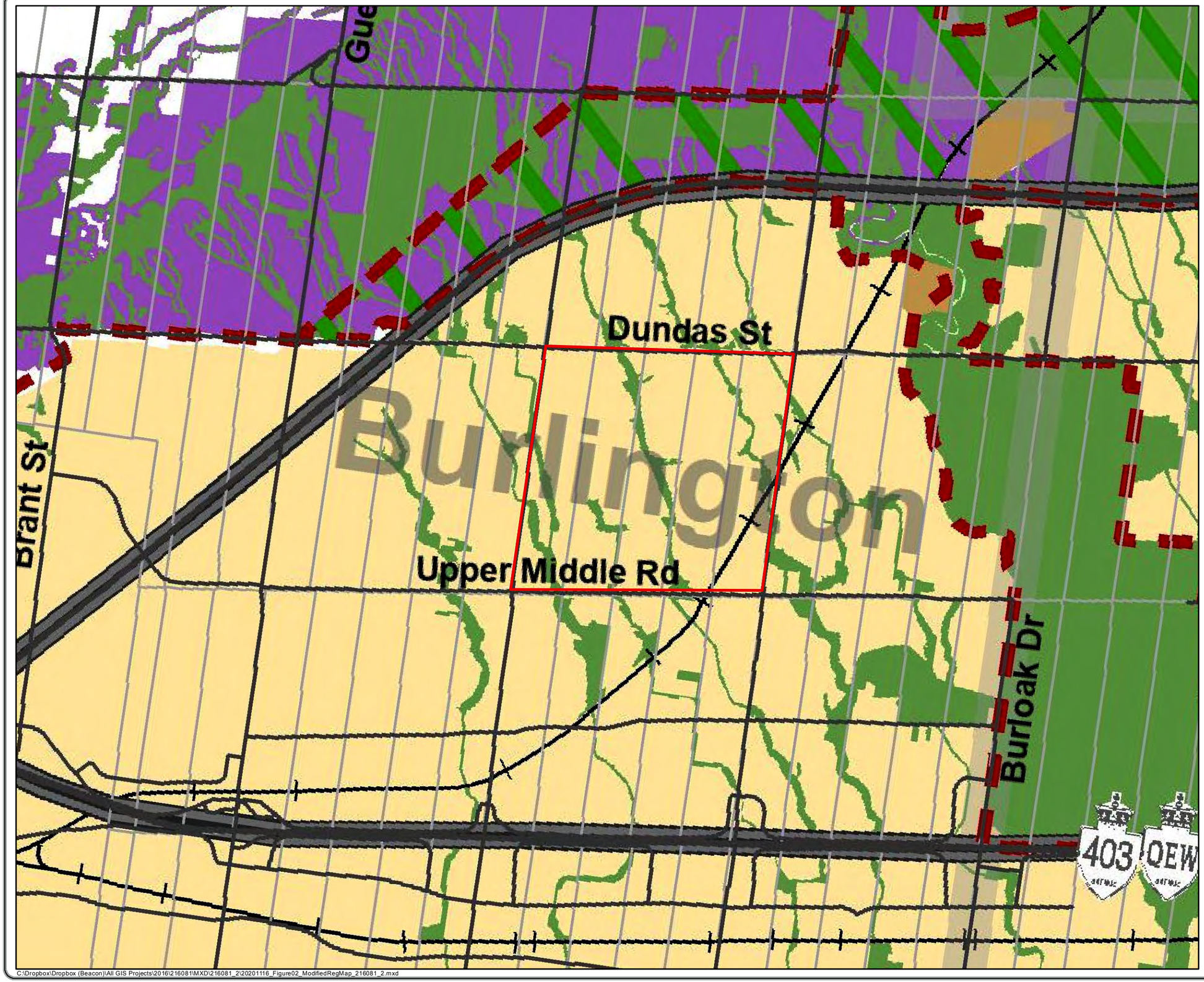
115.3(4) buffers,

115.3(5) watercourses that are within a Conservation Authority Regulation Limit or that provide a linkage to a wetland or a significant woodland, and

115.3(6) wetlands other than those considered significant under Section 115.3(1)b).

Policies 118(1) and 118(1.1) describe the protection requirements for the features listed above and identified through the local municipal planning process. Policy 118(2) relates to implementation of the RNHS as follows:

a) Prohibiting development and site alteration within significant wetlands, significant coastal wetlands, significant habitat of endangered and threatened species and fish habitat except in accordance with Provincial and Federal legislation or regulations;



Modified from Region of Halton OP Map 1G (2018)	Figure 2

Millcroft Golf Course

Legend

Study Area

BEACON ENVIRONMENTAL

Project: 216081.2
Last Revised: November, 2020

Client: Millcroft Greens Corporation	Prepared by: DU Checked by: AB

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Contains information licensed under the Open Government License–Ontario Orthoimagery Baselayer: Map-1G--Key-Features-within-the-Greenbelt-and-Regulation

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b) *Not permitting the alteration of any components of the Regional Natural Heritage System unless it has been demonstrated that there will be no negative impacts on the natural features and areas or their ecological functions;*
c) *Refining the boundaries of the Regional Natural Heritage System in accordance with Section 116.1; and*
d) *Introducing such refinements at an early stage of the development or site alteration application process and in the broadest available context so that there is greater flexibility to enhance the ecological functions of all components of the system and hence improve the long-term sustainability of the system as a whole.*

As indicated in s.118(2)(b), s.116.1 allows for the boundaries of the RNHS to be refined, with additions, deletions and / or boundary adjustments, through a Sub-watershed Study, an Environmental Impact Assessment (EIA), or similar studies based on terms of reference accepted by the Region. In this case, the EER is equivalent to an EIA, with the term EER used to conform to the City's policies.

With respect to an EIA (or an EER in this case), Policy 118(3) states:

> *The purpose of an EIA is to demonstrate that the proposed development or site alteration will result in no negative impacts to that portion of the Regional Natural Heritage System or unmapped Key Features affected by the development or site alteration by identifying components of the Regional Natural Heritage System as listed in Section 115.3 and their associated ecological functions and assessing the potential environmental impacts, requirements for impact avoidance and mitigation measures, and opportunities for enhancement.*

Wetlands, as defined by the Region, include:

> *Lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants.*

2.5.2 Environmental Quality Policies

Part IV of the ROP (2018) includes a section on Environmental Quality, with a number of general policies that speak to the need for an impact assessment in certain areas or under certain conditions, as well as support for use of alternative engineering standards to promote sustainability in land use planning (S. 141.8) (which have been incorporated into the proposed development plan for the subject property through the use of Low Impact Development (LID) measures).

Specific policies related to the protection water (Policy 145) and land (Policy 147) relevant to this EER include:

> *145. It is the policy of the Region to:*
> - *145(10) Encourage the protection and enhancement of watercourses and headwaters areas as an integral component for maintaining natural hydrological processes within a watershed.*
> - *145(12) Promote the regeneration of natural areas near watercourses.*

- *145(17) Consider the impact of development on fish habitat and ensure compliance with the* Federal Fisheries Act.
- *145(23) Restrict development and site alteration in or near sensitive surface and groundwater features and require the proponent to carry out an Environmental Impact Assessment in accordance with policies of this Plan and, undertake where appropriate, hydrogeological and hydrological studies to protect, improve or restore such features.*

147. It is the policy of the Region to:

(5) Recognize and protect trees as a renewable natural resource essential to the health and welfare of Halton residents, wildlife and rural environment, and to this end: …

(e) Support the Local Municipalities in requiring that all development proposals, to the maximum degree possible, preserve existing trees and plant additional trees in accordance with good forestry management practice.

(f) Require all development proposals to submit, at the time of initial application, an inventory of trees on site and a tree saving and planting plan unless the development will not result in the removal of any trees.

(6)(d) Promote the development of treescapes along streams and valleys so as to reduce flooding and excessive soil erosion, maintain stream banks and slope stability, and provide suitable fish habitat.

2.6 City of Burlington Official Plan

City of Burlington Council adopted a new OP on April 26, 2018. The new OP is currently in the process of being updated to address conformity with the ROP. Until the new plan is approved by the Region and Province, the City of Burlington's current Official Plan (approved in 2008, October 2017 Consolidation) remains in force.

For the purposes of this EER, the policies of the current in force OP have been used, however consideration has also been given to the new OP by also addressing compliance with the ROP and PPS.

2.6.1 Natural Heritage Policies

The City of Burlington Official Plan identifies significant natural features using three separate land use designations as follows:

1. The Greenlands designation includes lands that form a permanent natural resource base consisting of natural features and open space areas which are ecologically sensitive;
2. The Major Parks and Open Space designation applies to community and city-wide parks and other public and private open space lands; and
3. The Watercourse designation applies to most of the creeks and drainage features.

The Study Area does not overlap with any Greenlands designated areas and is therefore not subject to policies in S. 6.2 of the City OP. The Study Area is designated as Major Parks and Open Space and subject to the policies of s. 6.3. While policy 6.3.h encourages environmental protection, there are no specific policies under this designation requiring protection of natural heritage features and functions. S. 6.4 relates to the Watercourse designation which has been applied to Appleby Creek and Sheldon Creek and includes policies relating to protection of life and property in floodplains. The Watercourse policies prohibit development in floodplains, but do encourage degraded watercourses to be restored and enhanced to improve fish habitat. Furthermore, the policy specifies that: "Any works within or near a watercourse shall be reviewed by the City and Conservation Halton for floodplain implications" and that "new development adjacent to watercourses shall be subject to a setback from the stable top of bank, the regulatory floodplain and meander belt width (whichever is the greater) that are associated with the watercourse" as determined by the City, in conjunction with CH.

In addition, the City of Burlington uses the same definition of wetland as the Region (see end of **Section 2.5.1**).

2.6.2 Environmental Evaluation Policies

Section 2.5 of the City OP Functional Policies (Part II) include policies requiring that an EER be prepared in support of development applications to the satisfaction of the City. The requirement for an EER is generally triggered by the proximity of a development application relative to natural features. In the case of the subject property, the proposed development will occur on lands adjacent to a watercourse and associated floodplain and triggers the need for an EER. Section 2.5 (c) and (d), also require the EER to fulfill the requirements of a Regional EIA and Conservation Authority's EIA. Section 2.5 (e) further refers to the use of the Region's EIA Guidelines, which are being followed for this EER. Section 2.5 (g) outlines a process for preparing Terms of Reference for the EER through pre-consultation with the City and partner agencies and Section 2.5 (h) relates to confirmation of natural heritage feature boundaries with City and agency staff.

The City also requires that the EER include recommendations for buffers and development setbacks [S. 2.5 (j)], and plans to restore any degraded open space and environmental features [S.2.5 (l)].

2.6.3 Sustainable Design and Compatibility

Section 2.7 of the City OP Functional Policies (Part II) states that: "To the greatest extent possible, proposed development shall be consistent with the goals and objectives of Sustainable Development". This includes consideration for efficiency, accessibility (by foot, bicycle and public transit), preservation of existing trees and other vegetation, enhancement of the City's urban forest canopy and compatibility with existing significant natural features. These requirements are included within the approved EER ToR and/or are within this EER as well as other supporting reports such as the FSR (Urbantech 2020).

2.6.4 Storm Water Management Policies

Section 2.11 of the City OP Functional Policies (Part II) includes policies related to storm water management. These policies require consideration of flooding, erosion, hydrogeology, storm water quality and sedimentation, and implementing storm water management techniques that are naturalistic as opposed to man-made and maintaining and restoring natural hydrologic and ecologic function of significant watercourses.

Polices considered relevant to this proposal are listed below:

2.11.2.1(a)	*To ensure that future development does not increase the risk of property damage and danger to life from flooding.*
2.11.2.1 (b)	*To reduce flood potential in areas that are flood-prone.*
2.11.2.1 (c)	*To manage flooding concerns in a way that maintains or enhances fish habitat and other natural resource features.*
2.11.2.2(a)	*To minimize the adverse impact of development on downstream watercourse erosion.*
2.11.2.2(e)	*To ensure that future development does not increase the risk of property damage and danger to life from erosion.*
2.11.2.3 (a)	*To control future development in a way that maintains and/or enhances significant groundwater recharge and prevents undesirable groundwater level decline and reduction in base flow to watercourses.*
2.11.2.3 (b)	*To ensure base flow maintains permanent and seasonal fish habitat where it exists naturally.*
2.11.2.3(c)	*To minimize the possible negative effects on groundwater quality from land use practices and/or development.*
2.11.2.4 (a)	*To control the quality of storm water runoff from future developed surfaces so that the natural surface water and groundwater quality is maintained or restored.*

2.7 *Conservation Authorities Act* and Conservation Halton Regulations and Policies

CH regulates development, including site alteration, within and adjacent to wetlands, watercourses and valleylands under Ontario Regulation 162/06 (*Regulation for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*) pursuant to Section 28 of the *Conservation Authorities Act*.

The regulation enables CH to grant permission for development within these areas if, in its opinion, the control of flooding, erosion, pollution, or the conservation of land will not be affected by the development.

According to Policies 3.1 and 3.2 of the *Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document* (Conservation Halton 2016a), development is generally prohibited:

- Within a watercourse, valleyland, hazardous lands, wetland and lands adjacent or close to the shoreline of the Great Lakes-St. Lawrence River System or to inland lakes that may be affected by flooding, erosion or dynamic beaches;
- Within 15 metres of the stable top of bank of a major valley system and 7.5 metres of the stable top of bank of a minor valley system, where a valley is apparent;
- Within 15 metres from the greater of the limit of the flood plain or the predicted meander belt width of a watercourse associated with a major valley system and within 7.5 metres from the greater of the limit of the flood plain or the predicted meander belt width of a watercourse associated with a minor valley system, where a valley is not apparent;
- Within 120 metres of a Provincially Significant Wetland and all wetlands greater than or equal to 2 hectares in size;

- Within 30 metres of wetlands less than 2 hectares in size;
- Within 5 metres of the furthest landward extent of the aggregate of the flooding, erosion and dynamic beach hazards along the Lake Ontario and Hamilton Harbour shorelines; and
- Hazardous lands.

However, policies 3.4 – 3.53 (inclusive) do provide for some exceptions to the above prohibitions.

As outlined in Policy 3.4 (Slopes and Slope Stability), Appleby and Sheldon Creeks are considered to be minor valley systems. As such, a 7.5m regulatory allowance adjacent to the greater of the erosion or flood plain hazard would be applicable.

In addition to its regulatory responsibilities under the *Conservation Authorities Act*, CH provides an advisory role to municipalities through the planning process. Relevant policies provided in Section 4 of the *Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document* (Conservation Halton 2016a) include:

- A minimum 7.5 m (minor valley) lot line setback from flooding and erosion hazards for new development (s.4.2.3), and similar setbacks for valleylands (s.4.3.2);
- A minimum 15 m vegetation protection zone from the limit of non-PSW wetlands less than 2 ha (s.4.4.3);
- A minimum lot line setback of 30 m from PSW or other protected wetlands greater than 2 ha, and 15 m from other wetlands less than 2 ha for new development (s.4.4.4); and
- A minimum 10 m development and site alteration setback from the treed dripline of significant woodlands outside the Greenbelt Plan (s.4.6.4), in the absence of an up-to-date and approved subwatershed plan.

Wetland, as defined in the *Conservation Authorities Act* means land that:

a) Is seasonally or permanently covered by shallow water or has a water table close to or at its surface;
b) Directly contributes to the hydrological function of a watershed through connection with a surface watercourse;
c) Has hydric soils, the formation of which has been caused by the presence of abundant water; and
d) Has vegetation dominated by hydrophytic plants or water tolerant plants, the dominance of which has been favoured by the presence of abundant water.

but does not include periodically soaked or wet land that is used for agricultural purposes and no longer exhibits a wetland characteristic referred to in clause c) or d).

The Study Area includes regulated areas such as valleylands, flood plains, watercourses and wetlands. Under Ontario Regulation 162/06, any development or site alteration proposed within a regulated area requires a permit from CH.

CH no longer completes screenings on behalf of DFO under the Federal *Fisheries Act*, and so overseeing fish habitat related approvals is no longer within CH's delegated responsibility.

3. Study Methodology

3.1 Characterization of the Physical Environment

3.1.1 Bedrock and Surficial Geology

Bedrock and surficial geology in the Study Area was described using background studies. Refer to Geotechnical Report prepared by DS Consultants Ltd. (DSCL) (2020).

3.1.2 Physiography

The physiography of the Study Area was characterized by referencing Chapman and Putnam (1984).

3.1.3 Topography

A topographic survey was completed for subject property by Rady-Pentek and Edwards Surveying Ltd. in October 2018.

3.1.4 Soils

Soils in the Study Area were generally characterized using information available from *The Soils of Halton County* (Gillespie *et al*. 1971). Site-specific soil characterization was completed as part of the hydrogeological study completed by R.J. Burnside (2020) and vegetation community assessments completed by Beacon (see **Section 4.1.1** and applicable subsections under **Section 0**).

3.1.5 Groundwater

Groundwater resources in the Study Area are characterized in the Hydrogeological Investigation Report prepared by R.J. Burnside (2020). The investigation included a series of monitoring wells and a piezometer nest within Appleby Creek. Groundwater monitoring is ongoing.

3.1.6 Surface Water and Drainage

Surface water resources in the Study Area are characterized in the FSR (Urbantech 2020). Drainage areas and catchments are mapped in that report.

3.1.7 Floodplain

Floodplain mapping for Appleby Creek (Area A) and Sheldon Creek (lands adjacent to Area D) was obtained from CH. The mapping was based on HEC-RAS modelling data applied at a coarse scale. Urbantech Consulting has completed a hydraulic analysis using more detailed topographic data and drainage, and modeled using HEC-RAS to further refine the floodplain mapping associated with Appleby Creek. The updated floodplain limits are shown in Drawing FP-1 of the FSR (Urbantech 2020).

As part of efforts to renew the PTTW application with the MECP, the golf course was directed to take the existing online pond north of Upper Middle Road offline to protect baseflow contributions to Appleby Creek. Urbantech Consulting, in consultation with R.J. Burnside and Associates Ltd (R.J. Burnside) and Aqualogic have prepared a preliminary design for this proposal, which includes a pedestrian crossing and reinstatement of the channel[1] (note: provided under separate cover and subject to a separate review and permitting process). The proposed floodplain limits are illustrated in Drawing FP-2 of the FSR (Urbantech 2020). Reconfiguration of the pond and channel and the proposed residential development do not result in an increase in flooding on existing lots along the Appleby Creek corridor, and represents an increase in flood storage compared to existing conditions.

3.1.8 Fluvial Geomorphology

3.1.8.1 Reach Delineation

To facilitate a systematic evaluation of the relevant portion of Appleby Creek, the watercourse was delineated into distinct reaches. Reaches are linear channel segments that exhibit similar morphologies and functions and respond consistently to changes in hydrology and sediment inputs, as well as to other modifying factors (Montgomery and Buffington 1997; Richards *et al*. 1997).

Within the Study Area, Appleby Creek was subdivided into four distinct reaches (AC-1, AC-2, AC-3 and AC-4). A single reach was delineated for the portion of Sheldon Creek relevant to the Study Area (SC-1). Reaches were identified from aerial photography by examining land use, degree of confinement, and riparian cover. Reaches were subsequently confirmed through field review.

3.1.8.2 Field Assessment

To characterize existing geomorphic conditions along the relevant reaches of Appleby Creek and Sheldon Creek, rapid field assessments were conducted on August 24, 2018 and October 25, 2019. The following standard rapid visual assessment methods were applied:

i. Rapid Geomorphic Assessment (RGA – MOE 2003)

RGA documents observed indicators of channel instability by quantifying observations using an index that identifies channel sensitivity. Sensitivity is based on evidence of aggradation, degradation, channel widening and planimetric form adjustment. The index produces values that indicate whether the channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40) or in adjustment (score >0.41).

ii. Rapid Stream Assessment Technique (RSAT – Galli 1996)

RSAT uses an index to quantify overall stream health and includes the consideration of biological indicators (Galli 1996). Observations concerning channel stability, channel scouring/sediment deposition, physical in-stream habitat, water quality, and riparian habitat conditions are used to calculate a rating that indicates whether the channel is in poor (<13), fair (13-24), good (25-34), or excellent (35-42) condition.

[1] *While related to the Millcroft Greens development proposal insomuch as the pond is located in Area A, the PTTW application is subject to a separate review and permitting process.*

iii. Downs Classification Method (Downs 1995)

The Downs (1995) classification method infers present and future potential adjustments based on physical observations, which indicate the stage of evolution, and type of adjustments that can be anticipated based on the channel evolution model. The resultant index classifies streams as stable, laterally migrating, enlarging, undercutting, aggrading, or recovering.

3.2 Characterization of the Biological Environment

Beacon ecologists undertook field investigations to inventory flora and fauna, assess physical terrain characteristics, and provide an assessment of the ecological features and functions within the Study Area. In most cases, adjacent lands were surveyed from the boundary of the subject property. Detailed aquatic surveys extended outside of the subject property within lands owned by the golf course. Details of the various field investigations are summarized in **Table 1**. Survey station locations are illustrated in **Figure 3**.

Table 1. Dates of Field Investigations

Survey Type	Dates of Surveys
Ecological Land Classification and Floristic Survey	October 23, 2018 and September 17, 2019
Tree Inventory	September 10, 2018 and September 17, 2019
Avifauna Surveys	June 7 and July 3, 2019
Anuran Surveys	April 18, May 27, and June 26, 2019
Turtle Survey	October 10, 2018
Aquatic Habitat	October 23, 2018
Aquatic Community	September 26, 2019
Incidental Wildlife Observations	Concurrent with all the above.

3.2.1 Background Review

The following background resources were reviewed to assist with characterization of the biological environment within the Study Area:

- MECP SAR Screening;
- Mapping, species records and natural areas records from the MNRF's Natural Heritage Information Centre (NHIC) online make-a-map database;
- CH's 2008 Long Term Environmental Monitoring Report (2009);
- CH's Fish Community Monitoring Fact Sheet (2016b);
- CH's Species Occurrence database information;
- Ontario Breeding Bird Atlas data;
- Atlas of the Mammals of Ontario;
- Ontario Nature Reptile and Amphibian Atlas; and
- Ontario Butterfly Atlas.

Biophysical Survey Locations

Figure 3

Millcroft Golf Club

Legend

- Subject Property, Area A and Area B
- Study Area
- Aquatic Survey Area
- Fish Sampling Locations
- Anuran Monitoring Stations
- Surface Water Temperature Monitoring Stations
- Watercourse (Beacon 2018)

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Checked by: AB

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A summary of relevant species records obtained from the above sources and their applicability to the proposal is contained in **Appendix C**.

3.2.2 Terrestrial Resources

3.2.2.1 Vegetation Communities & Floristic Survey

Vegetation communities on the subject property were classified and mapped on October 23, 2018 and September 17, 2019. A floristic survey was completed concurrently. Areas within the hydro right-of-way (i.e. directly adjacent to Area E) were also surveyed. Surveys were conducted in accordance with the methodology of the *Ecological Land Classification for Southern Ontario: First Approximation and Its Application* (Lee *et al*., 1998) by an ecologist certified by the MNRF in the Ecological Land Classification system.

To classify the ecological communities within the subject property, the entire site was walked, and discrete units of natural and semi-natural communities were delineated as polygons on an aerial photograph of the property. Information on site conditions, soils, vegetation composition and structure of each community was recorded, including dominant species, percent cover, and relative abundance of species in each height class.

At the request of CH, natural and semi-natural vegetation communities within 120 m of the subject property were classified to the community-series level using a combination of air photo interpretation and observations made from publicly accessible lands.

3.2.2.2 Tree Inventory and Assessment

An inventory and assessment of all trees with a diameter at breast height (DBH) of 10 centimetres or more was completed on September 10th, 2018 (Areas A and B) and September 17th, 2019 (Areas C, D and E) by Arborists Certified by the International Society of Arboriculture (ISA) in accordance with City of Burlington standards. All trees on or on public property directly adjacent to the subject property were assessed and data collected on the species, diameter, crown size, health and condition.

Each tree was assigned a condition rating of good, fair, poor, or dead, based on the following criteria:

- ***Poor*** – Severe dieback, significant lean, missing leader, major defects, significant decay and/or disease presence;
- ***Fair*** – Moderate dieback and/or lean, limb defects, multiple stems, moderate foliage damage from stress;
- ***Good*** – Healthy vigorous growth, minor visible defects or damage; or
- ***Dead*** – No live growth.

Tree condition was assessed based on presence and severity of flaws, damage, evidence of pests or diseases, structural condition, dead or dying branches, or other decline indicators.

Trees were tagged, with metal numbered labels, using a staple gun. The location of each tree was surveyed by Rady-Pentek & Edward Surveying Ltd., a Registered Ontario Land Surveyor.

3.2.2.3 Avifauna

Surveys were conducted in accordance with the protocols provided in the Ontario Breeding Bird Atlas Guide for Participants (Cadman *et al.*, 2007). The entirety of Areas A and B were walked such that all singing birds on the subject property, and in immediately adjacent lands (i.e., 50 to 100 m) could be heard or observed. All birds heard and seen were recorded in the location observed on an aerial photograph of the site. Due to the lack of habitat features present in Areas C-E, breeding bird surveys were not undertaken in these areas.

Conditions at the time of the surveys are presented in **Table 2**.

Table 2. Breeding Bird Survey Details

	Survey 1	Survey 2
Date:	June 7, 2019	July 3, 2019
Start Time:	6:05	6:40
End Time:	6:50	7:35
Temperature (˚C):	14	23
Wind speed (km/h):	0	0-1
Cloud cover (%):	0	20 - 100
Precipitation:	None	None

In addition, during vegetation community surveys the underside of the bridge at Upper Middle Road was investigated for evidence of nesting.

3.2.2.4 Reptiles

The pond in Area A was observed for evidence of basking turtles on October 10, 2018. At the time of the survey the air temperature was 26°C and water temperature within the pond was 21°C. Incidental observations were recorded as applicable for this and other ponds in the Study Area.

Turtle hibernation and nesting surveys were not conducted. Based on the context of and features present within the Study Area it is obvious that potential hibernation habitat, if present, is limited to soft-bottomed pond features that are deep enough not to fully freeze during the winter months. Potential nesting habitat, if present, would likely be limited to sand traps and the embankment along Upper Middle Road. As none of these features are proposed to be fully removed as part of the proposed development, it was agreed through conversations with CH (pers. comm.; May 7, 2020) that hibernation and nesting surveys are not required and were not included in the approved EER ToR.

To record the potential for snakes, when encountered cover objects were overturned and suitable basking spots searched visually during other field surveys. Similar to the rationale provided above for turtles, as habitat for snakes is not being proposed to be altered as part of the proposed development, more comprehensive surveys for snakes (e.g. coverboard surveys) were not conducted or required.

3.2.2.5 Anurans

Surveys were conducted according to the Marsh Monitoring Program protocols (MMP, Bird Studies Canada 2009). Suitable breeding habitat such as wetlands and ponds within and north of Area A were surveyed after dusk under suitable weather conditions. The surveys focused on the pond near Upper Middle Road, the pond upstream of Millcroft Park Drive, and the channel south of Millcroft Park Drive. Weather details (i.e., air temperature, precipitation, wind speed, and cloud cover) at the time of survey are detailed in **Table 3**.

Surveys were conducted using the point count method whereby the surveyor stands at a set point for a specific period of time and record all species that can be heard calling from the location. Each survey station was surveyed for three minutes. Calling activity for each species detected was assigned a call code as follows:

- 0 - no calls;
- 1 - individuals of one species can be counted, calls not simultaneous;
- 2 - some calls of one species simultaneous, numbers can be reliably estimated; and
- 3 - full chorus, calls continuous and overlapping.

For call codes of 1 and 2, the estimated number of calling individuals was recorded.

Table 3. Anuran Survey Details

	Survey 1	Survey 2	Survey 3
Date	April 18, 2019	May 27, 2019	June 26, 2019
Start Time (24 hr)	21:17	21:44	22:25
Air Temperature	16°C	17°C	19°C
Water Temperature	14°C	19°C	n/r
Wind Speed (Beaufort)	2	0	0
Cloud Cover (%)	100	100	10
Precipitation	Rain	None/Dry	None/Humid

3.2.3 Aquatic Resources

3.2.3.1 Aquatic Habitat Assessment

An aquatic habitat assessment of the reach of Appleby Creek within Area A was completed on October 23, 2018. The assessment follows the Rapid Assessment Methodology as described in Section 4 Module 4 of the Ontario Stream Assessment Protocol (OSAP) (Stanfield *et al.,* 2010). The assessment involved recording the following habitat characteristics :

- Stream morphology, runs, pools, riffles;
- Channel width and depth profile, bank height, bank stability;
- Substrate types and distribution;
- Seepage areas;
- Dams and obstructions;
- Riparian and in-stream cover type and extent;
- Floodplain vegetation;

- Wetland and pond areas; and
- Side channels and floodplain.

3.2.3.2 Aquatic Community

The aquatic community in Appleby Creek (Area A) was characterized using background information and supplemented with fish community data obtained through sampling. Sampling was completed on September 26, 2019 under the authority of the Scientific Collector's Permit #1094220. A Halltech backpack electrofisher (model HT 2000/05) was used. The observed channel began at the large pond located north of Upper Middle Road and extended to the smaller pond east of the Millcroft Clubhouse (see **Figure 3** for fish sampling locations). It took 2578.2 electroseconds to complete this length of channel. Fish were caught, identified, photographed and then returned to Appleby Creek.

3.2.3.3 Surface Water Temperature

Surface water temperatures in Appleby Creek and in the dug pond (Area A) are monitored by RJ Burnside at stations SS2 and SS3 respectively during the months of April to July between 2011 and 2019; these survey stations are located at the upstream and downstream end of the portion of Appleby Creek within Area A (see Figure 4 in Burnside 2020 for survey station locations). Beacon relied upon this temperature data to establish the thermal regime of the creek by examining minimum, average and maximum daily and monthly temperatures during the summer season.

4. Results

The following sections present a characterization of the biophysical form and function of the Study Area. **Section 4.1**, Physical Environment, addresses the Study Area as a whole with applicable focus on water resources and geomorphology in Area A. **Section 4.2**, Biological Environment, presents an individual characterization of each Area (A – E).

4.1 Physical Environment

4.1.1 Bedrock, Surficial Geology & Soils

Based on borehole data obtained from the Geotechnical Investigation (DSCL 2019), bedrock resources on the site consist of Queenston Shales which were encountered at depths of 1.5 metres (m) below ground surface (mbgs) to 6.1 mbgs. The bedrock is overlain by a shale complex and native till deposits of clayey silt, sandy silt till, and clayey silt till. The till is overlain by 0.8 m to 1.8 m of fill. Topsoil depths ranges from 130 to 350 millimetres (mm).

Soil mapping indicates that the Study Area is generally comprised of Chinguacousy Clay Loams with the Appleby Creek valley comprised of Jeddo Clay Loams (Gillespie *et al*. 1971)

4.1.2 Physiography

The Study Area overlaps with the South Slope physiographic region (Chapman and Putnam 1984). The South Slope is underlain by glacial till. Soil types in this area are predominantly clay, with some clay loam, and loam.

4.1.3 Topography

The topography of the Study Area is flat to rolling with an overall slope to the south/southeast. The topographic survey prepared by Rady-Pentek and Edwards Surveying Ltd. (October 2018) suggests that the topography ranges in elevation between the two golf holes/parcels:

- Area A, North East Block (golf hole #7) – 141.0 metres above sea level (masl) to 143.0 masl with a 2.0 m grade change; and
- Area A, South West Block (golf hole #6) – 137.0 masl to 141.0 masl, with a 4.0 m grade change.

4.1.4 Climate

Climate provides the driving energy for a fluvial system and directly influences basin hydrology and rates of channel erosion, particularly through precipitation. Precipitation records obtained from climate normals (1981-2010) recorded at the Burlington TS climate station (ID 6151064), located approximately 7 km southwest of the subject property, averaged 67 mm per month in winter (November through February), and 79 mm in summer (July and August; Environment Canada 2019). This increase over the summer months is likely a result of convective thunderstorms. While total precipitation amounts are greater during the summer months, snowmelt and rain-on-snow events tend to produce the highest flows within a watershed.

4.1.5 Groundwater Resources

Within all Areas of the subject property, shallow groundwater flow follows local topography and surface water drainage patterns and constitutes a local groundwater flow system that generally flows towards watercourses within the Study Area (i.e. Appleby Creek and Sheldon Creek) and ultimately towards Lake Ontario. Evidence of significant recharge was not observed by RJ Burnside (2020); the subject property is not considered an Area of Significant Groundwater Recharge or Highly Vulnerable Aquifer.

As previously mentioned, groundwater monitoring is ongoing and will continue through to the end of 2020 to monitor the seasonal fluctuations.

4.1.6 Surface Water Resources, Area A

The following drainage information was summarized from the FSR Urbantech 2020). In general, surface water internal to Area A drains towards the online pond in the south east corner of Area A. For detailed information on the location, size, and runoff coefficients for each of the subcatchments associated with the Blocks below, refer to the FSR (Urbantech 2020).

Area A, North East Block (golf hole #7)

The North East Block generally drains from the north west to the south east with an average slope of approximately 1%. The Block contains two internal subcatchments totalling 3.80 ha with a runoff coefficient of 0.30, and four external drainage subcatchments conveying drainage to the Block totalling 1.15 ha and having a runoff coefficient of 0.40.

Area A, South West Block (golf hole #6)

Like the North East Block, the South West Block generally drains from north west to south east with an average slope of approximately 1%. The South West Block contains two internal subcatchments totalling 3.80 ha with a runoff coefficient of 0.30, and two external drainage subcatchments conveying drainage to the Block totalling 0.59 ha and having a runoff coefficient of 0.40.

4.1.7 Flood Plain, Area A

As detailed in the FSR (Urbantech Consulting 2020), the reconfiguration of the online pond and channel (being proposed as a separate undertaking associated with the PTTW process) as well as the proposed fill placement to facilitate additional residential development, does not increase the existing floodlines; notably, capacity is increased.

4.1.8 Fluvial Geomorphology

4.1.8.1 AquaLogic (2016) Assessment, Area A

As part of efforts to renew the PTTW application with the MECP, the golf course was directed to take the existing online pond north of Upper Middle Road offline to protect baseflow contributions to Appleby Creek. AquaLogic completed a fluvial geomorphic study and functional channel design analysis in support of the proposed channel reinstatement to bypass the pond (Functional Channel Design and Instream Flow Needs, Appleby Creek, Millcroft Golf Club, City of Burlington, 2016).

The report characterized Appleby Creek at Upper Middle Road as a 3rd order watercourse with an upstream drainage area of 4.66 km^2. The report described topography through the relevant portion of golf course as a relatively flat muted till plain with minor valley wall definition. Gradual riparian naturalization was documented relative to the initial construction of the golf course.

The channel was noted as being well-defined, with bankfull width dimensions in the range of 4-5 m and depths of up to 1 m. Substrate was described as consisting of clay to sandy silt, with some gravel and occasional cobbles. The report noted that channel morphology was influenced by water levels within the pond (backwater influence) and plastic grid cell lining that was exposed in localized areas. The watercourse was well-connected to the floodplain, with some localized erosion scars and modest confinement. Dense vegetation encroachment was observed.

The primary objective of the functional design by Aqualogic was to provide a naturalized bypass channel without constraining the use of the existing pond as a source of irrigation water for the golf course and without affecting the golf course layout. In an effort to balance the cut and fill ratio during development, it is proposed that a bypass channel be aligned with the existing pond. The bypass channel has been

designed with an average bankfull gradient of 0.6%, and dimensions of 4.3-4.7 m in width and 0.87-0.90 m in depth to accommodate a bankfull (design) discharge of 2.2 m^3/s.

4.1.8.2 Historical Assessment, Area A

The following section presents an overview of historic conditions of the Study Area with respect to land use, land cover, and channel conditions along Appleby Creek based on interpretation of historic aerial photography. The historic assessment is used to determine the extent of human-induced changes within a watershed, particularly the degree to which channel planform adjustment and land use has changed over time, including a qualitative assessment of the degree of land use and channel planform change over time (**Appendix B** and **Table 4**).

Table 4. Summary of Key Historical Observations

Time Period	Source	Observations
1954	University of Toronto Library	Land use is predominantly agricultural. The railway track to the east of the study area was observed. Mature trees were noted within a woodlot at the southern extent of the Study Area, along Upper Middle Road. While Appleby Creek could be distinguished in the aerial image, particularly downstream of Upper Middle Road, distinct instream features could not be identified due to the scale of the imagery. Sheldon Creek could not be discerned in the aerial image.
1971	Northway/Photomap/Remote Sensing Ltd.	Minimal change was noted in land use, as the surrounding land use remained predominantly agricultural. The mature woodlot at the southern extent of the Study Area still remained. The alignment of Appleby Creek remained largely unchanged. Sheldon Creek appeared to have been channelized, as a result of agricultural activities.
1995	City of Burlington	Land use in the study area had changed significantly, with the construction of the golf course. Land use had started to become residential in the immediate surrounding area. However, further beyond the limits of the Study Area, land use remained agricultural. Appleby Creek and Sheldon Creek had been realigned to their current extents. Upstream of Reach SC-1, one of the online ponds had been constructed on the upstream side; the downstream pond near Appleby Line had not yet been constructed.
2017	City of Burlington	Residential development has continued to expand in the surrounding area. The commercial development at the intersection of Upper Middle Road and Appleby Line had also been constructed in the interim period. The downstream pond along Appleby Creek had also been constructed. Minimal change could be observed along Appleby Creek.

Reach Break and Photo Locations

Figure 4A

Millcroft Golf Course Geomorphic Assessment

Legend

- Subject Property, Area A and Area B
- Reach Breaks
- Watercourse (Beacon 2018)
- Photo Locations
- Pond

Tiger Road
Clubview Drive
Stonebridge Crescent
Montrose Crescent
Bonavista Crescent
Appleby Line
Heron Way
Appleby Creek
Turnberry Road
Parklane Crescent
AC-4
AC-3
AC-2
AC-1
Gleneagles Court
Hadfield Court
Upper Middle Road
Vermont Crescent
Arbourfield Drive
Millcroft Park Drive
Country Club Drive
Simcoe Drive
Susan Court
Itabashi Way
Berwick Drive
Gordie Tapp Crescent
Mckerlie Crescent
Atkinson Drive
19
18
17
16
15
14
13
12
11
10
9
8
7
6
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4
3
2
1

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Reach Break and Photo Locations

Figure 4B

Millcroft Golf Course Geomorphic Assessment

Legend

- Subject Property, Area D
- Study Area
- Reach Breaks
- Watercourse (Beacon 2018)
- Photo Locations
- Pond

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4.1.8.3 Rapid Assessments, Areas A and D

Results of the rapid assessments are summarized in **Table 5** and **Table 6**, below. A photographic record of current site conditions at the time of the assessment is provided in **Appendix D**. Photo locations are shown in **Figures 4A** and **4B**.

Appleby Creek (Area A)

Reach AC-1

Reach AC-1, located downstream of Upper Middle Road, was characterized as moderately sinuous, well-defined channel, situated within a confined valley setting. The reach displayed a low gradient, and low degree of entrenchment. Riparian vegetation consisted of grasses, shrubs, and herbaceous species, and extended approximately 1-5 channel widths in dimension. Bank angles ranged between 0-60 degrees, with less than 5% of banks displaying indicators of active erosion. Bank materials consisted of clay and silt. Pools and riffles were well-defined, with bankfull dimensions ranging 4.1-6.1 m in width and 0.45-0.60 m in depth.

Evidence of active erosion was limited to the presence of a large scour pool (measuring approximately 7.0 m in width) immediately downstream of Upper Middle Road; this section of the creek also appeared to have been channelized (straightened). The remaining portion of the reach had been subject to an historic natural channel design. Riffle substrate consisted of clay and silt, sand, gravel, and cobbles, while pool substrate consisted of clay and silt, sand, and gravel. Instream aquatic vegetation was present, occupying approximately 10% of wetted width, and generally consisted of emergent species. Large instream wood debris was generally absent.

An RGA score of 0.21 ('in transition') indicated that Reach AC-1 was stressed, exhibiting minor evidence of active adjustment in the form of widening and planform adjustment. Evidence for widening included basal scour on inside meander bends and on both sides of the channel through riffles, and fracture lines along the top of bank. Chute formation and a thalweg alignment out of phase with the meander form were indicators of planform adjustment. The RSAT score of 18 indicated that this reach had a fair degree of ecological health, with water quality, riparian habitat conditions, and physical instream habitat noted as limiting factors. The Downs model classified this reach as U – 'undercutting' based on active erosion along outer bends.

Reach AC-2

Reach AC-2 was characterized as a well-defined channel, situated in a partially confined setting, with a low sinuosity and low-moderate gradient; entrenchment was generally low. Riparian vegetation, which consisted of trees, shrubs, herbaceous species and manicured grass, was fragmented and generally extended than 1 channel width in dimension. Bank angles ranged between 0-30 degrees, and 5-30% of banks displayed evidence of active erosion. Bank materials consisted of clay, silt, and sand. Riffle and pool morphology was observed, with bankfull dimensions measuring 4.0-6.6 m in width and 0.4-0.65 m in depth. Bed substrate consisted of coarse sand, gravel and cobbles in the riffles, and clay, silt, coarse sand, and gravel in the pools. Instream aquatic vegetation consisted of emergent and submergent species, occupying approximately 10% of wetted width. Instream large wood debris was generally absent.

An RGA score of 0.19 indicated that Reach AC-2 was stable (in regime). Minor evidence of aggradation was observed through lobate bar and medial/lateral bar formation, while evidence for planimetric form adjustment included formation of chutes and thalweg out of phase with the meander form. The RSAT score of 21.5 for this reach indicated that it had a fair degree of ecological health, with riparian habitat conditions and water quality noted as limiting factors. The Downs model classified this reach as a combination of s – 'stable' and m – 'lateral migration' (initiation of alternating bank erosion in straightened channels or migration of only the sharpest bends).

Reach AC-3

Reach AC-3 was characterized as a well-defined channel. The reach displayed a low sinuosity, low gradient, and moderate degree of entrenchment. Riparian vegetation consisted of trees, shrubs, herbaceous species and manicured grass and generally extended less than 1 channel width in dimension. Bank angles ranged between 0-30 degrees, with less than 5% of banks displaying indicators of active erosion. Bank failures in the form of slumping were observed. Bank materials consisted of clay and silt. Riffle-pool morphology was observed, with bankfull channel dimensions in the range of 4.0-5.0 m in width and 0.45-0.58 m in depth. Bed substrate consisted of clay, silt, sand, gravel, and cobbles in the riffles, and clay, silt, sand, and gravel in the pools. An exposed geogrid lining was noted in both riffle and pools sections. Aquatic instream vegetation, which consisted of emergent species, was noted through 10-30% of the wetted width.

An RGA score of 0.22 (in transition) for Reach AC-3 indicated that this reach was stressed based on evidence of aggradation and planimetric form adjustment. Evidence of aggradation included medial and lateral bar formation, and deposition in the overbank zone. Evidence for planimetric form adjustment included formation of chutes and thalweg out of phase with the meander form. Evidence of degradation was also noted, such as scour pool formation downstream of culvert/outfall, and channel worn into undisturbed overburden. The RSAT scored this reach as having a fair degree of ecological health (23.5) with riparian habitat conditions, water quality and physical instream habitat limiting the score. The Downs model classified this reach as m – 'lateral migration' (initiation of alternating bank erosion in straightened channels or migration of only the sharpest bends).

Reach AC-4

Reach AC-4 was characterized as a well-defined channel situated in an unconfined valley setting, with a low gradient, sinuosity, and entrenchment. Riparian vegetation consisted of shrubs, herbaceous species and manicured grass. The buffer was fragmented, measuring less than 1 channel width in dimension. Bank angles ranged between 30-90 degrees, with less than 5% of banks displaying signs of active channel erosion. Bank materials consisted of clay and silt while substrate consisted of gravel, and pools were composed of clay, silt, sand, gravel, and cobbles. The channel was heavily modified, having been channelized; upstream and downstream reach limits were governed by the presence of online ponds. Active erosion was observed at the upstream transition between the online pond to the channel. Exposed geotextile lining was observed throughout the reach and a weir was present within the lower portion of the reach. Vegetation encroachment within the channel was extensive. Woody debris was absent.

Reach AC-4 was characterized as in regime (stable; RGA score of 0.06) due to a general lack of erosion and grade control influences associated with the online pond and weir. The RSAT score of 26 implies that this reach displayed a good-fair degree of ecological health. Riparian habitat conditions and physical instream habitat were limiting factors. The Downs model classified this reach as m – 'lateral

migration', with initiation of alternating bank erosion in straightened channels or migration of only the sharpest bends.

Sheldon Creek (north east of Area D)

Reach SC-1

Reach SC-1 was characterized as a well-defined, channelized watercourse situated within a narrow corridor, surrounded by the golf course and residential development. This reach was unconfined, with a low gradient, sinuosity, and degree of channel entrenchment. Riparian vegetation consisted of predominantly manicured grass, with trees and shrubs also present. This riparian buffer was fragmented, and generally extended 1-5 channel widths in dimension. Bank angles ranged between 0-30 degrees, and less than 5% of the banks displaying evidence of active erosion. Bank materials consisted of clay, silt, and sand. Riffle-pool development was not observed, as channel morphology was homogenous. Channel bed substrate consisted of clay, silt, and sand, with areas of exposed interlocking stone lining observed. Upstream of Turnberry Road, bankfull widths ranged between 2.7 m and 4.4 m, and bankfull depths ranged between 0.50 m and 0.60 m. Wetted widths were generally consistent, measuring 2.0 m, and wetted depths ranged between 0.15 m and 0.20 m. Downstream of Turnberry Road, channel morphology was heavily influenced by the backwater condition associated with the large pond. Bankfull dimensions mimicked the constructed corridor, with widths in the range of 8.0 m, and depths in the range of 0.65 m. Emergent aquatic instream vegetation was observed throughout the reach, with up to 80% coverage noted in the channel. Woody debris was generally absent.

The RGA resulted in a score of 0, indicating that this reach did not display any observable indicators of active geomorphic processes (e.g. excessive erosion or deposition). This observation was attributed to the constructed nature of the channel, as well as the moderating influence of the existing online ponds on flow conditions within the creek. The RSAT score of 21 indicated that this reach was in a fair degree of ecological health, with narrow riparian buffer conditions and minimal instream habitat diversity contributing to the lower score. The Downs model classified this stream as S – 'stable', with no observable morphological adjustment in process.

Table 5. General Reach Characteristics

Reach	Bankfull Width (m)	Bankfull Depth (m)	Channel Substrate	Riparian Vegetation	Notes
AC-1	4.1-6.1	0.45-0.60	Clay, silt, sand, gravel, cobbles	Shrubs, grasses, herbaceous	• Fragmented riparian vegetation • Deep scour pool present • Reach subject to previous channel design
AC-2	4.0-5.5	0.40-0.65	Clay, silt, sand, gravel, cobbles	Trees, shrubs, grasses, herbaceous	• Fragmented riparian vegetation • Reach subject to previous channel design • Geotextile and geoweb lined along majority of reach • Channel morphology is influenced by the downstream online pond

Reach	Bankfull Width (m)	Bankfull Depth (m)	Channel Substrate	Riparian Vegetation	Notes
AC-3	3.5-5.0	0.45-0.65	Clay, silt, gravel, cobbles	Trees, shrubs, herbaceous	• Fragmented riparian vegetation • Reach subject to previous channel design • Gravel deposition in overbank, downstream of culvert • Channel morphology is influenced by road crossing and online ponds
AC-4	Not measured due to degree of modification		Clay, silt, sand, gravel cobbles	Shrubs, grasses, herbaceous	• Fragmented riparian vegetation • Channel morphology influenced by instream weir
SC-1	2.7-4.4 (upstream) 8.0 (downstream)	0.50-0.60 (upstream) 0.25 (downstream)	Clay, silt, sand	Grasses, some trees and shrubs	• Fragmented riparian vegetation • Past channelization • Flow regime heavily influenced by online ponds • No observable morphological processes

Table 6. Rapid Assessment Results

Reach	Rapid Geomorphic Assessment			Rapid Stream Assessment Technique			Downs Classification Method
	Score	Condition	Dominant Mode of Adjustment	Score	Condition	Limiting Factor	
AC-1	0.21	In Transition	Widening, planimetric form adjustment	17.5	Fair	Riparian habitat conditions, water quality	U – 'undercutting'
AC-2	0.19	In Regime	Aggradation, planimetric form adjustment	21.5	Fair	Riparian habitat conditions, water quality, physical instream habitat	m – 'lateral migration'
AC-3	0.22	In Transition	Aggradation, planimetric form adjustment	23.5	Fair	Riparian habitat conditions	m – 'lateral migration'
AC-4	0.06	In Regime	N/A	26	Good-Fair	Riparian habitat conditions, physical instream habitat	m – 'lateral migration'
SC-1	0	In Regime	N/A	21	Fair	Riparian habitat conditions, physical instream habitat	S – 'stable'

4.1.8.4 Meander Belt

The meander belt width is generally defined as the lateral extent that a meandering channel has historically occupied and will likely occupy in the future. Due to the degree of historical modification along Appleby Creek (Area A) and Sheldon Creek (Area D) within the Study Area an empirical modelling approach that considers the existing watercourse conditions was used to develop recommended meander belt (B_w) dimensions. These models use simple power functions based on field-based measurements of the average bankfull width (W_b) and cross-sectional area (A), following relations from Williams (1986 – Equations 1 and 2) and Ward (2001 – Equation 3). Research by Ward et al. (2002) indicated that the Williams (1986) equation, at times, under-predicted the belt width dimensions. As such, a modified approach to the relation, which incorporates a 20% factor of safety, was applied.

$$B_w = ([18 * A^{0.65}]) \quad \text{[Eq. 1]}$$
$$B_w = \left(\left[4.3 * {W_b}^{1.12}\right] * 1.2\right) \quad \text{[Eq. 2]}$$
$$B_w = \left(\left[6 * {W_b}^{1.12}\right] + W_b\right) \quad \text{[Eq. 3]}$$

The results of the empirical relation analysis for Reaches AC-2 and AC-3 as well as SC-1 within the Study Area are presented in
Table 7 and illustrated in **Figure 5A** and **Figure 5B**. The recommended meander belt dimension of 35 m for Appleby Creek was found to be comparable to the most recent natural channel design section of Appleby Creek downstream of Dundas Street, for which the floodplain dimension of the corridor appeared to have a similar dimension. For Reach SC-1 of Sheldon Creek, the modelled approach referenced the portion of reach upstream of Turnberry Road, where channel dimensions did not appear to be as heavily influenced by the downstream pond water levels.

Table 7. Recommended Meander Belt

Reach	Empirical Approach			Recommended Meander Belt (m)
	Williams – Area (m)	Williams – Width (m)	Ward – Width (m)	
AC-2	34	34	45	35
AC-3	31	26	39	35
SC-1	26	20	27	25

4.1.8.5 Summary of Key Findings

The purpose of the geomorphic assessment completed as part of the EER is to characterize existing conditions and contribute to the determination of limits of development through the provision of meander belt limits. The following points summarize the key findings:

- A review of background information and aerial imagery indicated that both Appleby Creek (Area A) and Sheldon Creek (Area D) had been channelized historically within the Study Area;
- RGA results for Reaches AC-1, AC-2, AC-3, and AC-4 identified the reach as being in transition (0.21), in regime (0.19), in transition (0.22), and in regime (0.06) respectively. RGA results for SC-1 identified the reach as stable (0);



Meander Belt	Figure 5A

Millcroft Golf Course Geomorphic Assessment

Legend

- Subject Property, Area A and Area B
- Study Area
- Reach Breaks
- Meander Belt (35 m)
- Watercourse (Beacon 2018)
- Pond

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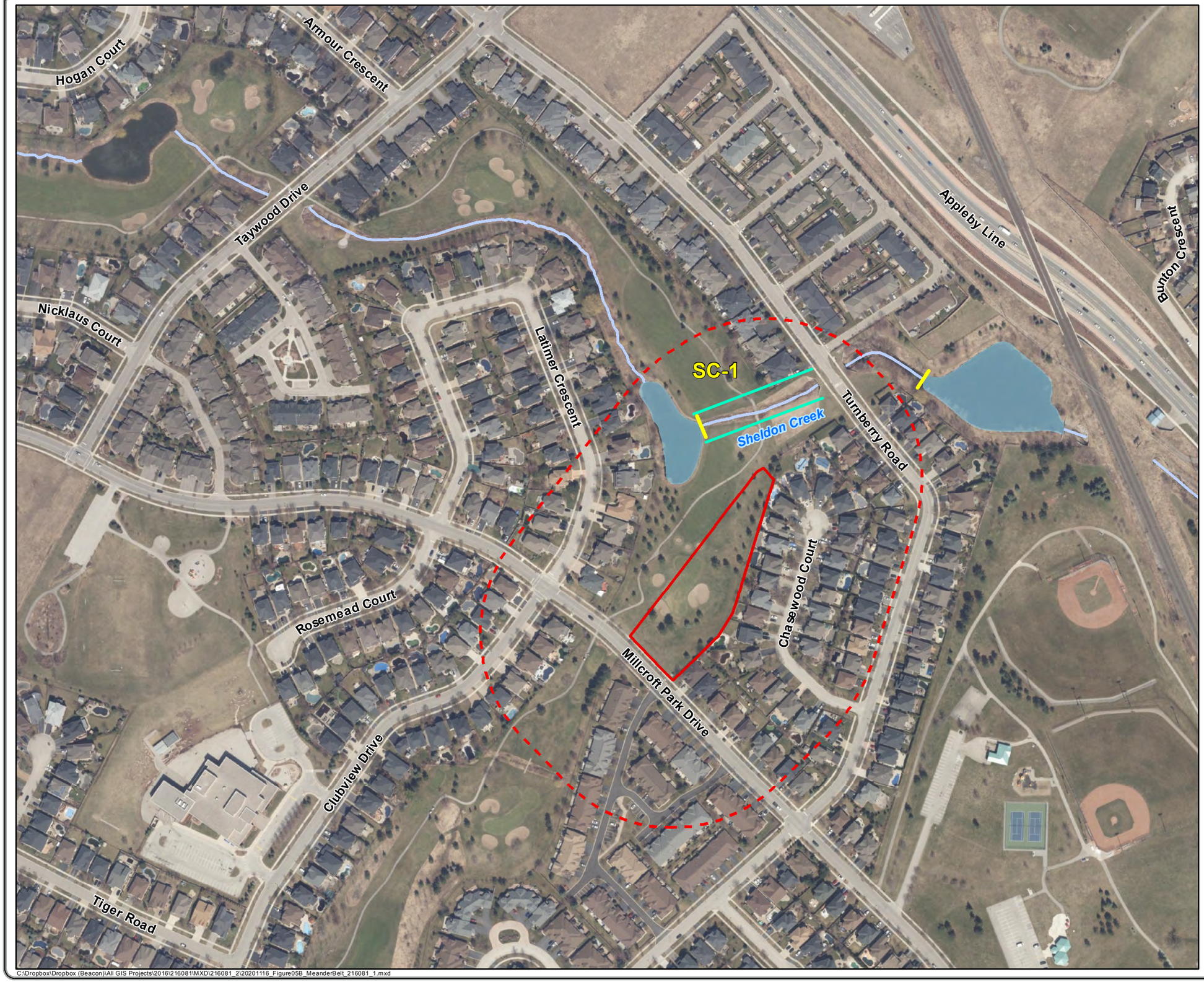
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Client: Millcroft Greens Corporation	Prepared by: DU Checked by: AB

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Meander Belt	Figure 5B

Millcroft Golf Course Geomorphic Assessment

Legend

- Subject Property, Area D
- Study Area
- Reach Breaks
- Meander Belt (25 m)
- Watercourse (Beacon 2018)
- Pond

BEACON ENVIRONMENTAL

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- The RSAT results indicate that Reaches AC-1, AC-2, and AC-3 are in fair ecological health (17.5, 21.5, 23.5, respectively), while AC-4 is in good ecological health (26). The RSAT results for SC-1 indicated a fair degree of ecological health (21); and
- As the reaches of Appleby Creek and Sheldon Creek within the Study Area have been historically modified, an empirical modelling approach was selected to determine the meander belt width. This resulted in a recommended meander belt dimension of 35 m for reaches AC-2 and AC-3, and 25 m for SC-1.

4.2 Biological Environment

The proceeding sections detail the results of the biological surveys conducted to characterize the terrestrial and aquatic ecology of the subject property, as applicable, specifically within Areas containing natural or semi-natural features. Survey results are typical of a highly-modified suburban landscape.

As Area C does not contain nor is it adjacent to any natural heritage features, description of the Area is not applicable and thus not included in this section.

4.2.1 Areas A and B

4.2.1.1 Terrestrial Resources

Terrestrial resources characterized in Area A include vegetation communities, flora, wetlands, avifauna, reptiles and amphibians. The results of these characterizations are presented below.

4.2.1.1.1 Vegetation Communities

Four different vegetation communities represented by four ELC polygons were observed and mapped in Area A and Area B. Vegetation communities within the Study Area but outside of the subject property include cultural thicket, meadow marsh and cultural meadow. All the communities are anthropogenic in origin; no rare or uncommon communities were observed. ELC data cards and related notes are presented in **Appendix E**. The locations of ELC polygons are illustrated on **Figure 6a**.

ELC Polygon 1 – Open Aquatic (OAO)

Polygon 1 corresponds with the dug pond in the southern corner of the subject property. Appleby Creek flows through the pond. The pond is approximately 2.30 m deep and contains some water-milfoil (*Myriophyllum* sp.) along the shoreline. Vegetation cover in the pond is estimated to be much less than 25%. As such, this unit has been classified as an aquatic feature and not a wetland in accordance with ELC and the Ontario Wetland Evaluation System (MNRF 2014).

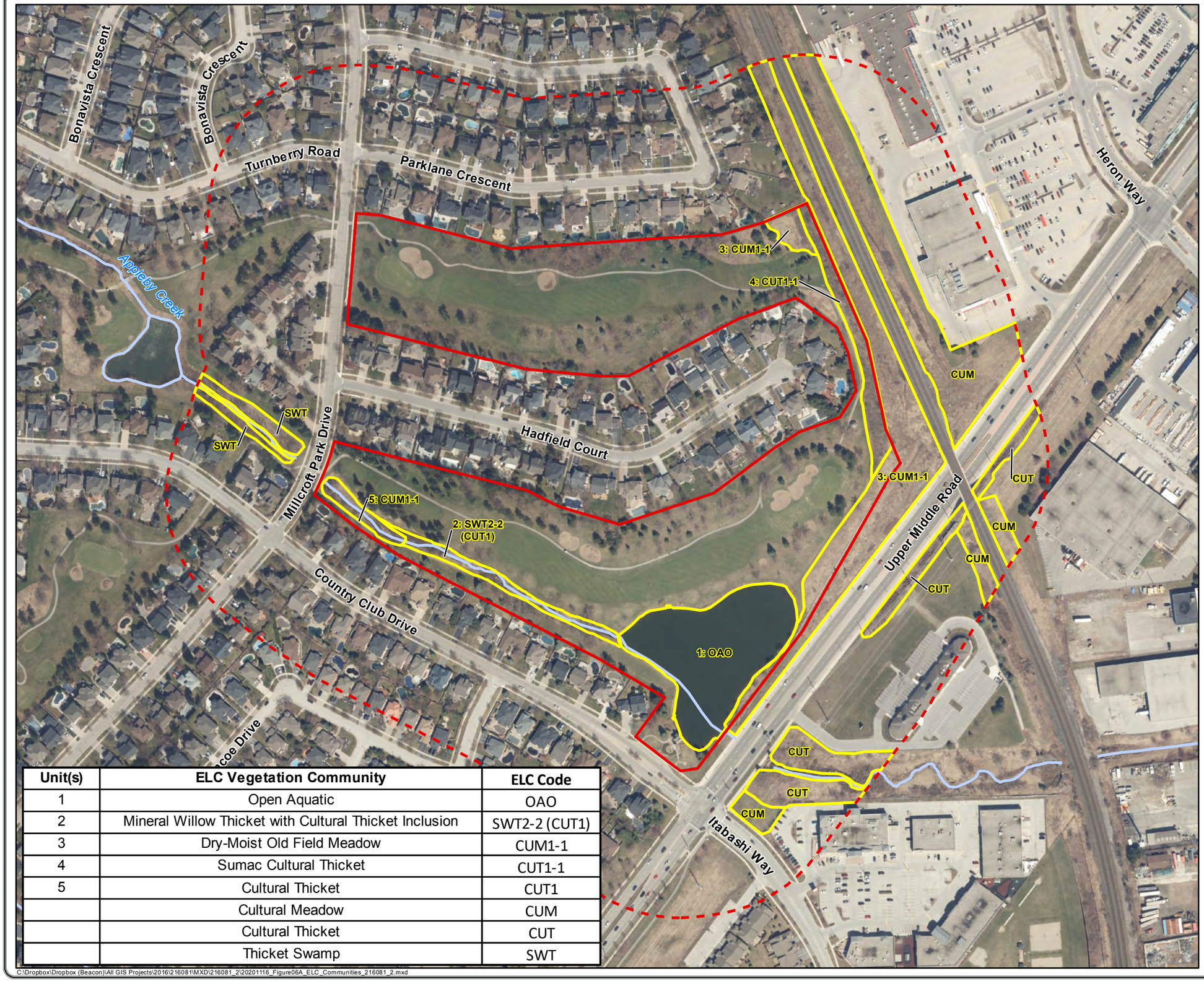
ELC Polygon 2 – Willow Mineral Deciduous Thicket Swamp (SWT2-2) with Mineral Cultural Thicket (CUT1)

Polygon 2 corresponds with the Appleby Creek riparian lands immediately to the north of the pond (Polygon 1). Much of the creek bank and adjacent lands have been modified and planted with trees and

Vegetation Communities Areas A and B

Figure 6A

Millcroft Golf Club



Unit(s)	ELC Vegetation Community	ELC Code
1	Open Aquatic	OAO
2	Mineral Willow Thicket with Cultural Thicket Inclusion	SWT2-2 (CUT1)
3	Dry-Moist Old Field Meadow	CUM1-1
4	Sumac Cultural Thicket	CUT1-1
5	Cultural Thicket	CUT1
	Cultural Meadow	CUM
	Cultural Thicket	CUT
	Thicket Swamp	SWT

Legend

- Subject Properties, Area A and B
- Study Area
- Vegetation Communities
- Watercourse (Beacon 2018)

BEACON ENVIRONMENTAL

Project: 216081.2
Last Revised: November, 2020

Client: Millcroft Greens Corporation

Prepared by: DU
Checked by: AB

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shrubs. The adjacent tablelands are comprised of an actively managed golf course as well as landscaped areas. These portions of Area A are classified as Cultural Thicket due to their anthropogenic origins and regular maintenance.

Portions of the riparian area also support small pockets of wetland which have been classified as thicket swamp and complexed with the cultural thicket. The sparse canopy throughout this unit ranges from 10 to 25 m in height and contains the occasional White Willow (*Salix alba*) with rare occurrences of White Ash (*Fraxinus americana*) and Hybrid Willow (*S. sepulcralis*). The subcanopy is denser than the canopy, with occasional Slender Willow (*S. petiolaris*), Pussy Willow (*S. discolor*) and Woolly-headed Willow (*S. eriocephala*). Sandbar Willow (*S. exigua*), Red-osier Dogwood (*Cornus stolonifera*) and Woolly-headed Willow are abundant in the understorey, and the ground layer is abundant with Fowl Bluegrass (*P. palustris*), with associates of Reed Canary Grass (*Phalaris arundinacea*) and Narrow-leaved Cattail (*Typha angustifolia*). These two bottom layers have a cover great than 60%. Soils consists of silty clay, with mottling encountered at 9 cm below ground surface in the wetland. Groundwater and bedrock were not encountered.

ELC Polygon 3 – Dry-moist Old Field Meadow (CUM1-1)

Polygon 3 is primarily located along the south eastern edge of the subject property; a small unit is also located on the north eastern corner of Area B. This young meadow community has a canopy ranging from two to 10 m with rare occurrences of planted Norway Maple (*Acer platanoides*), Common Apple (*Malus pumila*) and Crabapple (*M. baccata*); a subcanopy of White Ash and an understory of Tartarian Honeysuckle (*Lonicera tatarica*). These three aforementioned layers have sparse coverage of less than 10 percent. The dense ground layer is dominated by Canada Goldenrod (*Solidago canadensis* var. *canadensis*), with abundant associates of Smooth Brome (*Bromus inermis* ssp. *inermis*), Kentucky Bluegrass, and Riverbank Grape (*Vicia cracca*).

ELC Polygon 4 – Sumac Cultural Thicket (CUT1-1)

Polygon 4 is located along the north eastern edge of the subject property, abutting Polygon 3. This young thicket community has a canopy height ranging between two to 10 m in height and is dominated by Staghorn Sumac (*Rhus typhina*) with young White Ash as an occasional associate. The subcanopy and understory are also dominated by Staghorn Sumac, with the subcanopy containing Dog Rose (*Rosa canina*) and Common Buckthorn (*Rhamnus cathartica*) as occasional associates. The understorey contains Common Buckthorn, Dog Rose and Tartarian Honeysuckle. The ground layer contains abundant Kentucky Bluegrass, Canada Goldenrod, Canada Thistle (*Cirsium arvense*) and Smooth Brome.

4.2.1.1.2 Flora

A total of 77 species of vascular plants were catalogued during the botanical inventory and vegetation community classification surveys. Seventy-five were identified to the species level, and of this identified group, 43 (57.3%) are native to Ontario and 32 (42.7%) are introduced species. Some plants (e.g., sedges) could not be identified to the species level due to the seasonal timing of the surveys.

Most species inventoried have a high range of habitat tolerances, as evidenced by the high proportion of species with a low coefficient of conservatism (CC) values. One species with narrow habitat tolerances (i.e., with CC values ≥7) was found within ELC Polygon 2; this species is likely of planted

origin and will not be impacted by the proposed works. None of the species recorded are of conservation concern at the global, national or provincial levels. Two species noted on the subject property, One-seeded Bur Cucumber (*Sicyos angulatus*) and Wild Raisin (*Viburnum cassinoides*), are considered rare in Halton (Crins *et al*., 2006). Bur-cucumber, a moisture-tolerant annual vine, was recorded in ELC Polygon 2 – Willow Mineral Deciduous Thicket Swamp (SWT2-2). Wild Raisin was also recorded in ELC Polygon 2 and was planted as part of the landscaping along the creek. As such, it is not considered a natural occurrence and thus is not significant.

An annotated list of flora recorded within the subject property is contained in **Appendix F.**

4.2.1.1.3 Wetlands

No provincially or regionally significant or MNRF-identified wetlands have been identified within or adjacent to Areas A and B, or within the broader Study Area. Within the subject property, ELC Polygon 2 does support some very small riparian wetlands. Riparian wetlands along Appleby Creek, represented by swamp thicket and meadow marsh communities, are also present upstream of Area A.

Halton Region's Official Plan (2018) includes policies and definitions related to the evaluation of significant natural heritage features, including wetlands. The four Regional criteria related to defining wetland significance from s. 276.5 of the Region's Official Plan (2018) are as follows:

> *Significant wetland means:*
> 1) *for lands within the Niagara Escarpment Plan Area, Provincially Significant Wetlands and wetlands as defined in the Niagara Escarpment Plan that make an important ecological contribution to the Regional Natural Heritage System;*
> 2) *for lands within the Greenbelt Plan Area but outside the Niagara Escarpment Area, Provincially Significant Wetlands and wetlands as defined in the Greenbelt Plan;*
> 3) *for lands within the Regional Natural Heritage System but outside the Greenbelt Plan Area, Provincially Significant Wetlands and wetlands that make an important ecological contribution to the Regional Natural Heritage System; and*
> 4) *outside the Regional Natural Heritage System, Provincially Significant Wetlands.*

Furthermore, the City of Burlington defines regionally significant wetlands as "Wetlands classified as "Other Wetlands" by the Ministry of Natural Resources based on the Ontario Wetland Evaluation System 1994 Southern Manual, as amended from time to time."

To ensure compliance with the policies of the Region and CH, the wetlands within the subject property were evaluated against the above noted criteria for wetland significance and identification. The wetland in Area A (ELC Unit 2) and lands upstream are not within the Niagara Escarpment or Greenbelt Plan Areas. They are within the RNHS, however the wetlands' contributions to the ecology of the RNHS within the subject property is limited to provision of shade and allochthonous inputs to a small degraded portion of Appleby Creek. As such, in the opinion of Beacon the wetland in Area A and those upstream are not providing important ecological contributions to the RNHS and thus do not meet the Regional criteria for significance. However, they qualify as 'other wetlands' per ROP policy 115.3.6, and while they are not Key Features they are considered components of the RNHS.

4.2.1.1.4 Avifauna

During breeding bird surveys a total of 24 bird species were noted on the subject property during field surveys conducted in 2019. Of these 24 species, 20 were breeding or suspected to be breeding on the subject property. A summary of the results is provided in **Table 8.** None of the breeding species are of conservation concern. Non-breeding species, (i.e. foraging only species) included two heron species: Great Blue Heron (*Ardea herodias*) and Black-crowned Night-Heron (*Nycticorax nycticorax*), which were using the pond near Upper Middle Road for feeding. Herons are generally known to forage far from breeding sites, and to wander some distance post-breeding season. Black-crowned Night-herons are considered an S3 species, likely because their colonies are localized and mainly associated with the Great Lakes coastline. The Green Heron (*Butorides virescens*) recorded on site may or may not have been a breeding species, because the suitable habitat present was minimal and it was only observed on one of two visits. The subject property including the pond were also used for breeding by two common and widespread waterfowl (Canada Goose, *Branta canadensis* and Mallard, *Anas platyrhynchos*).

Most of the other breeding records represent common species that are regularly associated with disturbed or successional habitats. Some of the more abundant species observed included: American Robin (*Turdus migratorius*), Red-winged Blackbird (*Agelaius phoeniceus*) and European Starling (*Sturnus vulgaris*).

The MNRF classifies birds that require larger tracks of suitable habitat in which to breed, or those that have a higher breeding success in larger areas of suitable habitat as “area-sensitive” species. Area-sensitive species can be further broken down into woodland and grassland specialists, which typically require large tracts of their respective habitat types to breed and rear young successfully. No area-sensitive bird species were recorded on or adjacent to the subject property.

Lastly, no nests were observed under the bridge at Upper Middle Road during targeted area searches conducted in October 2018 and June 2019.

Table 8. Breeding Bird Survey Results

Species		Status					Breeding Pairs
Common Name	Scientific Name	National Species at Risk COSEWIC[a]	Species at Risk in Ontario Listing[b]	Provincial breeding season SRANK[c]	Halton Regional Status[d]	Area-sensitive (OMNR)[e]	
Great Blue Heron	*Ardea herodias*			S4	C		1 F
Green Heron	*Butorides virescens*			S4	U		1
Black-crowned Night-Heron	*Nycticorax nycticorax*			S3	U		1 F
Canada Goose	*Branta canadensis*			S5	n/a		2, 29 F
Mallard	*Anas platyrhynchos*			S5	A		2, 11 F
Killdeer	*Charadrius vociferus*			S5	C		1 F

Species		Status					Breeding Pairs
Common Name	Scientific Name	National Species at Risk COSEWIC[a]	Species at Risk in Ontario Listing[b]	Provincial breeding season SRANK[c]	Halton Regional Status[d]	Area-sensitive (OMNR)[e]	
Mourning Dove	*Zenaida macroura*			S5	A		1
Northern Flicker	*Colaptes auratus*			S4	C		1
Tree Swallow	*Tachycineta bicolor*			S4	A		1 F
Blue Jay	*Cyanocitta cristata*			S5	A		1
Black-capped Chickadee	*Poecile atricapillus*			S5	A		1
American Robin	*Turdus migratorius*			S5	A		16
Cedar Waxwing	*Bombycilla cedrorum*			S5	n/a		2
European Starling	*Sturnus vulgaris*			SE	A (I)		6
Warbling Vireo	*Vireo gilvus*			S5	C		1
Northern Cardinal	*Cardinalis cardinalis*			S5	C		2
Chipping Sparrow	*Spizella passerina*			S5	C		1
Song Sparrow	*Melospiza melodia*			S5	A		2
Red-winged Blackbird	*Agelaius phoeniceus*			S4	A		10
Common Grackle	*Quiscalus quiscula*			S5	A		5
Brown-headed Cowbird	*Molothrus ater*			S4	A		1
House Finch	*Haemorhous mexicanus*			SNA	A		1
American Goldfinch	*Spinus tristis*			S5	A		5
House Sparrow	*Passer domesticus*			SNA	A (I)		3

= Number of breeding pairs or territories; F = Foraging on or flying over the subject property

[a] COSEWIC = Committee on the Status of Endangered Wildlife in Canada

[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)

[c] SRANK (from Natural Heritage Information Centre) for breeding status
S4 (Apparently Secure), S5 (Secure), SE (Exotic), SNA (Not applicable…'because the species is not a suitable target for conservation activities'; includes non-native species)

[d] Dwyer J.K. 2006
A = Abundant, C = Common, U = Uncommon, I = Introduced

[e] MNRF 2000

4.2.1.1.5 Reptiles

Two Midland Painted Turtles (*Chrysemys picta marginata*) were observed incidentally in the Mill Pond during aquatic habitat investigations and a single individual during the second round of breeding bird surveys, but no turtles were recorded during basking surveys. While not observed during surveys, it is also possible that Snapping Turtle (*Chelydra serpentina*) is present in Area A.

Midland Painted Turtle was designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in April 2018 and currently does not have status under the SARA. Snapping Turtle is designated as Special Concern by COSEWIC and the Committee on the Status of Species at Risk in Ontario (COSSARO) and does not have status under the SARA or ESA.

Due to the lack of debris in the pond, turtle basking opportunities are limited to the shoreline. Potentially suitable hibernation habitat consists of the online pond. Potentially suitable turtle nesting sites within the study area consists of golf course sand traps and the embankment at the side of Upper Middle Road.

Area A does not contain specialized habitat for snakes; cover objects and hibernacula are lacking. Small numbers of common habitat generalists such as Eastern Garter Snake (*Thamnophis sirtalis sirtalis*) may be present in cultural vegetation communities adjacent to the railway and Upper Middle Road.

4.2.1.1.6 Anurans

No calling amphibians were recorded during the first two rounds of anuran surveys despite suitable survey conditions and the presence of potentially suitable habitat. Three Green Frog (*Lithobates clamitans*) were recorded calling from the online pond near Upper Middle Road (Amphibian Survey Station C) during the final round of surveys. Relative to other amphibian species in Ontario, Green Frog is generally considered to be tolerant of suburban and disturbed conditions. Given these results and the type and extent of potentially suitable habitat, amphibian abundance and productivity are low throughout areas surveyed.

Table 9. Anuran Survey Results

Survey Station	Survey Round 1	Survey Round 2	Survey Round 3
A	No calls	No calls	No calls
B	No calls	No calls	No calls
C	No calls	No calls	GRFR 1-(3)

SPPE = Spring Peeper, GRTR = Gray Tree Frog, GRFR = Green Frog, WOFR = Wood Frog
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.

4.2.1.2 Aquatic Resources

Aquatic resources characterized in Area A include aquatic habitat and the aquatic community in Appleby Creek. According to Burnside (2020) Appleby Creek is primarily fed by surface water flows though seasonally high shallow groundwater levels may contribute to seasonally high water levels in the creek (e.g. in spring). The results of the biological characterizations of Appleby Creek are presented below.

4.2.1.2.1 Aquatic Habitat

A concrete weir approximately 0.2 m in height is located downstream of the Mill Pond. This weir constitutes a barrier to fish migration. As part of the habitat characterization survey, a manual temperature reading was taken below the weir and in the pond. Water temperatures of 8.1°C and 8°C were recorded, respectively. The section of channel within Area A (i.e. between Upper Middle Road and Millcroft Park Drive) is characterized by cobble, sand, and clay substrates with an average temperature of 7.5°C from 2001-2018 (see **Section 4.2.1.2.3** for details). There is an alternation between riffles and runs with one deep pool (> 0.31 m). There is a moderate amount of in-stream woody debris with a high amount of detritus. Four sections of exposed plastic Geocells are present within the watercourse, representing barriers for fish to travel between the Mill Pond and the pond upstream of Reach AC-3 (see **Figure 4a**) . At the time of survey, the Geocells were observed to be approximately 11 cm in height from the surface of the water to the top of the grating. Below Millcroft Park Drive, two culverts provide additional capacity during high flow events. Downstream of the easternmost culvert is a pool with a depth of 0.16 m. There is also a storm sewer outlet to the east of the two culverts. Riparian vegetation is dominated by medium height grasses, however the middle portion of the channel is heavily dominated by Phragmites, a tall and highly invasive non-native species. About 10% of the channel has overhanging grassland species with a few deciduous tree branches, providing minimal stream cover.

The channel between Millcroft Park Drive and the online pond upstream of Reach AC-3 has similar substrate to the downstream channel with a dominance of sand and clay substrate. This channel has run and pool sequences with a large accumulation of woody debris and detritus. There is a concrete brick structure downstream of the pond which prevents fish from entering the pond (see Photograph 21 in **Appendix D**). Water temperature in the pond measured 7.7 °C at the time of the assessment. Riparian vegetation in the pond is the same as the downstream channel except there is a higher percentage of stream cover by deciduous tree species.

4.2.1.2.2 Aquatic Community

According to the 2008 Long Term Environmental Monitoring Report for urban creeks (Conservation Halton, 2009), the Appleby Creek watershed was rated “in good condition” using the modified Index of Biotic Integrity (IBI). This rating indicates a healthy stream with little impairment. CH completed fish community sampling south of the subject property; the most common fish species present were Western Blacknose Dace (*Rhinichthys obtusus*) and Creek Chub (*Semotilus atromaculatus*).

In 2016 CH released a fish community monitoring factsheet in which the Appleby creek watershed was rated “poor”. This rating indicates an unhealthy stream with moderate to severe impairment. Like areas adjacent to the subject property, the most common fish species present in the watershed were Western Blacknose Dace and Creek Chub. In addition, Beacon observed a large fish suspected to be a Common Carp (*Cyprinus carpio*) in the online pond near Upper Middle Road during the amphibian calling survey conducted in May 2019.

Beacon was granted access to CH’s fish database on March 3, 2020 under licence #20200208. CH’s fish sampling stations are described as the “first crossing downstream of Mainway Road just east of Appleby Line”, located at UTM 598815.166 E and 4804620.182 N and “On either side of Upper Middle Road East branch, just east of Country Club Drive”, located at UTM 597563.927 E and 4804647.932 N. A summary of relevant data from this database is presented in **Table 10**.

Table 10. Fish Species Present in Appleby Creek (Conservation Halton)

Family	Common Name	Scientific Name
Centrarchidae	Green Sunfish	*Lepomis cyanellus*
	Largemouth Bass	*Micropterus salmoides*
	Pumpkinseed	*Lepomis gibbosus*
Cyprinidae	Common Carp	*Cyprinus carpio*
	Fathead Minnow	*Pimephales promelas*
	Goldfish	*Carassius auratus*
Ictaluridae	Brown Bullhead	*Ameiurus nebulosus*

Table 11 presents a summary of the fish species captured during aquatic community sampling undertaken by Beacon in 2019. As previously mentioned, these fish sampling locations are illustrated in **Figure 3.**

Table 11. Results of Fish Community Sampling in Appleby Creek (2019)

Family	Common Name	Scientific Name
Centrarchidae	Largemouth Bass	*Micropterus salmoides*
	Pumpkinseed	*Lepomis gibbosus*
Cyprinidae	Creek Chub	*Semotilus atromaculatus*
	Fathead Minnow	*Pimephales promelas*
	Goldfish	*Carassius auratus*

Similar to the results provided by CH, Creek Chub was the most common fish captured by Beacon in Appleby Creek. Goldfish (*Carassius auratus*), Largemouth Bass (*Micropterus salmoides*) and Pumpkinseed (*Lepomis gibbosus*) were mainly caught within the three ponds that were sampled. Fathead Minnow (*Pimephales promelas*) was found exclusively within the portions of channel between the ponds, whereas Creek Chub (*Semotilus atromaculatus*) was found in all ponds and the channel.

Based on the fish community sampling completed by CH and Beacon, this portion of Appleby Creek provides refuge for coolwater and warmwater fish species, with the majority of species being typical of a warmwater regime. The MNRF's Aquatic Resource Area mapping includes Appleby Creek as a warmwater watercourse. Information regarding thermal regime of Appleby Creek that supports this characterization is contained in **Section 4.2.1.2.3**, below.

4.2.1.2.3 Surface Water Temperature

A summary of water temperatures collected in 2011-2018 by R.J. Burnside are provided below in **Table 12** and **Table 13**. Continuous temperature loggers are located in Appleby Creek (SS2) and in the pond (SS3) near Upper Middle Road (**Figure 3**). Water temperatures are recorded from April to November of the given year. Summarized below is the monthly averages, maximums and minimums for the months of July through to September for 2011-2018, when warmer temperatures are observed in the summer months.

Table 12. Summary of Surface Water Temperatures at SS2 (2011-2018)

Year	July			August			September		
	Avg. Daily Temp (ºC)	Avg. Daily Min. Temp (ºC)	Avg. Daily Max. Temp (ºC)	Avg. Daily Temp (ºC)	Avg. Daily Min. Temp (ºC)	Avg. Daily Max. Temp (ºC)	Avg. Daily Temp (ºC)	Avg. Daily Min. Temp (ºC)	Avg. Daily Max. Temp (ºC)
2011	-	-	-	-	-	-	17.2812	10.944	27.37
2012	23.76854	18.331	32.807	21.9626	14.804	31.37	18.28367	10.259	26.292
2013	21.25889	16.903	27.961	20.04008	15.664	24.931	18.98115	13.173	24.255
2014	19.14178	15.282	24.062	18.86999	14.325	26.097	15.96332	10.553	22.812
2015	21.31915	13.942	30.255	21.01497	14.517	27.468	19.1726	13.365	26.488
2016	22.01493	14.23	31.268	22.92857	16.427	28.953	19.26023	11.528	27.764
2017	22.08909	17.189	26.195	20.25333	13.076	26.097	17.58214	9.866	25.222
2018	21.84323	14.9	28.258	22.72977	16.903	27.468	18.90518	11.334	28.555

Note – (-) indicates no data was available.

Table 13. Summary of Surface Water Temperatures at SS3 (2011-2018)

Year	July			August			September		
	Avg. Daily Temp (ºC)	Avg. Daily Min. Temp (ºC)	Avg. Daily Max. Temp (ºC)	Avg. Daily Temp (ºC)	Avg. Daily Min. Temp (ºC)	Avg. Daily Max. Temp (ºC)	Avg. Daily Temp (ºC)	Avg. Daily Min. Temp (ºC)	Avg. Daily Max. Temp (ºC)
2011	-	-	-	-	-	-	18.96954	15.855	28.953
2012	25.86776	15.473	34.268	24.06766	21.855	27.862	19.68969	14.709	25.416
2013	23.99817	20.901	29.452	23.06001	18.996	27.37	21.98547	19.472	25.513
2014	22.93053	18.711	27.468	21.51468	18.711	25.319	19.71871	16.523	24.448
2015	22.25996	17.95	26.879	23.22482	20.901	25.513	21.56882	17.665	26.488
2016	24.42184	15.569	29.652	25.1362	20.996	29.652	21.64811	16.713	24.545
2017	21.99298	15.569	25.708	22.60295	19.948	24.255	20.60788	17.284	24.931
2018	23.70067	21.378	27.272	23.958	21.951	25.61	21.76345	16.618	27.665

Note – (-) indicates no data was available.

In 2012, highest average temperatures and the lowest average temperatures occurred at both SS2 and SS3. Water temperature at SS2 was highest in July (32.8 ºC) and lowest in September (10.26 ºC). SS3 water temperature was also highest in July (34.27 ºC) and lowest in September (14.71 ºC). When comparing daily average temperatures between the two stations, SS3 experienced warmer water temperatures than SS2.

Based on a review of the temperature data (i.e. over seven years of temperature data showing summertime temperature exceedances of 25ºC) and setting with online ponds upstream and downstream, the thermal regime of this reach of Appleby Creek is warmwater.

4.2.2 Area D

4.2.2.1 Vegetation Communities

Natural and semi-natural vegetation communities are not present in Area D but are present in the greater Study Area to the north east (**Figure 6b**). These vegetation communities are associated with Sheldon Creek and an online pond, and consist of shallow marsh, meadow marsh, cultural meadow and deciduous swamp. None of these vegetation communities are rare or uncommon.

4.2.2.2 Wetlands

Terrestrial resources are lacking within Area D, and no provincially or regionally significant wetlands have been identified within or adjacent to Area D. As shown in **Figure 6b**, unevaluated riparian wetlands associated with Sheldon Creek are present on adjacent lands to the north east.

Halton Region's Official Plan (2018) includes policies and definitions related to the evaluation of significant natural heritage features, including wetlands. The four Regional criteria related to defining wetland significance from s. 276.5 of the Region's Official Plan (2018) are as follows:

> *Significant wetland means:*
> 1) *for lands within the Niagara Escarpment Plan Area, Provincially Significant Wetlands and wetlands as defined in the Niagara Escarpment Plan that make an important ecological contribution to the Regional Natural Heritage System;*
> 2) *for lands within the Greenbelt Plan Area but outside the Niagara Escarpment Area, Provincially Significant Wetlands and wetlands as defined in the Greenbelt Plan;*
> 3) *for lands within the Regional Natural Heritage System but outside the Greenbelt Plan Area, Provincially Significant Wetlands and wetlands that make an important ecological contribution to the Regional Natural Heritage System; and*
> 4) *outside the Regional Natural Heritage System, Provincially Significant Wetlands.*

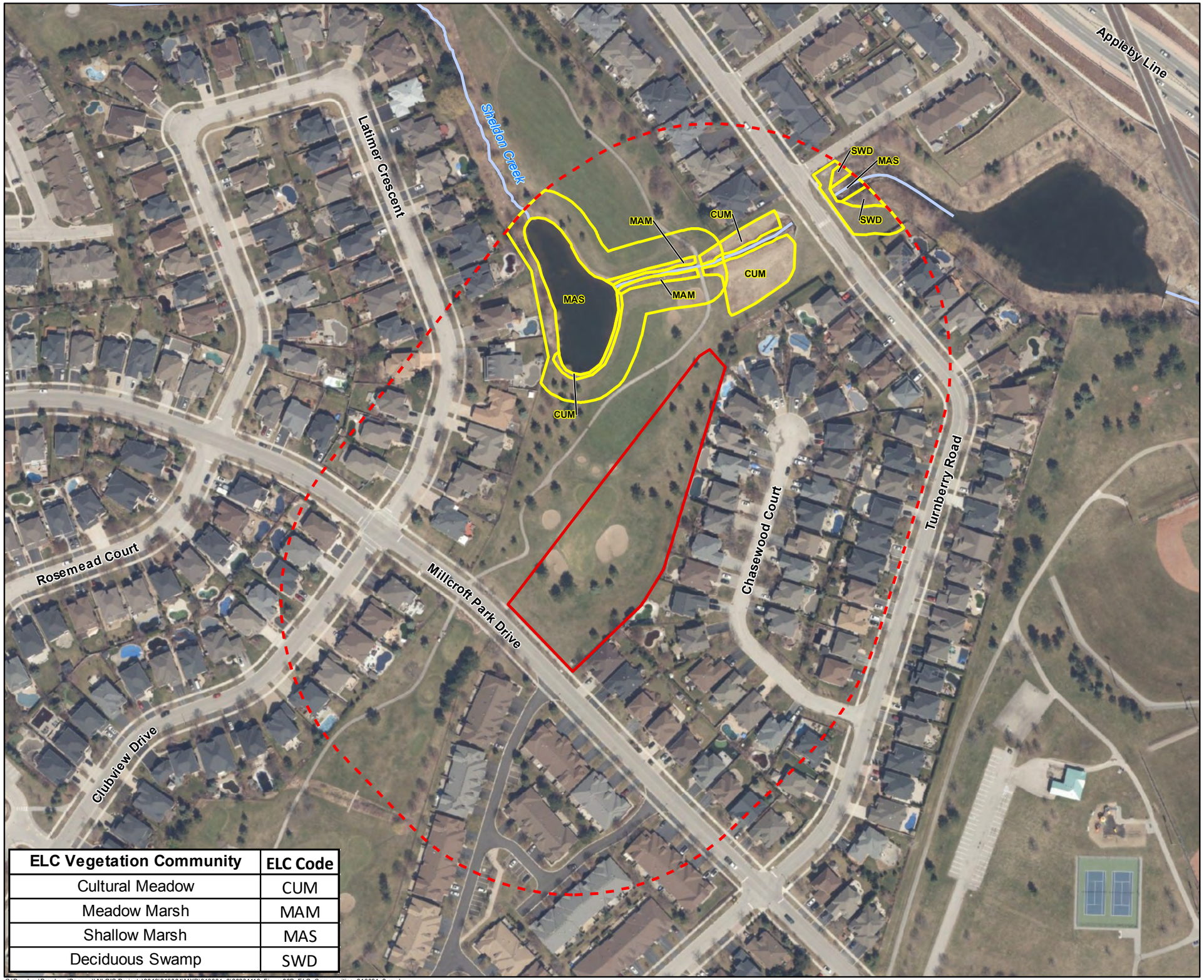
Furthermore, the City of Burlington defines regionally significant wetlands as "Wetlands classified as "Other Wetlands" by the Ministry of Natural Resources based on the Ontario Wetland Evaluation System 1994 Southern Manual, as amended from time to time."

To ensure compliance with the policies of the Region and CH, the wetlands adjacent to the subject property were evaluated against the above noted criteria for wetland significance and identification. The riparian wetlands north east of Area D are not within the Niagara Escarpment or Greenbelt Plan Areas. They are within the RNHS, however the wetland's contributions to the ecology of the RNHS within the subject property is limited to provision of shade and allochthonous inputs to a small degraded portion of Sheldon Creek. As such, in the opinion of Beacon the wetlands adjacent to Area D are not providing important ecological contributions to the RNHS and thus does not meet the Regional criteria for significance. As detailed surveys were not conducted on lands adjacent to the subject property, the applicability of CH's definition of wetland is not known. However, they likely qualify as 'other wetlands' per ROP policy 115.3.6, and while they are not Key Features they are considered components of the RNHS.

Vegetation Communities Area D

Figure 6B

Millcroft Golf Club



Legend

- Subject Property, Area D
- Study Area
- Vegetation Communities
- Watercourse (Beacon 2018)

ELC Vegetation Community	ELC Code
Cultural Meadow	CUM
Meadow Marsh	MAM
Shallow Marsh	MAS
Deciduous Swamp	SWD

BEACON ENVIRONMENTAL

Project: 216081.2
Last Revised: November, 2020

Client: Millcroft Greens Corporation

Prepared by: DU
Checked by: AB

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These riparian wetlands, which include a shallow online pond and other shallow marsh communities, meadow marsh and deciduous swamp, are within lands regulated by CH owing to the presence of Sheldon Creek and its associated erosion and flooding hazards.

4.2.2.3 Aquatic Resources

According to Burnside (2020) Sheldon Creek is primarily fed by surface water flows though seasonally high shallow groundwater levels may contribute to seasonally high water levels in the creek (e.g. in spring). Aquatic resources characterized adjacent to Area D include aquatic habitat and the aquatic community. The results of these characterizations are presented below.

4.2.2.3.1 Aquatic Habitat

South of Taywood Drive is a portion of Sheldon Creek that flows to the east towards Turnberry Drive. This portion of channel flows through two ponds before exiting the subject property under Appleby Line. Substrate is predominantly silt with sand and clay – similar to Appleby Creek (Area A). Riparian vegetation is dominated by dense Phragmites which provides 90-100% stream cover; there is no in-stream vegetation save for cattails downstream of Turnberry Drive. At the time of the assessment the channel downstream of Taywood Drive and upstream of Turnberry Drive was approximately 1 m in wetted width with very little water movement.

4.2.2.3.2 Aquatic Community

According to the 2008 Long Term Environmental Monitoring Report for Urban Creeks (Conservation Halton, 2009), the Sheldon Creek watershed was rated “in poor condition” using the modified Index of Biotic Integrity (IBI). This rating indicates an unhealthy stream with moderate to severe impairment. CH completed fish community sampling east of the subject property; the most common fish species present were Western Blacknose Dace and Creek Chub. The portion of Sheldon Creek adjacent to Area D has bedrock as its dominant substrate.

In 2016 CH released a fish community monitoring factsheet in which the Sheldon Creek watershed was rated “poor”. This rating indicates an unhealthy stream with moderate to severe impairment. Like areas adjacent to the subject property, the most common fish species present in the watershed were Western Blacknose Dace and Creek Chub. In addition, Beacon observed Smallmouth Bass (*Micropterus dolomieu)* fry in the online pond on Sheldon Creek during a site visit on September 17, 2019.

Beacon was granted access to CH’s fish database for Sheldon Creek on March 3, 2020 under licence #20200208. A summary of this database, which contains general records from Sheldon Creek, is presented in **Table 14**.

Based on the fish species recorded by CH, Sheldon Creek provides refuge for coolwater and warmwater fish species. The MNRF’s Aquatic Resource Area mapping includes Sheldon Creek as a warmwater watercourse. Of the species listed above, Brook Stickleback (*Culaea inconstans*) is considered rare in Halton; it is not rare at the provincial for national levels.

Table 14. Fish Species Present in Sheldon Creek

Family	Common Name	Scientific Name
Catostomidae	White Sucker	*Catostomus commersonii*
Centrarchidae	Smallmouth Bass	*Micropterus dolomieu*
	Pumpkinseed	*Lepomis gibbosus*
	Creek Chub	*Semotilus atromaculatus*
Cyprinidae	Fathead Minnow	*Pimephales promelas*
	Western Blacknose Dace	*Rhinichthys obtusus*
Gasterosteidae	Brook Stickleback	*Culaea inconstans*
Leuciscidae	Common Shiner	*Luxilus cornutus*
Percidae	Rainbow Darter	*Etheostoma caeruleum*

4.2.3 Area E

4.2.3.1 Terrestrial Resources

Terrestrial resources characterized in Area E include vegetation communities, flora and wetlands. The results of these characterizations are presented below.

4.2.3.1.1 Vegetation Communities

Three different vegetation communities represented by eleven ELC polygons were observed and mapped in Area E. All the communities are anthropogenic in origin; no rare or uncommon communities were observed. The locations of ELC polygons are illustrated on **Figure 6c**. ELC data cards and related field notes are presented in **Appendix E**.

ELC Polygon 5 – Dry-moist Old Field Meadow (CUM1-1)

Polygon 5 is primarily located within the hydro right-of-way north of Hole #16. This young cultural community is dominated by Canada Goldenrod with Smooth Brome and Kentucky Bluegrass as abundant associates. Other commonly encountered species include Lance-leaved Aster (*Symphyotrichum lanceolatum*), Wild Carrot (*Daucus carota*), and Reed Canary Grass.

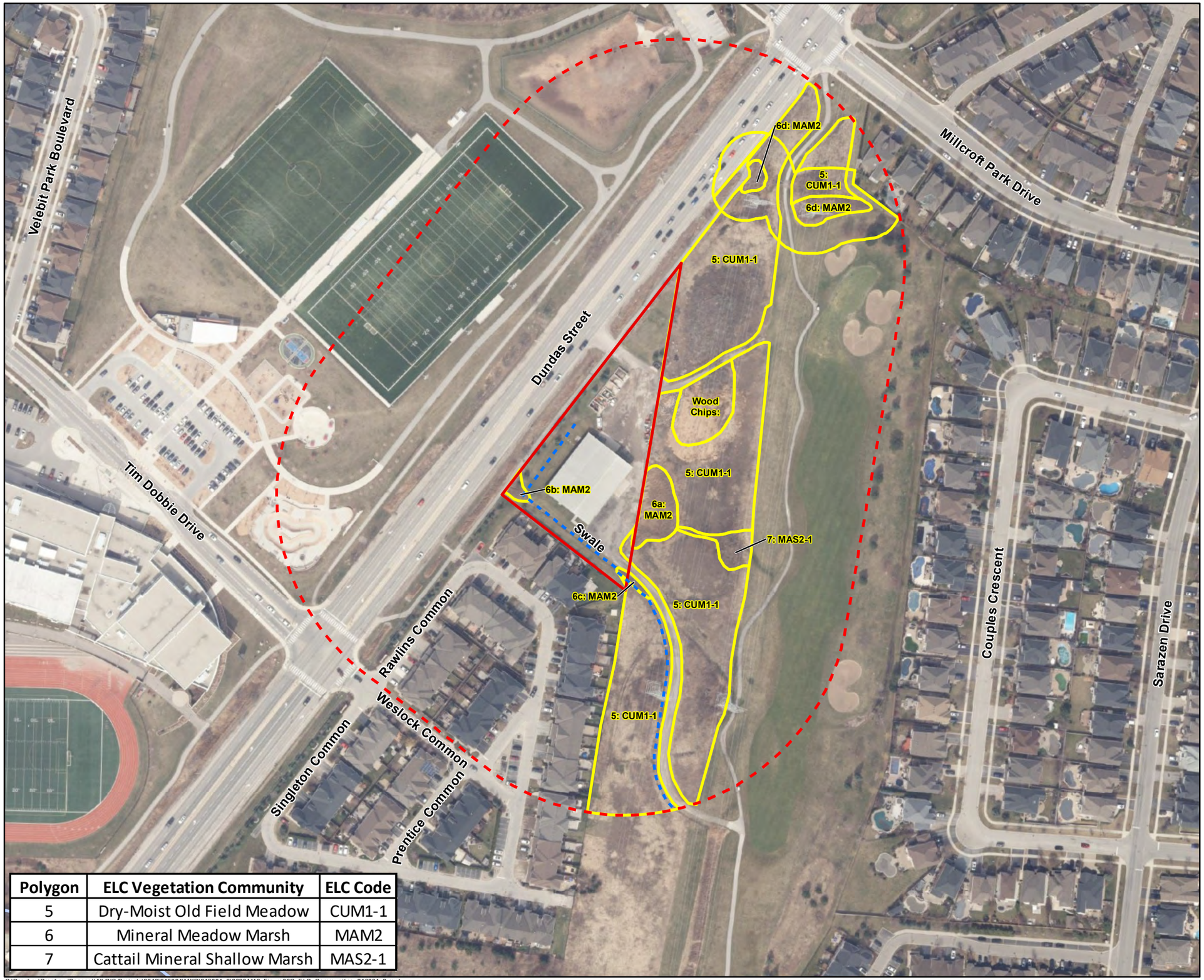
ELC Polygon 6a-d – Mineral Meadow Marsh (MAM2)

Polygon 6 represents a mineral meadow marsh entirely dominated by the exotic invasive grass, Phragmites (*Phragmites australis*) over 2 m in height. The largest patch of marsh is located behind the Millcroft Golf Club maintenance building (Polygon 6a, see **Photograph 1**); smaller patches are located within the Hydro right-of-way and western corner of the works yard. Polygons 6b and 6c are fed by overland flow from ditches along the north and west sides of the works yard. Immediately outside of the subject property, significant portions of the boulevard along Dundas Street are covered in Phragmites.

Vegetation Communities Area E

Figure 6C

Millcroft Golf Club



Polygon	ELC Vegetation Community	ELC Code
5	Dry-Moist Old Field Meadow	CUM1-1
6	Mineral Meadow Marsh	MAM2
7	Cattail Mineral Shallow Marsh	MAS2-1

Legend

- Subject Property, Area E
- Study Area
- Vegetation Communities
- Watercourse (Beacon 2018)
- Swale

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ELC Polygon 7 – Cattail Mineral Shallow Marsh (MAS2-1)

This community, located within the Hydro right-of-way, is dominated by Narrow-leaved Cattail, with Purple Loosestrife (*Lythrum salicaria*) as an abundant associate. Hydrologic inputs include overland flow from the adjacent wetland to the north west (ELC Polygon 6a). The wetland outlets to a drain within the active golf course. Connection with Appleby Creek was not observed.



Photograph 1. ELC Polygon 6a (Middle Right) and Golf Course Maintenance Building (Far Right)

The marshes adjacent to Area E likely formed following earthworks withing the hydro corridor. The biophysical conditions within and adjacent to these wetlands were discussed in detail with ecologists at CH. Soils within wetland features south of the maintenance building (polygons 6a and 7) primarily consist of mineral and aggregate fill. This finding is consistent with that of the hydrogeological report (Figure 9, RJ Burnside 2000). Mottles and gley were not observed. Accordingly, these wetlands do not meet the definition of wetland per the ROP, City of Burlington OP, *Conservation Authorities Act* or CH's policies (Conservation Halton 2016a) and thus are not regulated by CH.

4.2.3.1.2 Flora

A total of 77 species of vascular plants were catalogued during the botanical inventory and vegetation community classification surveys. Seventy-five were identified to the species level, and of this identified group, 43 (57.3%) are native to Ontario and 32 (42.7%) are introduced species. Some plants (e.g., sedges) could not be identified to the species level due to the timing of the surveys.

Most species inventoried have a high range of habitat tolerances, as evidenced by the high proportion of species with low coefficient of conservatism (CC) values. None of the species recorded are of conservation concern at the global, national, provincial or local levels.

An annotated list of flora recorded within Area E is contained in **Appendix F**.

4.2.3.1.3 Wetlands

As previously mentioned, no provincially significant, regionally significant or evaluated wetlands have been identified within or adjacent to the subject property, or within the broader Study Area. Within Area E, ELC Polygons 6 and 7 represent small surface water-fed depressions dominated by exotic invasive species and surrounded by a cultural matrix.

Halton Region's Official Plan (2018) includes policies and definitions related to the evaluation of significant natural heritage features, including wetlands. The four Regional criteria related to defining wetland significance from s. 276.5 of the Region's Official Plan (2018) are as follows:

> *Significant wetland means:*
> 1) *for lands within the Niagara Escarpment Plan Area, Provincially Significant Wetlands and wetlands as defined in the Niagara Escarpment Plan that make an important ecological contribution to the Regional Natural Heritage System;*
> 2) *for lands within the Greenbelt Plan Area but outside the Niagara Escarpment Area, Provincially Significant Wetlands and wetlands as defined in the Greenbelt Plan;*
> 3) *for lands within the Regional Natural Heritage System but outside the Greenbelt Plan Area, Provincially Significant Wetlands and wetlands that make an important ecological contribution to the Regional Natural Heritage System; and*
> 4) *outside the Regional Natural Heritage System, Provincially Significant Wetlands.*

Furthermore, the City of Burlington defines regionally significant wetlands as "Wetlands classified as "Other Wetlands" by the Ministry of Natural Resources based on the Ontario Wetland Evaluation System 1994 Southern Manual, as amended from time to time."

To ensure compliance with municipal policies, the wetlands within the subject property were evaluated against the above noted criteria for wetland significance. The wetlands in Area E are small, are not connected to other natural heritage features, are dominated by invasive species and not within the Niagara Escarpment or Greenbelt Plan Areas. In addition, they have not been identified as "other wetlands" by the MNRF. As such, in the opinion of Beacon the wetlands in Area E are not providing important ecological contributions to the RNHS and do not meet the Region of Halton's or City of Burlington's criteria for significance. However, some (specifically, ELC Polygon 6d) qualify as 'other wetlands' per ROP policy 115.3.6, and while they are not Key Features they are considered components of the RNHS.

As detailed in **Section 4.2.3.1.1**, ELC Polygons 6a and 7 do not contain hydric soils and thus are not considered wetlands. ELC Polygons 6 and 6c, which represent very small patches of invasive Phragmites along a ditch/swale. Per **Section 6.4.2**, this ditch is proposed to be subject to enhancements that will see the removal of invasive species and enhancement of the swale. It is worth noting that ditches parallel to Dundas Street are choked with Phragmites.

4.2.4 Tree Inventory and Assessment

A total of 577 trees were tagged and assessed on or adjacent to the subject property. Of these, 250 are in Area A; 196 in Area B; 75 in Area C; 35 in Area D; and 21 in Area E. Detailed results, including recommended opportunities for tree preservation, are contained within the Arborist Report (Beacon 2020) provided under separate cover.

4.2.5 Species at Risk

As previously mentioned, agency consultation was not completed in preparation of this EER. To assess the potential occurrence of SAR within the Study Area, Beacon cross-referenced the habitat needs of species previously recorded on or within 1 km of the Study Area and those reasonably expected to occur based on habitats present. An assessment of these species' potential to occur within or adjacent to the Study Area is contained in **Table 15**.

Table 15. Species at Risk and Their Potential to Occur within the Study Area

Category	Species	Common Name	Data Source	SARO Status	Beacon's Assessment of Occurrence
Birds	*Contopus virens*	Eastern Wood-Pewee	Beacon	SC	Not present. This species is commonly found in parks in urban areas but was not recorded on the subject property during breeding bird surveys.
	Hirundo rustica	Barn Swallow	Beacon	THR	Not present. Species was not observed in potentially suitable nesting sites (i.e. the bridge under Upper Middle Road) or foraging within the subject property.
Insects	*Danaus plexippus*	Monarch	Beacon, CH	SC	Not present. Species was not observed during field surveys and potentially suitable habitats for larval development is not present nor are significant foraging habitats.
Plants	*Juglans cinerea*	Butternut	Beacon	END	Not present. Species was not recorded during field investigations.
Amphibians	*Ambystoma jeffersonianum x laterale*	Jefferson x Blue-spotted Salamander (Jefferson genome dominates, hybrid pop. 1)*	NHIC online database	END	Not present. Potentially suitable habitat is not present on or adjacent to the subject property. According to the NHIC, the last record of this species is from May 19, 1989.
Reptiles	*Chelydra serpentina*	Snapping Turtle	Beacon, CH	SC	Potentially present. Potentially suitable foraging, hibernation and dispersal habitat are present within online ponds and the Appleby and Sheldon Creek tributaries. This species was not observed during field surveys.

*Species previously recorded on or within 1 km of the Study Area.

4.2.6 Significant Wildlife Habitat

According to the *Significant Wildlife Habitat Technical Guidelines* (MNRF 2000), there are four broad categories of Significant Wildlife Habitat (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 types of SWH, each 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).

Areas that are considered to support SWH are not specifically identified in the Official Plans of Halton Region or the City of Burlington. In addition, neither the Region's nor the City's planning departments have at this time criteria for assessing SWH. However, the MNRF has developed criteria for significant wildlife habitat for Ecoregion 7E (MNRF 2015) which may be used by local planning authorities.

Based on the observations made to date though the completion of biophysical surveys, it is the opinion of Beacon that the subject property does not support SWH due to its active use as a golf course, the highly urbanized nature of the surrounding lands and lack of habitat and species diversity.

5. Natural Heritage System

One of the requirements of this EER is to confirm the boundaries of the RNHS for the Study Area using site-specific information obtained through field review and site investigations.

The in-force City OP defers to the ROP for the identification of the RNHS. Section 115 of the Halton ROP describes the RNHS as including Key Features (as listed in **Section 2.5.1**) plus enhancements to Key Features, Linkages, Buffers, watercourses and, potentially, other wetlands.

The Halton ROP has identified a RNHS for all of Halton, including the Study Area and has also designated these areas as RNHS. On the subject property, the boundaries of the RNHS are based on Appleby Creek, Sheldon Creek and associated hazard mapping.

To identify the boundaries of the existing RNHS, the EER used a step-wise approach as follows:

1. Step 1. Identification of Key Features;
2. Step 2. Identification of Linkages;
3. Step 3. Identification of Regulated Watercourses and Wetlands;
4. Step 4. Identification of Regulatory Floodplain and Erosion Hazards;
5. Step 5. Identification of Buffers and Setbacks; and
6. Step 6. Identification of Enhancements to Key Features.

The steps are described in the following subsections.

5.1 Identification of Key Features

Key Features represent the framework for identification of the RNHS to which additional components (Buffers, Linkages, enhancement to the Key Features, and others) are added. Collectively, these components comprise the "system".

Key Features of the RNHS are described in Halton ROP Policy 115.3(1) and include the following:

a) Significant habitat of Endangered and Threatened species;
b) Significant wetlands;
c) Significant coastal wetlands;
d) Significant woodlands;
e) Significant valleylands;
f) Significant wildlife habitat;
g) Significant areas of natural and scientific interest; and
h) Fish habitat.

The process by which Key Features within the Study Area, which includes the subject property (Areas A - E) and adjacent lands within 120 m of the subject property, have been identified and assessed is described in detail in **Section 3**.

Key Features comprising the RNHS are associated with Appleby Creek and Sheldon Creek and described below in **Table 16**.

Table 16. Assessment of Key Natural Heritage Features

Key Feature	Assessment	Present in Study Area?
Significant Woodland	There are no treed areas that would qualify as woodlands in the Study Area.	No
Significant Wetland	There are no significant wetlands in the Study Area.	No
Significant Wildlife Habitat	None identified.	No
Significant Habitat of Endangered and Threatened Species	None identified.	No
Significant Area of Natural and Scientific Interest	None identified.	No
Significant Valleyland	None identified.	No
Fish habitat	Area A and adjacent lands: Both the online ponds upstream and downstream of Millcroft Park Drive currently provide fish habitat. However, due to the multiple barriers within the channel (e.g. Geocells, debris jams), migration between the two ponds is restricted. At the time of the assessment, fish were observed below the downstream weir near Upper Middle Road but no fish were observed upstream. There is some aquatic vegetation within the channel that could provide refuge to small fish species. The online pond could also function as refuge habitat. It is important to note that, as part of the PTTW process, the online pond immediately upstream of Upper Middle Road is proposed to be taken offline. As part of this proposal, the channel will be reinstated through this area and	Yes

Key Feature	Assessment	Present in Study Area?
	the offline pond will no longer provide fish habitat. Accordingly, the pond has not been included in the NHS however, the proposed reinstated channel has been included. Lands adjacent to Area D: Sheldon Creek and the associated online pond also qualify as fish habitat, as fish were observed in the online pond and no barriers to fish movement exist between the pond and the creek channel.	

5.2 Identification of Other Natural Heritage System Components

5.2.1 Watercourses

Watercourses are defined in the ROP (2018) as (s. 289.1): "An identifiable depression in the ground in which a flow of water regularly or continuously occurs". This is the same definition as s. 28 (25) of the *Conservation Authorities Act*. CH regulates watercourses, as defined above, including Appleby Creek (Area A) and Sheldon Creek (lands adjacent to Area D). For the purpose of this report, the proposed reinstated watercourse on the downstream end of Appleby Creek, which is proposed as part of a separate PTTW application, is also included.

5.2.2 Other Wetlands

According to the ROP (2018) s. 115.3(6), wetlands other than those considered significant under s. 115.3(1)b) may be included as components of the RNHS.

Section 4.2.1.1.3 and **Section 4.2.3.1.3** include assessments of the wetlands within and directly adjacent to Area A and Area E, respectively, to determine their significance using the ROP (2018) criteria under S. 155.3(1)(b) and definitions of the plan as well as those of the City OP (2019) and CH's policies (2016a). Through those evaluations it was determined that the riparian wetland of anthropogenic origin present along select portions of Appleby Creek (Area A, ELC Polygon 2) and anthropogenic wetlands dominated by exotic invasive species allocated in the hydro corridor near the Millcroft Golf Club maintenance yard (Area E and adjacent lands, ELC Polygons 6 and 7) have limited ecological function and do not meet the Region's criteria for significance. Furthermore, as ELC Polygons 6a and 7 do not have hydric soils (see field sheet in **Appendix E** for details), they do not meet the definition of a wetland per the three abovementioned documents and thus do not represent components of the RNHS and would not be considered regulated by CH.

Riparian wetlands and online ponds adjacent to Area D were not evaluated in detail. These features are incorporated within hazards and watercourses already protected under applicable municipal and conservation authority natural heritage and hazard lands policies, and they will not be negatively impacted by the proposed development (see Impact Assessment, **Section 1**). As a conservative measure, they have tentatively been included in the RNHS for the purpose of this report and are considered regulated by CH. Further study would be required to ascertain the wetlands' eligibility for inclusion in the RNHS and regulation by CH.

5.2.3 Regulated Floodplains

Floodplain is defined in the PPS (2020) and ROP (2018) as (s. 237) as: "for river, stream, and small inland lake systems, the area, usually low lands adjoining a watercourse, which has been or may be subject to flooding hazards."

CH identifies floodplains for all regulated watercourses. As outlined in **Section 4.1.9**, updated floodplain mapping has been prepared by Urbantech for both regulated watercourses on the subject property. The existing floodplain associated with Appleby Creek and Sheldon Creek are included as constraints to development.

5.3 Linkages

Linkages represent fundamental components of the RNHS as they provide connectivity between Key Features and enable the Key Features to function as a system.

Linkages are a component of the RNHS (s. 115.3(3)) and are defined in the Region's Official Plan (s. 255) as an area that provides connectivity between Key Features for plants and animals,

> *… enabling plants and animals to move between Key Features over multiple an area intended to provide connectivity supporting a range of community and ecosystem generations. Linkages are preferably associated with the presence of existing natural areas and functions and they are to be established where they will provide an important contribution to the long-term sustainability of the Regional Natural Heritage System. They are not meant to interfere with normal farm practice. The extent and location of the linkages can be assessed in the context of both the scale of the proposed development or site alteration, and the ecological functions they contribute to the Regional Natural Heritage System.*

Linkages provide avenues for species to move among natural areas and assist in maintaining viable populations. They are generally linear in form and comprised of continuous or semi-continuous natural habitats. They may or may not overlap with Key Features, and in fragmented landscapes are typically associated with drainage features, valley systems and hedgerows.

While much of Appleby Creek is urbanized, it does provide some level of linkage function by connecting the Escarpment to Lake Ontario. Sheldon Creek is almost entirely urbanized. Both watercourses support fish habitat and thus serve an aquatic linkage function. Urban-adapted wildlife may also use vegetated portions of the riparian corridors. Within the Study Area, these functions are limited by the presence of barriers to fish movement (e.g., the weir upstream of Upper Middle Road), urbanization and multiple road crossings. Furthermore, within the Study Area, Appleby Creek and Sheldon Creek do not connect Key Features, as none are present aside from the creeks themselves.

Accordingly, it is the opinion of Beacon that Linkages, as defined by the Region, are not present within the Study Area.

5.4 Ecological Buffers

Ecological buffers[2] are intended to provide protection to Key Features and their ecological functions by mitigating potential adverse impacts from development or site alteration on lands adjacent to such features. There are many variables that need to be considered in order to identify an appropriate and scientifically defensible buffer to a protected feature. These include: slope and topography, soils, drainage, vegetative structure of the buffer area, the sensitivities of the feature, and the nature and scope of the proposed changes in adjacent land use. Although it is generally recognized that, given all the variables to consider, it is more scientifically defensible to identify buffers on a site-specific basis, prescribed buffers are sometimes recommended or adopted by planning authorities because it simplifies the process, ensures a certain level of consistency, and provides more certainty about the amount of land that will need to be set aside for conservation purposes.

Although buffers are a mitigative tool that have become more or less standard as part of the natural heritage planning process in southern Ontario, they should be understood as only one of a multitude of possible tools in helping to mitigate the effects of changes in adjacent land uses. For example, the effectiveness of a buffer is generally increased when it is naturalized and implemented in conjunction with other design measures (e.g., physical barriers that clearly separate the protected natural area from the developed area such as fences or well-designed trails).

In addition, while buffers can often provide some supportive habitat functions, they should not be identified for the purposes of providing habitat and/or trying to compensate for local or regional scale habitat removal and fragmentation. Compensation for local or regional scale habitat removal and fragmentation can, however, be provided through habitat enhancement and restoration.

The primary function of a buffer is to mitigate potential impacts to Key Features from activities on the adjacent lands. The form and dimension of a buffer should be designed to provide sufficient levels of protection to the Key Feature(s) based on consideration of the adjacent land use change, so that the Key Feature and its functions are not adversely impacted.

Policy 220.1.1 of the Halton ROP defines a Buffer as follows:

> *An area of land located adjacent to Key Features or watercourses and usually bordering lands that are subject to development of site alteration. The purpose of the buffer is to protect the features and ecological functions of the Regional Natural Heritage System by mitigating impacts of the proposed development or site alteration. The extent of the buffer and activities that may be permitted within it shall be based on the sensitivity and significance of the Key Features and watercourses and their contribution to the long-term ecological functions of the Regional Natural Heritage System as determined through a Sub-watershed Study, an Environmental Impact Assessment or similar studies that examine a sufficiently large area.*

The buffers that are recommended in this EER are consistent with this policy, as well as local level municipal and CH policies. The EER has recommended that buffers and setbacks be applied immediately adjacent to wetlands and fish habitat. The following is a summary of the various buffers and setbacks prescribed on the subject property through this EER:

[2] *The term "buffer", as used by the Region and City of Burlington, is synonymous with the term "vegetation protection zone" per Conservation Halton (2016a).*

(i) Fish Habitat – 15 m from the bankful of warmwater watercourses; and
(ii) Other wetlands[3] – 15 m from the wetland edge.

The ROP (2018) does not specify minimum buffers requirements for natural heritage features. However, CH (2016a) recommends a 15 m buffer to warmwater baitfish watercourses (policy 3.6.1), with exceptions for lesser buffer widths allowed under some circumstances (policy 3.6.2). Development within 15 - 30 m of wetlands that are not provincially significant and less than 2 ha in size are permitted per CH policies (2016a). Notably, in Area A existing residential development is approximately 15 m from fish habitat and wetlands; in Area D existing development is less than 15 m from fish habitat; and in Area E existing development is less than 15 m from wetlands.

These buffers are considered appropriate from an ecological perspective based on Beacon's assessment of the existing site conditions, the sensitivities of the various features and areas being protected (as presented in **Section 4.2**), consideration of the applicable policies (as per **Sections 2** and **5.2**), the development history of the site (i.e. the surrounding residential development is 15 m or less from wetlands and fish habitat), the nature of the proposed development (as described in **Section 7**) and experience with other projects. Furthermore, the recommended buffers represent a refinement of the Region's baseline RNHS mapping (**Figure 2**) which include 30 m buffers to wetlands and watercourses (per the *Sustainable Halton Phase 3 Report 3.02 – Natural Heritage System Definition and Interpretation*, North-South Environmental 2009) and are subject to refinement through detailed study.

The buffers to features within the subject property and greater Study Area form part of the RNHS.

5.5 Enhancements to Key Features

In addition to the identification of Key Features, Linkages and Buffers, this EER has identified enhancements to Key Features. Enhancements to Key Features are considered components of the RNHS. Section 229.1.1 or the Halton ROP defines "Enhancements to Key Features" as "ecologically supporting areas adjacent to key features and/or measures internal to key features that increase the ecological resilience and function of individual key features or groups of key features".

All the ecological communities on the subject property have been modified or altered to varying extents to facilitate golf course and suburban residential uses. This land use history has resulted in the loss of ecological integrity and impaired the ecological resilience and function of most Key Features on the subject property. Furthermore, the subject property is situated within an urban environment and will remain subject to a range of related environmental stressors indefinitely. Without active intervention through appropriate management, these stressors will continue to compromise the ecological health, integrity and resiliency of the Key Features.

Primary sites for ecological restoration and enhancement were identified by assessing the ecological state and condition, origin and history of ecological features in the Study Area, identifying communities where ecological functions have been degraded and compromised, and prioritizing areas where implementation of environmental management strategies would be most effective for restoring a higher level of ecological integrity to the Key Features and provide multiple benefits.

[3] *Specifically, ELC Polygon 2, ELC Polygon 6d and riparian wetlands adjacent to the subject property. See* ***Section 5.2.2*** *for further detail.*

Restoration and Enhancement Areas were prioritized using the following criteria:

(i) Areas within Key Features providing greatest opportunity for enhancing fish habitat; and
(ii) Areas within Key Features providing greatest opportunity for restoring and enhancing native biodiversity.

Based on the above priorities, the EER has identified several opportunities on the subject property for potential enhancement, most if which are located within Area A.

The first opportunity corresponds to works related to the Mill Pond. This pond impairs water quality in Appleby Creek through thermal loading and nitrification. Works associated with taking this pond off-line from the creek would create opportunities to improve fish passage, water quality and aquatic habitat. Detailed designs showing proposed channel enhancements, weir removal and the removal of the online pond on Appleby Creek have been provided to CH through a separate permit process associated with the golf course's PTTW approvals. As such, specific areas for enhancement are not mapped as part of the EER. As mentioned in the introduction (**Section 1**), it is important to note that the removal of this online pond is not proposed nor required as part of the current development application but rather, in support of a requirement of the MECP through the golf course's PTTW approvals.

These are considered enhancements that are integral to the RNHS as they will improve the native biodiversity and resilience of habitats that have been altered and degraded over time, and directly support fish habitat. Improvement in the quality of these habitats that are expected to increase water quality within Appleby Creek and native species diversity within riparian zones. A general overview of these proposed enhancements is contained in **Section 6.1.3**.

Second, the landscape design, which includes a vegetated 6 m wide landscape buffer separating the rear yards of existing and proposed residential properties as well as riparian plantings, will provide enhanced ecological benefits to Appleby Creek. While not specifically included in the RNHS, the City of Burlington's Urban Forest will see benefits through increased canopy cover and climate change resiliency (see **Section 9.1** for further detail).

5.6 Summary of Components of the RNHS

As summarized below, the existing RNHS is comprised of features including and associated with Appleby Creek and Sheldon Creek. The boundaries of the RNHS are illustrated in **Figures 7a, 7b** and **7c**. The boundaries of and inclusion of wetland features within the Study Area but outside of the subject property represent a high-level assessment and may be subject to change following a detailed assessment, as applicable.

Key Features

Based on the assessment of natural heritage features in **Section 4.2** above, it was determined that the Study Area supports the following Key Features:

- Fish habitat.
-



Natural Heritage System Areas A - E

Figure 7A

Millcroft Golf Club

Legend

- Subject Property, Area A- E
- Study Area

Natural Heritage Features

- Fish Habitat +15 m
- Wetlands (Beacon) +15 m
- Wetlands (Conservation Halton) + 15 m

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Natural Heritage System Area A

Figure 7B

Millcroft Golf Club

Legend

- Subject Property, Area A and Area B
- Study Area

Natural Heritage Features

- Fish Habitat + 15 m
- Wetlands (Beacon) +15 m
- Wetlands (Conservation Halton) + 15 m

BEACON ENVIRONMENTAL

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Natural Heritage System Area D

Figure 7C

Millcroft Golf Club

Legend

- Subject Property, Area D
- Study Area

Natural Heritage Features

- Fish Habitat + 15 m
- Wetlands (Beacon) +15 m
- Wetlands (Conservation Halton) + 15 m

BEACON ENVIRONMENTAL

Project: 216081.2
Last Revised: November, 2020

Client: Millcroft Greens Corporation

Prepared by: DU
Checked by: AB

N

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Natural Heritage System Area E

Figure 7D

Millcroft Golf Club

Legend

- Subject Property, Area E
- Study Area

Natural Heritage Features

- Wetlands (Beacon) +15 m

BEACON ENVIRONMENTAL

Project: 216081.2
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N

1:2,000

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Other RNHS Components

- Other wetlands;
- Watercourses that are within a Conservation Authority Regulation Limit (i.e., Appleby Creek and Sheldon Creek);
- Regulated flood plains as determined, mapped and refined from time to time by the appropriate Conservation Authority;
- Buffers – the following buffers were recommended for the Key Features and RNHS components on and immediately adjacent to the subject property:
    - Fish habitat (warmwater) – 15 m;
    - Appleby Creek – 15 m;
    - Sheldon Creek – 15 m; and
    - Other wetlands – 15 m.

Enhancements to Key Features

Proposed enhancements to Key Features consists of reinstatement of the downstream section of Appleby Creek (through a separate approvals process), which will include taking the online pond near Upper Middle Road offline and removal of the weir. The proposed channel reinstatement includes native riparian plantings and the removal of barriers to fish passage. In addition, plantings in floodplain and riparian areas upstream of the channel reinstatement are proposed as part of the open space landscaping associated with the development. Notably, plantings included as part of the landscape design represent an improvement over existing conditions.

6. Proposed Development

Proposed development within the subject property consists of converting select holes within the Millcroft Golf Course to residential detached and one six-storey condominium, including associated site access and road networks, servicing and stormwater management. Each development Area includes a six-metre-wide landscape buffer to provide screening between the proposed development and the rear lots of existing residential development. Where feasible and applicable, parks, recreational trails and open space amenity areas are also included in the proposed development.

Currently, access between golf course holes is interwoven within the surrounding residential development. To accommodate golf play and the proposed residential development, reconfiguration of the remaining holes in the Millcroft Golf Course is required.

The following sections detail the proposed plans for each of the golf course holes and maintenance yard (Areas A – E) being considered for residential development. A copy of the Development Concept Plan prepared by Gerrard Design, which includes an overview of the plan (**Figure 8**) and detailed plans for each individual development Area, is provided in **Appendix G**.



PROPOSED REFINED CH ARL

EXISTING CH ARL

- 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.
- Aerial Photo: Google Earth, Approx. Spring 2015

GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT

PROJECT 1516

DATE NOV 16, 2020

SCALE NTS

6.1 Proposed Development Plan – Area A and Area B

The proposed development in Areas A and B consist of two private condominium/site plan blocks totalling 9.49 ha which include:

- Low density residential blocks consisting of 33 residential lots in Area A and 42 in Area B;
- Park blocks / Open space;
- Private Right-of-Ways (ROWs); and
- 6 m wide landscape buffers separating the rear of existing and proposed residential lots.

The FSR (Urbantech 2020) provides functional servicing design and stormwater management information in support of the proposed development plan. The following subsections summarize information in relation to the development plan.

6.1.1 Road Network

As shown in **Appendix G**, the proposed road network consists of two cul-de-sacs originating from Millcroft Park Drive, one servicing the north portion of the proposed development (Area B) and another the south (Area A), terminating on the eastern portion of the subject property.

6.1.2 Trail Network

The proposed pedestrian trail network consists of a system of sidewalks and recreational trails connecting the parklands and residential developments proposed within Area A with each other and existing sidewalks on Country Club Drive.

6.1.3 Channel Reinstatement and Pond Retrofit

Section 4.5.2 of the FSR (Urbantech 2020) identifies decommissioning and conversion of the existing online pond into a reconfigured and offline SWM facility (to be taken offline as part of the PTTW process) that will also serve Millcroft Golf Course's irrigation needs. The downstream portion of Appleby Creek will be restored in the vicinity of the former pond, and the weir upstream of Upper Middle Road removed. These works include a pedestrian crossing over Appleby Creek that will connect to the pedestrian trail network proposed as part of the Millcroft Greens development. The proposed channel reinstatement (to be prepared by Aqualogic) will integrate natural channel design principles to replicate and enhance the existing watercourse condition upstream of the pond; with low flow channel dimensions will be determined based on post-development modelled flows. Details for the proposed minor reinstatement and formalization of a low flow channel through the former pond are being reviewed through a separate permit process with CH as part of the golf course's PTTW requirements.

As mentioned in **Section 1**, while the PTTW was initiated under a process separate from the proposed residential development, coordination between the two projects is required to ensure compatibility.

6.1.4 Grading

From a grading perspective, as it relates to impacts to the natural heritage and natural hazard features within the Areas, the proposed grading has been designed to match existing grades of the surrounding development and, to the extent possible, at the outer edge of the landscape buffer in an effort to maintain as many existing trees within the 6m landscape buffer as possible. Within Area A, fill placement is proposed to remove the proposed development in Area A from the Regional Storm floodplain. This grading is proposed in an area of existing golf course development but will require the removal of some landscaping trees.

6.1.5 Stormwater Servicing and Management

The FSR (Urbantech 2020) provides detailed information pertaining to proposed stormwater management within all five Areas. Water quantity and quality controls are proposed for each area to meet current guidelines/standards which includes using the offline Mill Pond for stormwater management as well as LID measures for water quality benefits. Stormwater, once treated within the reconfigured offline pond, will discharge to the Appleby Creek. The outfall will require a Permit from CH pursuant to Ontario Regulation 162/06. The design of the outfall can be incorporated into the on-going permit process related to the PTTW process such that the outfall can be designed simultaneously with the redesigned low flow channel.

6.2 Proposed Development Plan – Area C

The proposed development in Area C consists of a private condominium/site plan block totalling 1.46 ha which includes:

- Low density residential blocks consisting of 16 residential lots;
- Park blocks / Open space;
- Private Right-of-Ways (ROWs); and
- 6 m wide landscape buffer separating the rear of existing and proposed residential lots.

The FSR (Urbantech 2020) provides functional servicing design and stormwater management information in support of the proposed development plan. The following subsections summarize information in relation to the development plan.

6.2.1 Road Network

As shown in **Appendix G**, the proposed road network consists of a cul-de-sac originating from Country Club Drive.

6.2.2 Trail Network

The proposed pedestrian trail network consists of a sidewalk connecting the green space at the end of the cul-de-sac with the existing sidewalk on Country Club Drive.

6.2.3 Grading

There are no components of the RNHS within Area C. The grading has been designed to match existing grades at the outer edge of the landscape buffer and at the property line, as appropriate. Grading will result in the removal of existing landscaping trees within the golf course lands.

6.2.4 Stormwater Servicing and Management

The FSR (Urbantech 2020) provides water quality benefits and water quantity controls for Area C. Stormwater from Area C will discharge into the existing stormwater system with no direct connection from Area C to Appleby Creek. Please refer to the FSR for more details.

6.3 Proposed Development Plan – Area D

The proposed development in Area D consists of a private condominium/site plan block totalling 0.75 ha which includes:

- Low density residential blocks consisting of 7 residential lots;
- Park blocks / Open space;
- Private Right-of-Ways (ROWs); and
- 6 m wide landscape buffer separating the rear of existing and proposed residential lots.

The FSR (Urbantech 2020) provides functional servicing design and stormwater management information in support of the proposed development plan. The following subsections summarize information in relation to the development plan.

6.3.1 Road Network

As shown in **Appendix G**, the proposed road network consists of a cul-de-sac originating from Millcroft Drive.

6.3.2 Trail Network

The proposed pedestrian trail network consists of a sidewalk connecting the green space at the end of the cul-de-sac with the existing sidewalk on Millcroft Park Drive.

6.3.3 Grading

Similar to Area C, Area D does not contain any components of the RNHS. The proposed grading has been designed to match existing grades at the outer edge of the landscape buffer and at the property line, as appropriate. Grading will result in the removal of existing landscaping trees within the golf course lands.

6.3.4 Stormwater Servicing and Management

The FSR (Urbantech 2020) provides for water quality benefits and quantity controls for Area D. The majority of the stormwater from Area D will be directed to the existing storm sewer system within the Millcroft development however, some will discharge to Sheldon Creek. Refer to the FSR for more details.

6.4 Proposed Development Plan – Area E

The proposed development in Area E consists of a private six-storey condominium block totalling 0.66 ha which includes:

- Outdoor amenity areas;
- Surface parking;
- Underground parking; and
- 6 m wide landscape buffer separating the rear of existing residential lots and the condominium.

Access to the condominium block fronts on Dundas Street. The FSR (Urbantech 2020) provides functional servicing design and stormwater management information in support of the proposed development plan. The following subsections summarize information in relation to the development plan.

6.4.1 Grading

Similar to Areas C and D, Area E does not contain any components of the RNHS. and the proposed grading has been designed to match existing grades at the outer edge of the landscape buffer and at the property line, as appropriate. Please refer to the FSR for additional details.

6.4.2 Stormwater Servicing and Management

The FSR (Urbantech 2020) provides for water quality benefits for Area E. Stormwater flows from Area E are proposed to discharge to a grassed swale within the hydro corridor which ultimately outlets to Appleby Creek. The existing grassed swale located along the western boundary of Parcel E will be restored as an enhanced grassed swale (note: invasive species currently in the swale will be removed) to provide water quality benefits . An oil & grit separator is proposed on site and will capture pollutants prior to discharging offsite to provide additional water quality benefits.

7. Impact Assessment and Mitigation

After the refinement of the RNHS, a further function of this EER is to assess the potential impacts of the proposed development (as described in **Section 6**) on the refined RNHS on the subject property. The impact assessment presented in this study examines the potential effects of proposed development

at the site level, as well as adjacent lands (i.e., the subject property and greater Study Area, respectively).

Section 118(2) of the Regional Official Plan requires the application of a systems-based approach in implementing the RNHS. This includes not permitting the alteration to any components of the RNHS "unless it has been demonstrated that there will be no negative impacts on the natural features and areas or their ecological functions", and refining the boundaries of the RNHS (as per s. 116.1) at a stage in the process where it still allows for flexibility in enhancing the ecological functions of the system components.

Section 118.3d of the Halton ROP describes the purpose of an EIA (which is comparable to an EIS and this EER) as follows:

> *… to demonstrate that the proposed development or site alteration will result in no negative impacts to that portion of the Regional Natural Heritage System or unmapped Key Features affected by the development or site alteration by identifying components of the Regional Natural Heritage System as listed in Section 115.3 and their associated ecological functions and assessing the potential environmental impacts, requirements for impact avoidance and mitigation measures, and opportunities for enhancement...*

"Negative Impacts" is defined in the Regional Official Plan (s. 260.2) to mean:

> *260.2(1) in regard to water, degradation to the quality and quantity of water, sensitive surface water features and sensitive ground water features, and their related hydrologic functions, due to single, multiple or successive development or site alteration activities;*
> *260.2(2) in regard to fish habitat, any permanent alteration to, or destruction of fish habitat, except where, in conjunction with the appropriate authorities, it has been authorized under the Fisheries Act; and*
> *260.2(3) in regard to other components of the Regional Natural Heritage System, degradation that threatens the health and integrity of the natural features or ecological functions for which an area is identified due to single, multiple or successive development or site alteration activities.*

This impact assessment has been scoped to address specific concerns and issues related to impacts of the proposed development. One of the primary design objectives for the proposed development was to integrate the proposed community with the RNHS in a complimentary manner that affords protection to the RNHS and opportunities for the community to experience the RNHS in an environmentally respectful manner. To achieve this objective, the proposed Concept Plan was designed to: (1) avoid portions of the subject property that have been identified as forming part of the RNHS or areas constrained by natural hazards; (2) minimize site alterations for servicing within the RNHS and hazard lands; and, (3) implement mitigation measures and environmental management systems that protect and enhance the RNHS. The proposed development plan achieves these objectives.

Included below are impact assessment matrices for Areas A – E (**Table 17** to **Table 21**) that are organized by technical discipline (e.g., hydrogeology, hydrology, aquatic biology, terrestrial biology, etc.). The matrices describes the impact source(s) (e.g. development/site alteration activity), the potential impact to the impact receptor(s) (features, attributes and functions), the recommended mitigation measures (including special monitoring or management needs) to be implemented, where

appropriate, to avoid or reduce potential negative impacts (and any associated monitoring or management actions required) and the anticipated residual impacts.

As with the other components of the EER, an integrated multi-disciplinary approach was applied to impact assessment. This approach allows for assessment of biophysical relationships documented within the subject property, such as relationships between surface water resources in sustaining fish habitat in Appleby Creek and Sheldon Creek. The information presented in the matrices incorporates the key findings of the relevant and related technical studies and analyses as appropriate.

As direct impacts to Key Features of the RNHS have been avoided though the design of the development, including and not limited to creation of lot lines outside of the RNHS, the impact assessment is focused primarily on addressing potential indirect impacts. The impact assessment also speaks to the impacts of anticipated tree removals outside the proposed RNHS required to accommodate development.

Table 17. Impact Assessment Matrix – Area A

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
PHYSICAL ENVIRONMENT						
Geology	**Bedrock**	The bedrock of the subject property is described in **Section 4.1.1.** Bedrock underlying the subject property consists of weathered Queenston Shale that is generally found at depths between 1.5 and 6.1 m below ground surface (bgs).	Grading and Servicing	It is not anticipated that bedrock will be substantially exposed or disturbed by the proposed development however, shale may be encountered during the excavation of the realigned watercourse and drinking and wastewater servicing on the Subject property.	The detailed design will identify the potential requirement for over-excavation in the event shale is encountered and will identify the desirability of adding alluvium, Granular B, etc.	Neutral
	Surficial Geology	The surficial geology of the subject property is described in **Section 4.1.1.** Topsoil depth ranges from 130 mm to 350 mm. Beneath that, overburden consists of fill underlain by clayey silt, sandy silt till, clayey silt till and a shale complex overlying shale bedrock.	Site Preparation and Grading	Site grading is anticipated to impact upon the surficial geology. Cutting will reduce the depth of the overburden and filling has the potential to change to the stratigraphy through mixing. Considering that the stratigraphy is primarily fill that is variably underlain by more finer tills, it is not anticipated that these modifications will substantially impact the till substrates.	Conserve overburden on the site by maintaining a cut/fill balance to the extent feasible so as to minimize exportation or importation of fill materials. Avoid mixing coarser and finer grained substrates during fill operations.	Neutral
Landform	**Physiography**	The physiography of the Study Area is described in **Section 4.1.2.** Lands within the subject property are relatively flat and significant landforms are not present. The Study Area is situated on the South Slope physiographic region. Characteristic soils of this region include clay and, in alluvial areas, modern sand and gravel deposits.	Site Preparation and Grading	The proposed development will not significantly affect the physiography of the site as it is relatively flat.	No mitigation required.	Neutral
	Topography	The topography of the Study Area is described in **Section 4.1.3.** The Study Area lies in a relatively flat area with an overall slope to the south/southeast. Areas A and B generally fall from north east to south west with a maximum grade change of 5 m across both Areas. Elevations on the northern (golf hole #7) and southern (golf hole #6) parcels range from approximately 141 to 143 metres above sea level (masl) and 137 to 141 masl, respectively. <u>Cut/fill changes to existing topography:</u> Municipal standards require a suitable depth of cover above storm and sanitary sewers and watermains for frost protection. Services (particularly sanitary sewers) must also be at a sufficient depth to service basements. This requires filling certain areas of the existing site to a suitable level. In other areas, the existing topography may not meet municipal standards for maximum road slopes, therefore cutting certain areas of the site is required. Further constraining the proposed grading/cut/fill	Site Preparation and Grading	Cutting and filling the site results in minor changes in surface drainage patterns (see Drawing GR-AB in Urbantech 2020) as well as potential impacts to existing vegetation. Changes in topography have the potential to alter surface water contributions to adjacent natural features. The proposed development will not significantly affect the topography of the site as it is relatively flat.	Existing grades along property lines, and along the outer edge of buffers, will be matched under post-development conditions to minimize impacts to topography. Existing surface drainage characteristics will be maintained or replicated in order to sustain adjacent natural heritage features (i.e. Appleby Creek).	Neutral

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
		is the requirement to match existing servicing inverts and existing boundary grades. Changes to existing drainage patterns: Refer to "Surface Water", below.				
Soils	**Topsoil**	See “Surficial Geology”, above. Removal of existing topsoil: Topsoil stripping and stockpiling will be required to facilitate grading of the subject property. As part of the proposed LID measures, a minimum of 300 mm topsoil depth will be applied to the subject property to improve infiltration. Existing topsoil, including organic matter, will be stripped and stockpiled to facilitate earthworks and to ensure building foundations and infrastructure bedding are placed on stable material. A portion of the stockpiled topsoil will be utilized in open space areas as well as residential yards in the development.	Site Preparation and Grading	Stripping and stockpiling of topsoil can result in loss of organic material/nutrients. During site grading activities, topsoil porosity can be reduced due to earth-moving machinery (i.e., scrapers) and topsoil stockpiling, which can reduce the infiltration capacity of the soil to be re-applied to the site. Specific potential impacts could include: • Compaction of topsoil as a result of machinery movement and handling of soil; • Compaction of topsoil as a result of compression under weight of stockpile; • Sterilization of topsoil due to extended duration of stockpiling; • Compaction of surface of subsoil layer as a result of machinery movement; • Loss of depth of topsoil cover and potential for attenuation of stormwater runoff due to a decrease in the extent of post-development topsoil cover and depth; and/or • Loss of topsoil due to erosion by wind or rainfall runoff.	• Prohibit machinery encroachment into areas that are proposed to remain undisturbed or that are proposed for naturalization • Where possible, limit height of topsoil stockpile to a maximum of 3 m and stockpile for a maximum of 1 year (preferably less than 6 months) • Stockpile organic-rich surface layer of topsoil separately from subsurface layers • Test topsoil and supplement with required amendments to facilitate proper soil chemistry to support plant growth • Scarify compacted sub-surface soil layer prior to installation of topsoil profile post-development • Provide a minimum depth of 300 mm of topsoil over all areas (post development) and place topsoil with an emphasis on minimizing soil compaction • Provide temporary cover over topsoil stockpiles to mitigate erosion resulting from wind and precipitation. Direct surface runoff away from topsoil stockpiles and implement erosion and sediment control initiatives. • Stabilize topsoiled/finegraded areas with vegetation cover after topsoil placement. Utilise erosion blankets/Terraseeding or other methods to stabilize topsoil on slopes where required.	Neutral

Water Balance	**Surface and Groundwater**	Per Section 7.5 of the Hydrogeological Report (RJ Burnside 2020), without mitigation the proposed development has the potential to decrease shallow groundwater infiltration levels by 37% and increase surface water runoff.	Residential Development	Increased imperviousness owing to an increase in hard surfaces results in a reduction of infiltration and increase in surface runoff.	• Mitigate reduction of infiltration and increase in surface runoff through use of LID measures. Including:
					  • Increasing topsoil depth to 300 mm; and
					  • Disconnection of roof leaders to rear yards (RJ Burnside 2020).
						Neutral

Groundwater Resources	**Groundwater Flows, Patterns and Gradients (Shallow)**	Groundwater levels in monitoring wells were observed to be 0.7 mbgs to 4.1 mbgs, averaging 1.8 mbgs. (RJ Burnside 2020). Generally, shallow groundwater flow follows local topography and surface water drainage patterns and constitutes a local groundwater flow system that generally flows towards Appleby Creek.	Grading and Servicing; Residential Development	• Potential for underground servicing, if below the water table, to interrupt groundwater flows and direct them along service corridors; • Potential for basements to intercept groundwater; and • Potential for encountering groundwater during construction of underground services and/or basements.	• Use of Best Management Practices (BMPs) including use of anti-seepage collars or clay plugs to prevent groundwater flow along granular bedding and erosion of backfill materials. • Use of a perimeter drainage system around the exterior of basements. • Should groundwater be encountered during construction, dewatering and/or depressurizing is recommended.	Neutral

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
	Groundwater Quality (Shallow)	Groundwater quality is proposed to be maintained though the use of LID measures. The addition of topsoil within the study area will increase opportunities for attenuation of pollutants, and potential impacts to groundwater quality are expected to be nominally improved following the change in land use (see Section 7.6.5 of RJ Burnside 2020).	Residential Development	Runoff from urban developments may contain dilute contaminants including suspended solids, chlorides, petrochemicals, metals, pesticides, fertilizer, bacteria and viruses. Most are attenuated by soil and soil biota, except for chlorides and nitrogen. A change in land use from an active golf course to a residential area will result in a reduction in fertilizer and pesticide application.	Not applicable.	Positive
Surface Water	**Drainage Catchment Areas**	As outlined in Urbantech Consulting 2020, proposed changes to site grading result in minor changes to existing drainage patterns, though water will still generally drain towards the south/southeast. Existing drainage to Appleby Creek will not be significantly altered.	Site Preparation and Grading	None expected - existing drainage patterns are not proposed to be significantly altered.	No mitigation necessary – existing drainage patterns are not proposed to be significantly altered.	Neutral
	Surface Drainage and Fluvial Geomorphology	As outlined in Urbantech Consulting 2020, proposed changes to site grading result in minor changes to existing drainage patterns, though water will still generally drain towards the south/southeast. Existing drainage to Appleby Creek will not be significantly altered.	Site preparation, grading, and residential development	Potential impacts associated with the proposed development include: • Release of sediment to Appleby Creek Increase rates of erosion or sedimentation relative to existing conditions due to alterations in flow regime as a result of land use change.	Appropriate phasing, erosion and sediment control measures will mitigate potential for sediment release during construction. Implementation of appropriate stormwater management measures, as outlined in the Urbantech FSR (2020) will mitigate the potential for increase rates of erosion and sedimentation within a portion of Appleby Creek that currently does not benefit from stormwater quantity controls.	Positive
	Water Quality	Development could result in the following potential stressors to water quality: • Increased heavy metal / chloride concentrations in post-development stormwater runoff resulting from vehicles / road salt; • Increased loading of fine particulate matter from impervious surfaces; and, • Increased temperature of surface runoff due to interaction with warm surfaces (asphalt/roof tops).	Grading, site preparation, channel reinstatement and pond retrofit	Discharge of sediment and other pollutants into watercourses have the potential to disrupt aquatic habitat/impact aquatic species by interfering with turbidity/visibility, feeding and by increasing surface water temperatures. Heavy metals and chlorides can impact surface water resources.	As outlined in Urbantech Consulting 2020 and **Section 7.2**, under post-development conditions, water quality control in the form of LIDs measures and a SWM pond near Upper Middle Road will provide enhanced water quality compared to existing conditions. The integration of subsurface LID systems will result in a reduction in the temperature of stormwater discharged into receiving watercourses (in comparison to a conventional end-of-pipe SWM system). Release of sediment into the watercourses will be mitigated through the use of erosion and sediment control practices during construction. All machinery will arrive on site in a clean condition and will be maintained for the duration of the works. Wash, refuel and service of machinery will be undertaken in such a way as	Immediate/ during construction: Neutral Long-term/ post-construction: Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
					to prevent any deleterious substances from entering the water.	
Key Features	**Fish Habitat**	Fish habitat in Area A is described in **Section 0**. Appleby Creek has been classified as providing warm water habitat generally considered to be in good condition (Conservation Halton 2009). However, the fish community has been rated as 'poor' (Conservation Halton 2016b). Beacon's observations of fish barriers, online ponds and geoweb indicate that the portion of Appleby Creek that is within the subject property and greater Study Area provides limited fish habitat. It is recognised that the conversion of the online pond to a SWM pond will increase the available in-channel fish habitat while eliminating fish habitat within the online pond.	Site grading	Grading adjacent to fish habitat is proposed. These impacts are considered temporary as it is proposed that this portion of the channel be restored and enhanced to provide for improved habitat functions.	Implement 15 m warmwater watercourse buffers as per the proposed RNHS and Conservation Halton policies (which represents a buffer that is greater than what is present under existing conditions). The proposed riparian buffers adjacent to the channel will be more than adequate to protect fish habitat from any potential impacts related to human encroachment or sedimentation. Provide enhanced water quality through SWM measures.	Immediate/ during construction: Neutral Long-term/ post-construction: Positive
Regulated Watercourses		Regulated watercourses form part of the RNHS. There is one watercourse in Area A that is regulated by CH: Appleby Creek (see **Section 5.2.1**).	Site grading	The potential for the release of sediment during and immediately following construction represents a possible impact to the downstream system. No long-term negative impacts are anticipated to the regulated watercourse and its functions provided it is enhanced in accordance with the recommendations of this EER. The design of the stormwater outfall to Appleby Creek can be completed in conjunction with the reinstatement of the watercourse channel as part of the PTTW process.	Application of appropriate (15 m ecological) buffers and (7.5 m hazard) setbacks to the regulated watercourse when adjacent to development. Implementation of Best Management Practices. See "Water Quality", above.	Immediate/ during construction: Neutral Long-term/ post-construction: Positive
Other Wetlands		Non-significant wetlands may be considered components of the RNHS according to the Regional Official Plan (2018). As outlined in **Section 5.2.2**, small riparian wetlands have been identified in Area A (ELC Polygon 2 and lands upstream and downstream of Area A).	Site grading	The potential for the release of sediment during and immediately following construction represents a possible impact to the wetlands. Wetlands upstream of Area A will not be impacted by the proposed development within Area A.	Application of appropriate (15m) buffers and E&SC measures.	Immediate/ during construction: Neutral Long-term/ post-construction: Positive
Wildlife	**Birds**	As detailed in **Section 4.2.1.1.4**, the bird community in Area A is generally reflective of the anthropogenic habitat type present (i.e. active golf course within a residential area). The community is comprised of common to widespread species that are tolerant of disturbance.	Tree removals	The bird communities associated with Area A and the greater study area are not expected to be affected by the proposed residential development. The same species would be expected to be present in both existing and proposed habitats given the surrounding residential development. The proposed development represents a scenario where more treed habitat will be available for birds.	Areas that are proposed for restoration such as the buffers and Appleby Creek, that are currently part of an active golf course will provide some habitat for early successional species for some time, thus it is expected that most species recorded on the subject property will remain. Manicured treed areas will be replicated through proposed streetscaping, landscape buffer, trail and park areas.	Neutral -Positive
	Reptiles	As detailed in **Section 4.2.1.1.5**, Midland Painted Turtles were observed in the online pond in Area A. Basking opportunities are limited to	Pond retrofit proposed as part of PTTW process.	The online pond is proposed to be taken offline and replaced with a SWM pond that will continue to be used for irrigation purposes. While SWM ponds are not intended to	The online pond presently provides very few opportunities for turtle nesting or basking. Through the PTTW permit process, it is anticipated that landscaping associated with the	Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
		the shore of the pond, and nesting sites are limited to sand traps within the golf course.		function as wildlife habitat, turtles often utilize such infrastructure for foraging, basking and overwintering.	facility will represent a net gain over vegetation present under existing conditions. Water quality will be addressed through the implementation of a forebay structure upstream of the permanent pool of the proposed SWM pond.	
	Amphibians	The results of the calling amphibian surveys are contained in **Section 4.1.1.2.6**. Green Frog was recorded calling from the online pond in Area A.	Pond retrofit proposed as part of PTTW process	There is anticipated to be a negligible impact to amphibians due to the proposed development. Marginal habitat for breeding amphibians is present within the online pond near Upper Middle Road. This feature is proposed to be replaced with a SWM pond that will continue to be used for irrigation purposes, which will perform much of the same function for amphibians as the extant pond. Future light impacts from the proposed residential development are not anticipated to be significantly greater than those which presently exist.	The online pond presently provides very few opportunities for amphibian foraging. Through the PTTW permit process, it is anticipated that landscaping associated with the facility will represent a net gain over vegetation present under existing conditions. Exclusion of fish from the pond (by taking the pond offline) will likely result in an increase in amphibian survival.	Positive
Vegetation	**Vegetation Communities**	A total of seven ELC polygons (representing six community types) were generated for the subject property (see **Section 4.1.1.1** for descriptions). Vegetation communities within the Study Area are generally reflective of a suburban land use matrix abutting a minor creek system (Appleby Creek) within an active golf course. None of the ecological communities in or adjacent to Area A are considered rare or significant at the Provincial level. Only wetland communities, consisting of the (planted) willow thicket swamp adjacent to Appleby Creek (ELC Polygon 2), are eligible for inclusion in the proposed RNHS in accordance with applicable policies.	Channel reinstatement near the pond as part of the PTTW process and residential development	The channel reinstatement proposed as part of the PTTW will impact vegetation communities within riparian areas along Appleby Creek. The realigned channel will include restoration and buffer plantings up to 15 m from the top of bank, representing a net gain in area covered in natural vegetation. Other vegetation communities on the subject property (e.g. ELC units 3 and 4), while not candidates for inclusion in the refined RNHS, will nevertheless mostly be incorporated within proposed trail areas.	Loss of vegetation cover related to the proposed development will be mitigated by landscaping portions of the site with appropriate native species. Opportunities for restoration of vegetation cover exist within the development area (e.g. buffers, parks, trails, realigned channel). The online pond near Upper Middle Road is proposed to be replaced with an off-line SWM pond that will continue to be used for irrigation purposes as part of a PTTW application. Through the PTTW process it is anticipated that landscaping associated with the facility will represent a net gain over vegetation present under existing conditions, as little natural vegetation is currently present in the vicinity of the pond. Given that the area proposed for development is comprised of golf course lands, it is anticipated that the proposed development will result in a net increase in permanently vegetated areas, as each lot, park and buffer block will be landscaped and permanently re-vegetated.	Positive
	Plants	As detailed in **Section 4.2.1.1.2**, the subject property supports a low diversity of plant species owing to the current land use. Only one of the species recorded in Area A is considered rare in Halton (One-seeded Bur Cucumber) – it will not be impacted by the proposed development.	Development including grading, servicing and channel reinstatement (proposed as part of the PTTW process).	Site grading has the potential to impact plants if vegetation is not protected by construction/silt fencing.	• Proposed habitat enhancements and buffer plantings increase the amount of habitat available to One-seeded Bur Cucumber. • Existing (desirable) vegetation can be protected through the use of temporary construction silt fencing.	Neutral-Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
	Trees	Trees associated with the subject property consist of manicured treed areas primarily located along the edges of the golf course and riparian areas. Of the 577 trees recorded on the subject property, 250 are in Area A (see Arborist Report (Beacon 2020)).	Development including grading, servicing and channel reinstatement (proposed as part of the PTTW process).	It is estimated that the proposed Development Plan will require the removal of 142 trees from Area A due to grading, servicing and lotting conflicts associated with the Millcroft green development and the PTTW works, with an additional 19 removed due to condition. The loss of these trees will result in a temporary loss of tree canopy and associated ecological functions, and also presents an opportunity to replace exotic and invasive species with native species.	In addition to trees identified for preservation, additional opportunities to preserve select trees internal to the development limits may be identified and will be examined at the detailed design stage. The temporary loss of tree cover is to be addressed through plantings of street trees and landscaping in parks, as well as plantings in buffers and enhancement areas where opportunities exist. It is anticipated that the combination of these plantings, particularly over time, will result in a more extensive tree canopy on the Subject property than currently exists as much of the area proposed for development is presently a golf course.	Positive

Table 18. Impact Assessment Matrix - Area B

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
PHYSICAL ENVIRONMENT						
Geology	**Bedrock**	The bedrock of the subject property is described in **Section 4.1.1.** Bedrock underlying the subject property consists of weathered Queenston Shale that is generally found at depths between 1.5 and 6.1 m below ground surface (bgs).	Grading and Servicing	It is not anticipated that bedrock will be substantially exposed or disturbed by the proposed development however, shale may be encountered during the excavation of the realigned watercourse and drinking and waste water servicing on the Subject property.	The detailed design will identify the potential requirement for over-excavation in the event shale is encountered and will identify the desirability of adding alluvium, Granular B, etc.	Neutral
	Surficial Geology	The surficial geology of the subject property is described in **Section 4.1.1.** Topsoil depth ranges from 150 mm bgs to 1800 mm bgs. Beneath that, overburden consists of fill underlain by clayey silt, sandy silt till, clayey silt till and a shale complex overlying shale bedrock.	Site Preparation and Grading	Site grading is anticipated to impact upon the surficial geology. Cutting will reduce the depth of the overburden and filling has the potential to change to the stratigraphy through mixing. Considering that the stratigraphy is primarily fill that is variably underlain by more finer tills, it is not anticipated that these modifications will substantially impact the till substrates.	Conserve overburden on the site by maintaining a cut/fill balance to the extent feasible so as to minimize exportation or importation of fill materials. Avoid mixing coarser and finer grained substrates during fill operations.	Neutral
Landform	**Physiography**	The physiography of the Study Area is described in **Section 4.1.2.** Lands within the subject property are relatively flat and significant landforms are not present. The Study Area is situated on the South Slope physiographic region. Characteristic soils of this region include clay and, in alluvial areas, modern sand and gravel deposits.	Site Preparation and Grading	The proposed development will not significantly affect the physiography of the site as it is relatively flat.	No mitigation required.	Neutral
	Topography	The topography of the Study Area is described in **Section 4.1.3.** The Study Area lies in a relatively flat area with an overall slope to the south/southeast. Areas A and B generally fall from north east to south west with a maximum grade change of 5 m across both Areas. Elevations in Area B range from approximately 141 to 143 masl. <u>Cut/fill changes to existing topography:</u> Municipal standards require a suitable depth of cover above storm and sanitary sewers and watermains for frost protection. Services (particularly sanitary sewers) must also be at a sufficient depth to service basements. This requires filling certain areas of the existing site to a suitable level. In other areas, the existing topography may not meet municipal standards for maximum road slopes, therefore cutting certain areas of the site is required. Further constraining the proposed grading/cut/fill is the requirement to match existing servicing inverts and existing boundary grades.	Site Preparation and Grading	Cutting and filling the site results in minor changes in surface drainage patterns (see Drawing GR-AB in Urbantech 2020) as well as potential impacts to existing vegetation. Changes in topography have the potential to alter surface water contributions to adjacent natural features. The proposed development will not significantly affect the topography of the site as it is relatively flat.	Existing grades along property lines, and along the outer edge of buffers, will be matched under post-development conditions to minimize impacts to topography. Existing surface drainage characteristics will be maintained or replicated in order to sustain adjacent natural heritage features (i.e. Appleby Creek).	Neutral

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
		Changes to existing drainage patterns: Refer to "Surface Water", below.				
Soils	**Topsoil**	See “Surficial Geology”, above. Removal of existing topsoil: Topsoil stripping and stockpiling will be required to facilitate grading of the subject property. Existing topsoil, including organic matter, will be stripped and stockpiled to facilitate earthworks and to ensure building foundations and infrastructure bedding are placed on stable material. A portion of the stockpiled topsoil will be utilized in open space areas as well as residential yards in the development.	Site Preparation and Grading	Stripping and stockpiling of topsoil can result in loss of organic material/nutrients. During site grading activities, topsoil porosity can be reduced due to earth-moving machinery (i.e., scrapers) and topsoil stockpiling, which can reduce the infiltration capacity of the soil to be re-applied to the site. Specific potential impacts could include: • Compaction of topsoil as a result of machinery movement and handling of soil; • Compaction of topsoil as a result of compression under weight of stockpile; • Sterilization of topsoil due to extended duration of stockpiling; • Compaction of surface of subsoil layer as a result of machinery movement; • Loss of depth of topsoil cover and potential for attenuation of stormwater runoff due to a decrease in the extent of post-development topsoil cover and depth; and/or • Loss of topsoil due to erosion by wind or rainfall runoff.	• Prohibit machinery encroachment into areas that are proposed to remain undisturbed or that are proposed for naturalization • Where possible, limit height of topsoil stockpile to a maximum of 3 m and stockpile for a maximum of 1 year (preferably less than 6 months) • Stockpile organic-rich surface layer of topsoil separately from subsurface layers • Test topsoil and supplement with required amendments to facilitate proper soil chemistry to support plant growth • Scarify compacted sub-surface soil layer prior to installation of topsoil profile post-development • Provide a minimum depth of 300 mm of topsoil over all areas (post development) and place topsoil with an emphasis on minimizing soil compaction • Provide temporary cover over topsoil stockpiles to mitigate erosion resulting from wind and precipitation. Direct surface runoff away from topsoil stockpiles and implement erosion and sediment control initiatives. • Stabilize topsoiled/finegraded areas with vegetation cover after topsoil placement. Utilise erosion blankets/Terraseeding or other methods to stabilize topsoil on slopes where required.	Neutral

Water Balance	**Surface and Groundwater**	Per Section 7.5 of the Hydrogeological Report (RJ Burnside 2020), without mitigation the proposed development has the potential to decrease shallow groundwater infiltration levels by 37% and increase surface water runoff.	Development	Increased imperviousness owing to an increase in hard surfaces results in a reduction of infiltration and increase in surface runoff.	• Mitigate reduction of infiltration and increase in surface runoff through use of LID measures. Including:
					  • Increasing topsoil depth to 300 mm; and
					  • Disconnection of roof leaders to rear yards (RJ Burnside 2020).
						Neutral

Groundwater Resources	**Groundwater Flows, Patterns and Gradients (Shallow)**	Groundwater levels in monitoring wells were observed to be 0.7 mbgs to 4.1 mbgs, averaging 1.8 mbgs. (RJ Burnside 2020). Generally, shallow groundwater flow follows local topography and surface water drainage patterns and constitutes a local groundwater flow system that generally flows towards Appleby Creek.	Grading and Servicing; Residential Development	• Potential for underground servicing, if below the water table, to interrupt groundwater flows and direct them along service corridors; • Potential for basements to intercept groundwater; and, • Potential for encountering groundwater during construction of underground services and/or basements.	• Use of BMPs including use of anti-seepage collars or clay plugs to prevent groundwater flow along granular bedding and erosion of backfill materials. • Use of a perimeter drainage system around the exterior of basements. • Should groundwater be encountered during construction, dewatering and/or depressurizing is recommended.	Neutral
	Groundwater Quality (Shallow)	Groundwater quality is proposed to be maintained though the use of LID measures. The addition of topsoil within the study area will increase opportunities for attenuation of pollutants, and potential impacts to groundwater quality are	Residential Development	Runoff from urban developments may contain dilute contaminants including suspended solids, chlorides, petrochemicals, metals, pesticides, fertilizer, bacteria and viruses. Most are attenuated by soil and soil biota, except for chlorides and nitrogen. A change in land use from an	Not applicable.	Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
		expected to be nominally improved following the change in land use (see Section 7.6.5 of RJ Burnside 2020).		active golf course to a residential area will result in a reduction in fertilizer and pesticide application.		
Surface Water	**Drainage Catchment Areas**	As outlined in Urbantech Consulting 2020, proposed changes to site grading result in minor changes to existing drainage patterns, though water will still generally drain towards the south/southeast. Existing drainage to Appleby Creek will not be significantly altered.	Site Preparation and Grading	None expected - existing drainage patterns are not proposed to be significantly altered.	No mitigation necessary – existing drainage patterns are not proposed to be significantly altered.	Neutral
	Water Quality	Development could result in the following potential stressors to water quality: • Increased heavy metal / chloride concentrations in post-development stormwater runoff resulting from vehicles / road salt; • Increased loading of fine particulate matter from impervious surfaces; and, • Increased temperature of surface runoff due to interaction with warm surfaces (asphalt/roof tops).	Grading, site preparation, channel reinstatement and pond retrofit	Discharge of sediment and other pollutants into watercourses have the potential to disrupt aquatic habitat/impact aquatic species by interfering with turbidity/visibility, feeding and by increasing surface water temperatures. Heavy metals and chlorides can impact surface water resources.	As outlined in Urbantech Consulting 2020 and **Section 7.2**, under post-development conditions, water quality control in the form of LIDs measures and a SWM pond near Upper Middle Road will provide enhanced water quality compared to existing conditions. The integration of subsurface LID systems will result in a reduction in the temperature of stormwater discharged into receiving watercourses (in comparison to a conventional end-of-pipe SWM system). Release of sediment into the watercourses will be mitigated through the use of erosion and sediment control practices during construction. All machinery will arrive on site in a clean condition and will be maintained for the duration of the works. Wash, refuel and service of machinery will be undertaken in such a way as to prevent any deleterious substances from entering the water.	Immediate/ during construction: Neutral Long-term/ post-construction: Positive
Wildlife	**Birds**	As detailed in **Section 4.2.1.1.4**, the bird community in Area B is generally reflective of the anthropogenic habitat type present (i.e. active golf course within a residential area). The community is comprised of common to widespread species that are tolerant of disturbance.	Tree removals	The bird communities associated with Area B are not expected to be negatively affected by the proposed adjacent development. The same species would be expected to be present in both existing and proposed habitats.	Areas that are proposed for restoration such as the buffers and Appleby Creek (adjacent Area A), that are currently part of an active golf course will provide some habitat for early successional species for some time, thus it is expected that most species recorded on the subject property will remain. Manicured treed areas will be replicated through proposed streetscaping, trail and park areas.	Neutral
Vegetation	**Vegetation Communities**	A total of two ELC polygons (representing six vegetation community types) were generated for Area B (see **Section 4.2.1.1.1** for descriptions). Vegetation communities within the Study Area are generally reflective of a suburban land use matrix abutting minor creek systems within an active golf course. None of the ecological communities on the Subject property or Area B are considered rare or significant at the Provincial level, and no	Development, including grading and servicing.	The grading, servicing and open space lands proposed as part of the Development Plan will impact vegetation communities within Area B. Natural and semi-natural vegetation communities on the eastern edge of Area B (e.g. ELC polygons 3 and 4), while not candidates for inclusion in the proposed RNHS, will nevertheless mostly be incorporated within proposed trail areas.	Loss of vegetation cover related to the proposed will be mitigated by landscaping portions of the site with appropriate native species. Opportunities for restoration of vegetation cover exist within the development area (e.g. buffers, open space, trails). Given that the area proposed for development is comprised of golf course lands, it is anticipated that the proposed development will result in a	Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
		vegetation communities are eligible for inclusion in the proposed RNHS in accordance with applicable policies.			net increase in permanently vegetated areas, as each lot, park and LID block will be landscaped and permanently re-vegetated.	
	Trees	Trees associated with the subject property consist of manicured treed areas primarily located along the edges of the golf course and riparian areas. A total of 196 trees with trunk diameters of 10 cm or greater were recorded in Area B (see Arborist Report (Beacon 2020)).	Development, including grading and servicing.	It is estimated that the proposed Development Plan will require the removal of 106 trees from Area B due to grading, servicing and lotting conflicts. An additional 10 trees will be removed due to condition. The loss of these trees will result in a temporary loss of tree canopy and associated ecological functions, and may also present an opportunity to replace exotic and invasive species with native species.	In addition to trees identified for preservation, additional opportunities to preserve select trees internal to the development limits may be identified and will be examined at the detailed design stage. The loss of tree cover is to be addressed through plantings of street trees and landscaping in parks, as well as plantings in buffers and enhancement areas where opportunities exist. It is anticipated that the combination of these plantings, particularly over time, will result in a more extensive tree canopy on the Subject property than currently exists as much of the area proposed for development is presently a golf course.	Positive

Table 19. Impact Assessment Matrix - Area C

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
PHYSICAL ENVIRONMENT						
Geology	**Bedrock**	The bedrock of the subject property is described in **Section 4.1.1.** Bedrock underlying the subject property consists of weathered Queenston Shale that is generally found at depths between 1.5 and 6.1 m below ground surface (bgs).	Grading and Servicing	It is not anticipated that bedrock will be substantially exposed or disturbed by the proposed development however, shale may be encountered during the excavation of the realigned watercourse and drinking and waste water servicing on the Subject property.	The detailed design will identify the potential requirement for over-excavation in the event shale is encountered and will identify the desirability of adding alluvium, Granular B, etc.	Neutral
	Surficial Geology	The surficial geology of the subject property is described in **Section 4.1.1.** Topsoil depth ranges from 150 mm bgs to 180 mm bgs. Beneath that, overburden consists of fill underlain by clayey silt, clayey silt till and sandy silt till and a shale complex overlying shale bedrock.	Site Preparation and Grading	Site grading is anticipated to impact upon the surficial geology. Cutting will reduce the depth of the overburden and filling has the potential to change to the stratigraphy through mixing. Considering that the stratigraphy is primarily fill that is variably underlain by more finer tills, it is not anticipated that these modifications will substantially impact the till substrates.	Conserve overburden on the site by maintaining a cut/fill balance to the extent feasible so as to minimize exportation or importation of fill materials. Avoid mixing coarser and finer grained substrates during fill operations.	Neutral
Landform	**Physiography**	The physiography of the Study Area is described in **Section 4.1.2.** Lands within the subject property are relatively flat and significant landforms are not present. The Study Area is situated on the South Slope physiographic region. Characteristic soils of this region include clay and, in alluvial areas, modern sand and gravel deposits.	Site Preparation and Grading	The proposed development will not significantly affect the physiography of the site as it is relatively flat.	No mitigation required.	Neutral
	Topography	The topography of the Study Area is described in **Section 4.1.3.** Area C generally falls from north east to the south west with a maximum grade change of 0.50 m. <u>Cut/fill changes to existing topography:</u> Municipal standards require a suitable depth of cover above storm and sanitary sewers and watermains for frost protection. Services (particularly sanitary sewers) must also be at a sufficient depth to service basements. This requires filling certain areas of the existing site to a suitable level. In other areas, the existing topography may not meet municipal standards for maximum road slopes, therefore cutting certain areas of the site is required. Further constraining the proposed grading/cut/fill is the requirement to match existing servicing inverts and existing boundary grades. <u>Changes to existing drainage patterns:</u> Refer to "Surface Water", below.	Site Preparation and Grading	Cutting and filling the site results in minor changes in surface drainage patterns (see Drawing GR-C in Urbantech 2020) as well as potential impacts to existing vegetation. The proposed development will not significantly affect the topography of the site as it is relatively flat.	Existing grades along property lines, and along the outer edge of buffers, will be matched under post-development conditions to minimize impacts to topography.	Neutral

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
Soils	**Topsoil**	See “Surficial Geology”, above. <u>Removal of existing topsoil</u>: Topsoil stripping and stockpiling will be required to facilitate grading of the subject property. Existing topsoil, including organic matter, will be stripped and stockpiled to facilitate earthworks and to ensure building foundations and infrastructure bedding are placed on stable material. A portion of the stockpiled topsoil will be utilized in open space areas as well as residential yards in the development.	Site Preparation and Grading	Stripping and stockpiling of topsoil can result in loss of organic material/nutrients. During site grading activities, topsoil porosity can be reduced due to earth-moving machinery (i.e., scrapers) and topsoil stockpiling, which can reduce the infiltration capacity of the soil to be re-applied to the site. Specific potential impacts could include: • Compaction of topsoil as a result of machinery movement and handling of soil; • Compaction of topsoil as a result of compression under weight of stockpile; • Sterilization of topsoil due to extended duration of stockpiling; • Compaction of surface of subsoil layer as a result of machinery movement; • Loss of depth of topsoil cover and potential for attenuation of stormwater runoff due to a decrease in the extent of post-development topsoil cover and depth; and/or • Loss of topsoil due to erosion by wind or rainfall runoff.	• Prohibit machinery encroachment into areas that are proposed to remain undisturbed or that are proposed for naturalization • Where possible, limit height of topsoil stockpile to a maximum of 3 m and stockpile for a maximum of 1 year (preferably less than 6 months) • Stockpile organic-rich surface layer of topsoil separately from subsurface layers • Test topsoil and supplement with required amendments to facilitate proper soil chemistry to support plant growth • Scarify compacted sub-surface soil layer prior to installation of topsoil profile post-development • Provide a minimum depth of 300 mm of topsoil over all areas (post development) and place topsoil with an emphasis on minimizing soil compaction • Provide temporary cover over topsoil stockpiles to mitigate erosion resulting from wind and precipitation. Direct surface runoff away from topsoil stockpiles and implement erosion and sediment control initiatives. • Stabilize topsoiled/finegraded areas with vegetation cover after topsoil placement. Utilise erosion blankets/Terraseeding or other methods to stabilize topsoil on slopes where required.	Neutral

Water Balance	**Surface and Groundwater**	Per Section 7.5 of the Hydrogeological Report (RJ Burnside 2020), without mitigation the proposed development has the potential to decrease shallow groundwater infiltration levels by 37% and increase surface water runoff.	Development	Increased imperviousness owing to an increase in hard surfaces results in a reduction of infiltration and increase in surface runoff.	• Mitigate reduction of infiltration and increase in surface runoff through use of LID measures. Including:
					  • Increasing topsoil depth to 300 mm; and
					  • Disconnection of roof leaders to rear yards (RJ Burnside 2020).
						Neutral

Groundwater Resources	**Groundwater Flows, Patterns and Gradients (Shallow)**	Groundwater levels in monitoring wells were observed to be 1.15 mbgs to 3.70 mbgs. (RJ Burnside 2020). Generally, shallow groundwater flow follows local topography and surface water drainage patterns.	Grading and Servicing; Residential Development	• Potential for underground servicing, if below the water table, to interrupt groundwater flows and direct them along service corridors; • Potential for basements to intercept groundwater; and, • Potential for encountering groundwater during construction of underground services and/or basements.	• Use of BMPs including use of anti-seepage collars or clay plugs to prevent groundwater flow along granular bedding and erosion of backfill materials. • Use of a perimeter drainage system around the exterior of basements. • Should groundwater be encountered during construction, dewatering and/or depressurizing is recommended.	Neutral
	Groundwater Quality (Shallow)	Groundwater quality is proposed to be maintained though the use of LID measures. The addition of topsoil within the study area will increase opportunities for attenuation of pollutants, and potential impacts to groundwater quality are expected to be nominally improved following the change in land use (see Section 7.6.5 of RJ Burnside 2020).	Residential Development	Runoff from urban developments may contain dilute contaminants including suspended solids, chlorides, petrochemicals, metals, pesticides, fertilizer, bacteria and viruses. Most are attenuated by soil and soil biota, except for chlorides and nitrogen. A change in land use from an active golf course to a residential area will result in a reduction in fertilizer and pesticide application.	Not applicable.	Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
Surface Water	**Drainage Catchment Areas**	As outlined in Urbantech Consulting 2020, proposed changes to site grading result in minor changes to existing drainage patterns, though water will still generally drain towards the south/southeast.	Site Preparation and Grading	None expected - existing drainage patterns are not proposed to be significantly altered.	No mitigation necessary – existing drainage patterns are not proposed to be significantly altered.	Neutral
Water Balance	**Site Water Balance**	Per Section 7.5 of the Hydrogeological Report (RJ Burnside 2020), without mitigation the proposed development has the potential to decrease shallow groundwater infiltration levels by 37% and increase surface water runoff.	Development	Increased imperviousness owing to an increase in hard surfaces results in a reduction of infiltration and increase in surface runoff.	Mitigate reduction of infiltration and increase in surface runoff through use of LID measures. Including: • Increasing topsoil depth to 300 mm; and • Disconnection of roof leaders to rear yards (RJ Burnside 2020).	Neutral
Wildlife	**Birds**	Bird surveys have not been completed in Area C due to the lack of natural and semi-natural areas. Based on the habitat present, it is likely that Area C supports common urban adapted species (e.g. Robin, Blue Jay, House Sparrow, etc).	Tree removals	The bird communities associated with the subject property are not expected to be negatively affected by the proposed development. The same species would be expected to be present in both existing and proposed habitats.	As the proposed development matches the development fabric of the surrounding landscape, golf course areas will still exist adjacent to Area C, and the proposed development will be subject to extensive landscaping; it is expected that most species expected on the subject property will remain. Manicured treed areas will be replicated through proposed streetscaping as well as planting in the landscape buffer and open space areas.	Neutral
Vegetation	**Trees**	Trees associated with the subject property consist of manicured treed areas primarily located along the edges of the golf course and riparian areas. A total of 75 trees with trunk diameters of 10 cm or greater were recorded in Area C (see Arborist Report (Beacon 2020)).	Development, including grading and servicing	It is estimated that the proposed Development Plan will require the removal of 45 trees from Area C due to grading, servicing and lotting conflicts. The loss of these trees will result in a temporary loss of tree canopy and associated ecological functions, and may also present an opportunity to replace exotic and invasive species with native species.	In addition to trees identified for preservation, additional opportunities to preserve select trees internal to the development limits may be identified and will be examined at the detailed design stage. The loss of tree cover is to be addressed through plantings of street trees and landscaping in open space areas and landscape buffers where opportunities exist. It is anticipated that the combination of these plantings, particularly over time, will result in a more extensive tree canopy on the Subject property than currently exists as much of the area proposed for development is presently a golf course.	Positive

Table 20. Impact Assessment Matrix - Area D

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
PHYSICAL ENVIRONMENT						
Geology	**Bedrock**	The bedrock of the subject property is described in **Section 4.1.1.** Bedrock underlying the subject property consists of weathered Queenston Shale that is generally found at depths between 1.5 and 6.1 m below ground surface (bgs).	Grading and Servicing	It is not anticipated that bedrock will be substantially exposed or disturbed by the proposed development however, shale may be encountered during the excavation of the realigned watercourse and drinking and waste water servicing on the Subject property.	The detailed design will identify the potential requirement for over-excavation in the event shale is encountered and will identify the desirability of adding alluvium, Granular B, etc.	Neutral
	Surficial Geology	The surficial geology of the subject property is described in **Section 4.1.1.** Topsoil depth ranges from 50 mm bgs to 150 mm bgs. Beneath that, overburden consists of fill underlain by clayey silt and sandy silt till and a shale complex overlying shale bedrock.	Site Preparation and Grading	Site grading is anticipated to impact upon the surficial geology. Cutting will reduce the depth of the overburden and filling has the potential to change to the stratigraphy through mixing. Considering that the stratigraphy is primarily fill that is variably underlain by more finer tills, it is not anticipated that these modifications will substantially impact the till substrates.	Conserve overburden on the site by maintaining a cut/fill balance to the extent feasible so as to minimize exportation or importation of fill materials. Avoid mixing coarser and finer grained substrates during fill operations.	Neutral
Landform	**Physiography**	The physiography of the Study Area is described in **Section 4.1.2.** Lands within the subject property are relatively flat and significant landforms are not present. The Study Area is situated on the South Slope physiographic region. Characteristic soils of this region include clay and, in alluvial areas, modern sand and gravel deposits.	Site Preparation and Grading	The proposed development will not significantly affect the physiography of the site as it is relatively flat.	No mitigation required.	Neutral
	Topography	The topography of the Study Area is described in **Section 4.1.3.** The Study Area lies in a relatively flat area with an overall slope to the south/southeast. Area D generally falls from the north east to the south west with a maximum grade change of approx. 2 m. <u>Cut/fill changes to existing topography:</u> Municipal standards require a suitable depth of cover above storm and sanitary sewers and watermains for frost protection. Services (particularly sanitary sewers) must also be at a sufficient depth to service basements. This requires filling certain areas of the existing site to a suitable level. In other areas, the existing topography may not meet municipal standards for maximum road slopes, therefore cutting certain areas of the site is required. Further constraining the proposed grading/cut/fill is the requirement to match existing servicing inverts and existing boundary grades. <u>Changes to existing drainage patterns:</u> Refer to "Surface Water", below.	Site Preparation and Grading	Cutting and filling the site results in minor changes in surface drainage patterns (see Drawing GR-D in Urbantech 2020) as well as potential impacts to existing vegetation. Changes in topography have the potential to alter surface water contributions to adjacent natural features. The proposed development will not significantly affect the topography of the site as it is relatively flat.	Existing grades along property lines, and along the outer edge of landscape buffers, will be matched under post-development conditions to minimize impacts to topography. Existing surface drainage characteristics will be maintained or replicated in order to sustain adjacent natural heritage features (e.g. Sheldon Creek).	Neutral

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
Soils	**Topsoil**	See “Surficial Geology”, above. Removal of existing topsoil: Topsoil stripping and stockpiling will be required to facilitate grading of the subject property. Existing topsoil will be stripped and stockpiled to facilitate earthworks and to ensure building foundations and infrastructure bedding are placed on stable material. A portion of the stockpiled topsoil will be utilized in open space areas as well as residential yards in the development.	Site Preparation and Grading	Stripping and stockpiling of topsoil can result in loss of organic material/nutrients. During site grading activities, topsoil porosity can be reduced due to earth-moving machinery (i.e., scrapers) and topsoil stockpiling, which can reduce the infiltration capacity of the soil to be re-applied to the site. Specific potential impacts could include: • Compaction of topsoil as a result of machinery movement and handling of soil; • Compaction of topsoil as a result of compression under weight of stockpile; • Sterilization of topsoil due to extended duration of stockpiling; • Compaction of surface of subsoil layer as a result of machinery movement; • Loss of depth of topsoil cover and potential for attenuation of stormwater runoff due to a decrease in the extent of post-development topsoil cover and depth; and/or • Loss of topsoil due to erosion by wind or rainfall runoff.	• Prohibit machinery encroachment into areas that are proposed to remain undisturbed or that are proposed for naturalization • Where possible, limit height of topsoil stockpile to a maximum of 3 m and stockpile for a maximum of 1 year (preferably less than 6 months) • Stockpile organic-rich surface layer of topsoil separately from subsurface layers • Test topsoil and supplement with required amendments to facilitate proper soil chemistry to support plant growth • Scarify compacted sub-surface soil layer prior to installation of topsoil profile post-development • Provide a minimum depth of 300 mm of topsoil over all areas (post development) and place topsoil with an emphasis on minimizing soil compaction • Provide temporary cover over topsoil stockpiles to mitigate erosion resulting from wind and precipitation. Direct surface runoff away from topsoil stockpiles and implement erosion and sediment control initiatives. • Stabilize topsoiled/finegraded areas with vegetation cover after topsoil placement. Utilise erosion blankets/Terraseeding or other methods to stabilize topsoil on slopes where required.	Neutral
Water Balance	**Site Water Balance**	Per Section 7.5 of the Hydrogeological Report (RJ Burnside 2020), without mitigation the proposed development has the potential to decrease shallow groundwater infiltration levels by 37% and increase surface water runoff.	Development	Increased imperviousness owing to an increase in hard surfaces results in a reduction of infiltration and increase in surface runoff. Recharge is also limited by the presence of an underground parking area.	• Mitigate reduction of infiltration and increase in surface runoff through use of LID measures which includes allowing for a minimum topsoil depth to 300 mm. •	Neutral
Groundwater Resources	**Groundwater Flows, Patterns and Gradients (Shallow)**	Groundwater levels in monitoring wells were observed to be 0.52 mbgs to 1.85 mbgs. (RJ Burnside 2020). Generally, shallow groundwater flow follows local topography and surface water drainage patterns and constitutes a local groundwater flow system that generally flows towards Sheldon Creek.	Grading and Servicing; Residential Development	• Potential for underground servicing, if below the water table, to interrupt groundwater flows and direct them along service corridors; • Potential for basements to intercept groundwater; and, • Potential for encountering groundwater during construction of underground services and/or basements.	• Use of BMPs including use of anti-seepage collars or clay plugs to prevent groundwater flow along granular bedding and erosion of backfill materials. • Use of a perimeter drainage system around the exterior of basements. • Should groundwater be encountered during construction, dewatering and/or depressurizing is recommended.	Neutral
	Groundwater Quality (Shallow)	Groundwater quality is proposed to be maintained though the use of LID measures. The addition of topsoil within the study area will increase opportunities for attenuation of pollutants, and potential impacts to groundwater quality are expected to be nominally improved following the change in land use (see Section 7.6.5 of RJ Burnside 2020).	Residential Development	Runoff from urban developments may contain dilute contaminants including suspended solids, chlorides, petrochemicals, metals, pesticides, fertilizer, bacteria and viruses. Most are attenuated by soil and soil biota, except for chlorides and nitrogen. A change in land use from an active golf course to a residential area will result in a reduction in fertilizer and pesticide application.	Not applicable.	Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
Surface Water	**Drainage Catchment Areas**	As outlined in Urbantech Consulting 2020, proposed changes to site grading result in minor changes to existing drainage patterns, though water will still generally drain towards the south/southeast. Existing drainage to Sheldon Creek will not be significantly altered.	Site Preparation and Grading	None expected - existing drainage patterns are not proposed to be significantly altered.	No mitigation necessary – existing drainage patterns are not proposed to be significantly altered.	Neutral
	Surface Drainage and Fluvial Geomorphology	As outlined in Urbantech Consulting 2020, proposed changes to site grading result in minor changes to existing drainage patterns, though water will still generally drain towards the south/southeast. Existing drainage to Sheldon Creek will not be significantly altered.	Site preparation, grading, residential development	Potential impacts associated with the proposed development include: • Release of sediment to Sheldon Creek; and • Increase rates of erosion or sedimentation relative to existing conditions due to alterations in flow regime as a result of land use change	Appropriate phasing, erosion and sediment control measures will mitigate potential for sediment release during construction. Implementation of appropriate stormwater management measures, as outlined in the Urbantech FSR (2020) will mitigate the potential for increase rates of erosion and sedimentation within a portion of Sheldon Creek that currently does not benefit from stormwater quantity controls.	Positive
	Water Quality	Development of the subject property results in the following potential stressors to water quality: • Increased heavy metal / chloride concentrations in post-development stormwater runoff resulting from vehicles / road salt; • Increased loading of fine particulate matter from impervious surfaces; and, • Increased temperature of surface runoff due to interaction with warm surfaces (asphalt/roof tops).	Site Preparation and Grading	Discharge of sediment and other pollutants into watercourses have the potential to disrupt aquatic habitat/impact aquatic species by interfering with turbidity/visibility, feeding and by increasing surface water temperatures. Heavy metals and chlorides can impact groundwater and surface water resources.	As outlined in Urbantech Consulting 2019 and **Section 7.2**, under post-development conditions, water quality control in the form of LID measures will constitute an increase in water quality compared to existing conditions. The integration of subsurface LID systems will result in a reduction in the temperature of stormwater discharged into receiving watercourses (in comparison to a conventional end-of-pipe SWM system). Release of sediment into the watercourses will be mitigated through the use of erosion and sediment control practices during construction. All machinery will arrive on site in a clean condition and will be maintained for the duration of the works. Wash, refuel and service of machinery will be undertaken in such a way as to prevent any deleterious substances from entering the water.	Immediate/ during construction: Neutral Long-term/ post-construction: Positive
Key Features	**Fish Habitat**	Fish habitat is described in **Section 4.2.2.1**. Sheldon Creek and its associated online pond qualify as fish habitat.	Golf course reconfiguration, residential development	It is not anticipated that the proposed residential development will impact fish habitat in Sheldon Creek as no alteration of the channel or online pond is proposed, and the nearest area of site alteration is approximately 40 m from the creek. Baseflow will be maintained. Potential erosion impacts from the reconfiguration of the existing golf course are easily mitigated.	Reconfiguration of the golf course represents a minor change to an existing use and as such mitigation measures, aside from implementation of erosion and sediment control measures, are not applicable. LID measures proposed as part of the development will mitigate impacts to baseflow. The proposed residential development will adhere to proposed ecological buffers (15 m).	Immediate/ during construction: Neutral Long-term/ post-construction: Neutral
Regulated Watercourses		Regulated watercourses form part of the RNHS. Sheldon Creek, including the online pond, is adjacent to Area D and is regulated by CH.	Golf course reconfiguration	No long-term negative impacts are anticipated to the regulated watercourse and its functions as residential development and site alteration are proposed over 40 m	Application of appropriate buffers (15 m ecological) and setbacks (7.5 m hazard) to the regulated watercourse have been exceeded; the	Immediate/ during

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
				away from Sheldon Creek and potential erosion impacts from the reconfiguration of the existing golf course are easily mitigated.	nearest residential development is approximately 40 m from Sheldon Creek. Reconfiguration of the golf course represents a minor change to an existing use and as such mitigation measures, aside from implementation of erosion and sediment control measures, are not applicable.	construction: Neutral Long-term/ post-construction: Neutral
Wildlife	**Birds**	Bird surveys have not been completed in Area C due to the lack of natural and semi-natural areas. Based on the habitat present, it is likely that Area C supports common urban adapted species (e.g. Robin, Blue Jay, House Sparrow, etc).	Tree removals	The bird communities associated with the subject property are not expected to be negatively affected by the proposed development. The same species would be expected to be present in both existing and proposed habitats.	As the proposed development matches the development fabric of the surrounding landscape, golf course areas will still exist adjacent to Area D, and the proposed development will be subject to extensive landscaping; it is expected that most species expected on the subject property will remain. Manicured treed areas will be replicated through proposed streetscaping as well as planting in the landscape buffer and open space areas.	Neutral
	Reptiles	Turtles were not incidentally observed during the tree inventory, though it is possible that the online pond could provide habitat for turtles. Basking opportunities are limited to the shore of the pond, and nesting sites are limited to sand traps within the golf course.	Golf course reconfiguration	No changes are proposed for Sheldon Creek or the online pond. Reconfiguration of the existing golf course will not change the location or number of sand traps present in or adjacent to Area D.	The online pond presently provides very few opportunities for turtle nesting or basking, and the sand traps do not provide ideal habitat for nesting. Neither of these features will be impacted and thus mitigation is not required.	Neutral
	Amphibians	Green Frog was recorded calling from the online pond in Area A (see **Section 4.2.1.1.6**). Calling amphibian surveys have not yet been completed in Area D. Based on the habitat present, which is similar to that within Area A, a similar species assemblage and abundance is expected.	Golf course reconfiguration; residential development	There is anticipated to be a negligible impact to amphibians due to the proposed development. Marginal breeding and foraging habitat for breeding amphibians is present within the online pond adjacent to Area D. This feature is not proposed to be altered; baseflows will be maintained. Future light impacts from the proposed residential development are not anticipated to be significantly greater than those which are already present.	As no impacts are anticipated, mitigation measures are not applicable.	Neutral
Vegetation	**Trees**	Trees associated with Area D consist of manicured treed areas primarily located along the edges of the golf course. A total of 35 trees with trunk diameters of 10 cm or greater were recorded in Area D (see Arborist Report (Beacon 2020)).	Development, including grading and servicing	It is estimated that the proposed Development Plan will require the removal of 17 trees from Area D due to grading, servicing and lotting conflicts. The loss of these trees will result in a temporary loss of tree canopy and associated ecological functions, and may also present an opportunity to replace exotic and invasive species with native species.	In addition to trees identified for preservation, additional opportunities to preserve select trees internal to the development limits may be identified and will be examined at the detailed design stage. The loss of tree cover is to be addressed through plantings of street trees and landscaping in parks where opportunities exist. It is anticipated that the combination of these plantings, particularly over time, will result in a more extensive tree canopy in Area D than currently exists as much of the area proposed for development is presently a golf course.	Positive

Table 21. Impact Assessment Matrix - Area E

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
PHYSICAL ENVIRONMENT						
Geology	**Bedrock**	The bedrock of the subject property is described in **Section 4.1.1.** Bedrock underlying the subject property consists of weathered Queenston Shale that is generally found at depths between 1.5 and 6.1 m below ground surface (bgs).	Grading and Servicing	It is not anticipated that bedrock will be substantially exposed or disturbed by the proposed development however, shale may be encountered during the excavation of the realigned watercourse and drinking and waste water servicing on the Subject property.	The detailed design will identify the potential requirement for over-excavation in the event shale is encountered and will identify the desirability of adding alluvium, Granular B, etc.	Neutral
	Surficial Geology	The surficial geology of the subject property is described in **Section 4.1.1.** Topsoil depth ranges from 100 mm to 125 mm. Beneath that, overburden consists of fill underlain by clayey silt, sandy silt till, clayey silt till and a shale complex overlying shale bedrock.	Site Preparation and Grading	Site grading is anticipated to impact upon the surficial geology. Cutting will reduce the depth of the overburden and filling has the potential to change to the stratigraphy through mixing. Considering that the stratigraphy is primarily fill that is variably underlain by more finer tills, it is not anticipated that these modifications will substantially impact the till substrates.	Conserve overburden on the site by maintaining a cut/fill balance to the extent feasible so as to minimize exportation or importation of fill materials. Avoid mixing coarser and finer grained substrates during fill operations.	Neutral
Landform	**Physiography**	The physiography of the Study Area is described in **Section 4.1.2.** Lands within the subject property are relatively flat and significant landforms are not present. The Study Area is situated on the South Slope physiographic region. Characteristic soils of this region include clay and, in alluvial areas, modern sand and gravel deposits.	Site Preparation and Grading	The proposed development will not significantly affect the physiography of the site as it is relatively flat.	No mitigation required.	Neutral
	Topography	The topography of the Study Area is described in **Section 4.1.3.** The Study Area lies in a relatively flat area with an overall slope to the south/southeast. Area E generally falls from the north east to the south west. <u>Changes to existing drainage patterns:</u> Refer to "Surface Water", below.	Site Preparation and Grading	Cutting and filling the site results in minor changes in surface drainage patterns (see Drawings 5 and FGP in Urbantech 2019) as well as potential impacts to existing vegetation. Changes in topography can alter surface water contributions to adjacent natural features. The proposed development will not significantly affect the topography of the site as it is relatively flat.	Existing grades along property lines, and along the outer edge of buffers, will be matched under post-development conditions to minimize impacts to topography. Existing surface drainage characteristics will be maintained or replicated in order to sustain adjacent natural heritage features (i.e. Appleby Creek).	Neutral
Soils	**Topsoil**	See “Surficial Geology”, above. <u>Removal of existing topsoil:</u> Topsoil stripping and stockpiling will be required to facilitate grading of the subject property. Existing topsoil, including organic matter, will be stripped and stockpiled to facilitate earthworks and to ensure building foundations and infrastructure bedding are placed on stable material. A portion of the stockpiled topsoil will be utilized in open space areas as well as residential yards in the development.	Site Preparation and Grading	Stripping and stockpiling of topsoil can result in loss of organic material/nutrients. During site grading activities, topsoil porosity can be reduced due to earth-moving machinery (i.e., scrapers) and topsoil stockpiling, which can reduce the infiltration capacity of the soil to be re-applied to the site. Specific potential impacts could include: • Compaction of topsoil as a result of machinery movement and handling of soil; • Compaction of topsoil as a result of compression under weight of stockpile; • Sterilization of topsoil due to extended duration of stockpiling;	• Prohibit machinery encroachment into areas that are proposed to remain undisturbed or that are proposed for naturalization • Where possible, limit height of topsoil stockpile to a maximum of 3 m and stockpile for a maximum of 1 year (preferably less than 6 months) • Stockpile organic-rich surface layer of topsoil separately from subsurface layers • Test topsoil and supplement with required amendments to facilitate proper soil chemistry to support plant growth • Scarify compacted sub-surface soil layer prior to installation of topsoil profile post-development	Neutral

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
				• Compaction of surface of subsoil layer as a result of machinery movement; • Loss of depth of topsoil cover and potential for attenuation of stormwater runoff due to a decrease in the extent of post-development topsoil cover and depth; and/or • Loss of topsoil due to erosion by wind or rainfall runoff.	• Provide a minimum depth of 300 mm of topsoil over all areas (post development) and place topsoil with an emphasis on minimizing soil compaction • Provide temporary cover over topsoil stockpiles to mitigate erosion resulting from wind and precipitation. Direct surface runoff away from topsoil stockpiles and implement erosion and sediment control initiatives. Stabilize topsoiled/finegraded areas with vegetation cover after topsoil placement. Utilise erosion blankets/Terraseeding or other methods to stabilize topsoil on slopes where required.	
Groundwater Resources	**Groundwater Flows, Patterns and Gradients (Shallow)**	Groundwater levels in monitoring wells were observed to be 0.37 mbgs to 1.32 mbgs. (RJ Burnside 2020). Generally, shallow groundwater flow follows local topography and surface water drainage patterns and constitutes a local groundwater flow system that generally flows towards Appleby Creek.	Grading and Servicing; Residential Development	• Potential for underground servicing, if below the water table, to interrupt groundwater flows and direct them along service corridors; • Potential for basements to intercept groundwater; and; • Potential for encountering groundwater during construction of underground services and/or the underground parking lot.	• Use of BMPs including use of anti-seepage collars or clay plugs to prevent groundwater flow along granular bedding and erosion of backfill materials. • Use of a perimeter drainage system around the exterior of the underground parking lot. • Should groundwater be encountered during construction, dewatering and/or depressurizing is recommended.	Neutral
	Groundwater Quality (Shallow)	Groundwater quality is proposed to be maintained though the use of LID measures. The addition of topsoil within the study area will increase opportunities for attenuation of pollutants, and potential impacts to groundwater quality are expected to be nominally improved following the change in land use (see Section 7.6.5 of RJ Burnside 2020).	Residential Development	Runoff from urban developments may contain dilute contaminants including suspended solids, chlorides, petrochemicals, metals, pesticides, fertilizer, bacteria and viruses. Most are attenuated by soil and soil biota, except for chlorides and nitrogen. A change in land use from an active golf course to a residential area will result in a reduction in fertilizer and pesticide application.	Not applicable.	Positive
Surface Water	**Drainage Catchment Areas**	As outlined in Urbantech Consulting 2019, proposed changes to site grading result in minor changes to existing drainage patterns, though water will still generally drain towards the south/southeast. Existing drainage to Appleby Creek will not be significantly altered.	Site Preparation and Grading	None expected - existing drainage patterns are not proposed to be significantly altered.	No mitigation necessary – existing drainage patterns are not proposed to be significantly altered.	Neutral
	Water Quality	Development of the subject property results in the following potential stressors to water quality: • Increased sediment loading to watercourses during topsoil stripping / earthworks operations; • Increased heavy metal / chloride concentrations in post-development stormwater runoff resulting from vehicles / road salt; • Increased loading of fine particulate matter from impervious surfaces; and,	Grading, site preparation,	Discharge of sediment and other pollutants into watercourses have the potential to disrupt aquatic habitat/impact aquatic species by interfering with turbidity/visibility, feeding and by increasing surface water temperatures. Heavy metals and chlorides can impact groundwater and surface water resources.	As outlined in Urbantech Consulting 2020 and **Section 7.2**, under post-development conditions, water quality control in the form of LID measures and an oil and grit separator result in an enhancement to existing water quality. The net result is an increase in water quality compared to existing conditions. Release of sediment into the adjacent ditch that empties into Appleby Creek will be mitigated through the use of erosion and sediment control practices during construction. All machinery will arrive on site in a clean condition and will be maintained for the duration	Immediate/ during construction: Neutral Long-term/ post-construction: Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
		• Increased temperature of surface runoff due to interaction with warm surfaces (asphalt/roof tops).			of the works. Wash, refuel and service of machinery will be undertaken in such a way as to prevent any deleterious substances from entering the water.	
Other Wetlands		Non-significant wetlands may be considered components of the RNHS according to the Regional Official Plan (2018). As outlined in **Section 5.2.2**, several small wetlands have been identified within Area E (ELC Polygons 6 and 7). Of these, all are dominated by the exotic invasive species and have limited ecological function.	Residential development (affects ELC Polygons 6b and 6c).	Proposed redevelopment of the operations and maintenance yard near Dundas Street will see the alteration of on-site overland flow that sustains ELC Polygons 6b and 6c. As these small wetlands are dominated by an exotic invasive species and have limited ecological function, it is recommended that they be removed.	Mitigation for the loss of wetland habitat and the limited associated ecological functions provided will be achieved by creating additional wetland habitats in the enhanced Appleby Creek channel and through landscape buffer plantings.	Immediate/ during construction: Neutral Long-term/ post-construction: Positive
Wildlife	**Birds**	As detailed in **Section 4.2.1.1.4**, the bird community in Areas A and B is generally reflective of the anthropogenic habitat type present (i.e. active golf course within a residential area). The community is comprised of common to widespread species that are tolerant of disturbance. Bird surveys have not been completed in Area E. Based on the habitat present, it is likely that Area E supports common urban adapted species (e.g. Robin, Blue Jay, House Sparrow, etc.).	Tree removals	The bird communities associated with Area E are not expected to be negatively affected by the proposed development. The same species would be expected to be present in both existing and proposed habitats.	Areas that are proposed for development that are currently part of an active golf course will provide some habitat for early successional species for some time, thus it is expected that most species potentially present in Area E will remain. Manicured treed areas will be increased through proposed streetscaping and landscaped outdoor amenity space, which will provide greater habitat opportunities for birds than what currently exists.	Neutral - Positive
	Amphibians	Calling amphibian surveys have not yet been completed in Area E. Based on the habitat present, it is not expected that the area supports an abundance of amphibians, if any.	Residential development	There is anticipated to be a negligible impact to amphibians due to the proposed development. Marginal habitat for breeding amphibians is present within wetlands and meadows adjacent to Area E. These features are not proposed to be negatively altered; decommissioning of the golf course operations activities (i.e. wood chip and brush storage) will limit impacts to lands within the hydro corridor. Future light impacts from the proposed residential development are not anticipated to be significantly greater than those which presently exist.	As no negative impacts are anticipated, mitigation measures are not applicable.	Neutral - Positive
Vegetation	**Vegetation Communities**	A total of eleven ELC polygons (representing three community types) were generated for Area E (see **Section 4.2.3.1.1** for descriptions). Vegetation communities within Area E are generally reflective of a suburban land use matrix abutting utility corridor within an active golf course. None of the ecological communities in Area E are considered rare or significant at the Provincial level. Furthermore, with the exception of ELC Polygons 6d, wetland communities within and directly adjacent to Area E are not eligible or, in the case of ELC Polygons 6b and 6c, not recommended for inclusion in the RNHS.	Residential development	Through the design of the proposed development ELC Polygons 6b and 6c, which represent small Phragmites-dominated wetlands associated with a drainage swale, will be wholly or partially removed, respectively. These small wetlands do not represent vegetation communities with significant or positive natural heritage or hydrologic function. Other vegetation communities on the subject property (e.g. ELC units 5a-e; 6a, d, and e; and 7), will be unaffected by the proposed development.	Loss of small areas dominated by exotic invasive species is not anticipated to negatively affect the ecological function of Area E or adjacent lands. Loss of vegetation cover related to the proposed will be mitigated by landscaping portions of the site with appropriate native species. Opportunities for restoration of vegetation cover exist within the development area (e.g. landscape buffers, streetscaping, and outdoor amenity areas). Given that the area proposed for development is comprised of a maintenance building and yard, it	Neutral - Positive

CATEGORY	FEATURE /FUNCTION	DESCRIPTION	PROPOSED ACTIVITY	POTENTIAL IMPACTS	RECOMMENDED MITIGATION	NET EFFECT
					is anticipated that the proposed development will result in a net increase in permanently vegetated areas. Management of Phragmites in Area E is not recommended unless included as part of a wider invasive species management plan that includes City-led management of Phragmites along Dundas Street and within the hydro corridor.	
	Trees	Trees associated with the subject property consist of manicured treed areas associated with the golf course operations building. A total of 21 trees with trunk diameters of 10 cm or greater were recorded in Area E (see Arborist Report (Beacon 2020)).	Development, including grading and servicing	It is estimated that the proposed Development Plan will require the removal of all trees from Area E primarily due to the construction of the proposed underground parking lot but also due to grading, servicing and lotting conflicts. The loss of these trees will result in a temporary loss of tree canopy and associated (limited) ecological functions, and may also present an opportunity to replace exotic and invasive species with native species.	In addition to trees identified for preservation, additional opportunities to preserve select trees internal to the development limits may be identified and will be examined at the detailed design stage. The loss of tree cover is to be addressed through plantings of street trees and landscaping in outdoor amenity areas, as well as plantings in landscape buffers where opportunities exist. It is anticipated that the combination of these plantings, particularly over time, will result in a more extensive and high-quality tree canopy in Area E than currently exists as much of the area proposed for development is presently a maintenance building and yard.	Positive

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8. Constraints to Development and Conservation Halton's Approximate Regulation Limit

One of the primary objectives of the EER is to identify potential constraints related to the anticipated development of the subject property. The identification of both physical and natural heritage constraints to development is primarily necessary to guide the design and servicing of the proposed development so as to avoid or minimize impacts to hazard lands and the RNHS within and adjacent to the subject property. Addressing constraints to development can also present opportunities for both mitigating impacts, and enhancing the RNHS, thereby providing a foundation for a sustainable community.

The biophysical constraints to development identified through this study are described in **Section 4.1** to **Section 5**.

Constraints to development consist of hazard lands, significant ecological features (i.e. the RNHS) and their associated setbacks and buffers that, in most cases, are precluded from development in accordance with applicable policies (refer to discussion on meander belt setback, **Section 8.1**). Opportunities to development consist of lands within the subject property excluded from the constraints.

Physical constraints within the subject property consist of the following:

- Appleby Creek and Sheldon Creek;
- Erosion hazards; and
- Flooding hazards.

Natural heritage constraints to development consist of:

- Fish habitat; and
- Other wetlands.

Constraints and opportunities to development are detailed in **Figures 9a, 9b, 9c, 9d** and **9e** and described in detail below. This mapping illustrates the constraints that underlie the RNHS**,** including all of the physical and ecological constraints that were considered in the development of the proposed Development Plan (described in **Section 6**) and the impact assessment (provided in **Section 7**).

Notably, **Figure 9b** illustrates constraints to development in Area A under existing conditions. **Figure 9c** illustrates constraints to development in Area A under proposed conditions, i.e. following the proposed cut and fill in the floodplain. There is no difference between existing and proposed development constraints in the other development Areas. Both existing and proposed constraints to development are included in **Figure 9a** (overview of all Areas).

At the request of the City of Burlington, Conservation Halton's approximate regulation limit (ARL) under existing and proposed conditions, as well as their underlying components, have been included in **Figures 9a** through **9e**. The outer boundaries of the existing ARL and the proposed refined ARL are defined by the 7.5 m setback to the existing and proposed floodplain, respectively, the meander belt, and a 30 m regulation limit to wetlands. Setbacks associated with watercourses are contained within the abovementioned setbacks and do not affect the outermost limit of the ARL. In most cases, the existing development constraint limit and the proposed refined ARL are coincident; there are some

Constraints to Development Areas A - E

Figure 9A

Millcroft Golf Club

Legend

- Subject Property, Area A - E
- Study Area
- Proposed Development
- Proposed SWM Pond and Channel Reinstatement
- Existing Development Constraint Limit
- Proposed Development Constraint Limit

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- Existing CH ARL
- Proposed Refined CH ARL

Hazards & Associated Setbacks

Hazards

- Floodplain (Conservation Halton)
- Floodplain (Urbantech Existing)
- Floodplain (Urbantech Proposed)
- Meander Belt

Hazard Setbacks

- Floodplain (Conservation Halton) + 7.5 m
- Floodplain (Urbantech Proposed) + 7.5 m
- Floodplain (Urbantech) + 7.5 m
- Meander Belt + 7.5 m

Natural Heritage Features & Assoc. Buffers

Natural Heritage Features

- Wetlands (Beacon)
- Wetlands (Conservation Halton)
- Fish Habitat

Natural Heritage Buffers

- Wetlands (Beacon) +15 m
- Wetlands (Conservation Halton) + 15 m
- Fish Habitat + 15 m

BEACON ENVIRONMENTAL

Project: 216081.2
Last Revised: November, 2020

Client: Millcroft Greens Corporation

Prepared by: DU
Checked by: AB

DRAFT

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Existing Constraints to Development Area A

Figure 9B

Millcroft Golf Club

Legend

- Subject Property, Area A & B
- Study Area
- Existing Development Constraint Limit

CH Approximate Regulation Limit

- Existing CH ARL

Hazards & Associated Setbacks

Hazards

- Floodplain (Urbantech Existing)
- Meander Belt

Hazard Setbacks

- Floodplain (Urbantech) + 7.5 m
- Meander Belt + 7.5 m

Natural Heritage Features & Assoc. Buffers

Natural Heritage Features

- Wetlands (Beacon)
- Fish Habitat

Natural Heritage Buffers

- Wetlands (Beacon) +15 m
- Fish Habitat + 15 m

BEACON ENVIRONMENTAL

Project: 216081.2
Last Revised: November, 2020

Client: Millcroft Greens Corporation

Prepared by: DU
Checked by: AB

DRAFT

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Constraints to Development Area A

Figure 9C

Millcroft Golf Club



Legend

- Subject Property, Area A & B
- Study Area
- Proposed Development
- Proposed SWM Pond and Channel Reinstatement
- Proposed Development Constraint Limit

CH Approximate Regulation Limit

- Proposed Refined CH ARL

Hazards & Associated Setbacks

Hazards

- Floodplain (Urbantech Proposed)
- Meander Belt

Hazard Setbacks

- Floodplain (Urbantech Proposed) + 7.5 m
- Meander Belt + 7.5 m

Natural Heritage Features & Assoc. Buffers

Natural Heritage Features

- Wetlands (Beacon)
- Fish Habitat

Natural Heritage Buffers

- Wetlands (Beacon) +15 m
- Fish Habitat + 15 m

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Constraints to Development Area D

Figure 9D

Millcroft Golf Club

Legend

- Subject Property, Area D
- Study Area
- Proposed Development
- Existing Development Constraint Limit

CH Approximate Regulation

- Existing CH

Hazards & Associated

Hazards

- Floodplain (Urbantech Existing)
- Meander Belt

Hazard Setbacks

- Floodplain (Urbantech) + 7.5 m
- Meander Belt + 7.5 m

Natural Heritage Features & Assoc. Buffers

Natural Heritage Features

- Wetlands (Beacon)
- Wetlands (Conservation Halton)
- Fish Habitat

Natural Heritage Buffers

- Wetlands (Beacon) +15 m
- Wetlands (Conservation Halton) + 15 m
- Fish Habitat + 15 m

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Constraints to Development Area E

Figure 9E

Millcroft Golf Club

Legend

- Subject Property, Area E
- Study Area
- Proposed Development
- Existing Development Constraint Limit

CH Approximate Regulation Limit

- Existing CH

Hazards & Associated

Hazards

- Floodplain (Conservation Halton)
- Floodplain (Urbantech Existing)

Hazard Setbacks

- Floodplain (Conservation Halton) + 7.5
- Floodplain (Urbantech) + 7.5 m

Natural Heritage Features & Assoc. Buffers

Natural Heritage Features

- Wetlands (Beacon)
- Fish Habitat

Natural Heritage Buffers

- Wetlands (Beacon) +15 m
- Fish Habitat + 15 m

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locations in Area A where the 30 m wetland ARL exceeds portions of the existing development constraint limit defined by the 15 m buffer to wetlands.

8.1 Physical Constraints to Development

Physical constraints to development are related to surface and groundwater features and areas, and in most cases also include setbacks related to natural hazards (e.g., erosion and flooding) in the landscape. The following physical constraints related to the Study Area are summarized in **Table 22** and **Table 23**:

- Watercourses;
- Erosion Hazards; and
- Flooding Hazards.

The extent of the various constraints has been determined based on a combination of site-specific assessments (**Section 4.1**), and application of the appropriate policies (**Section 2**).

Notably, a small section of the proposed road off Millcroft Park Drive in Area A is located within a portion of the 7.5 m setback to the meander belt. The purpose of the setback, also referred to as an erosion access allowance[4], is to allow for emergency and construction access to erosion prone areas. Accordingly, having a small portion of a road within the erosion setback meets the intent of the MNR's technical guide *River and Stream Systems: Erosion Hazard Limits* (2002) and CH policies as the road does not impede access to the meander belt.

Table 22. Summary of Physical Constraints to Development – Area A

Category	Constraints to Development
Watercourses	Area A includes Appleby Creek which is considered a minor watercourse system by CH and represents a constraint to development. The reinstated channel proposed as part of the works associated with the separate PTTW process has been included as a constraint. Generally, no development or site alteration is permitted within a watercourse; although crossings of watercourses and realignments of watercourses may be permitted provided a study is completed to address environmental impacts and the necessary permits are obtained from CH, DFO and/or MNRF. Appleby Creek represents less of a constraint than intact, natural watercourses because it is a minor system with very limited natural heritage functions. As part of the PTTW process it is proposed for reinstatement as part of the removal of the online pond. Through that process, its hydrologic and ecological functions will be maintained and/or enhanced. Where a watercourse provides fish habitat, development buffers of 15 m are required for warmwater fisheries by CH. Within the subject property, Appleby Creek is considered a warmwater watercourse and a 15 m buffer has been applied to either side of the channel.

4 *Per CH's Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document (2011), access and egress means "methods or procedures to ensure safe vehicular and pedestrian movement, and access for the maintenance and repair of protection works, during times of flooding hazards, erosion hazards and/or other water-related hazards."*

Category	Constraints to Development
Meander Belt	For unconfined watercourses, the meander belt represents a component of the watercourse hazard limit, a zone in which development is generally not permitted by CH. In some cases, development is permitted within the e7.5 m erosion setback provided there is no alternative and the development does not impede access to the erosion hazard. In the case of Appleby Creek (Area A), it is Beacon's understanding that the floodplain cut and fill proposed by Urbantech will result in the creation of a confined valley system post-development. Based on this understanding, meander belt limits are not identified in the determination of development constraints associated with Reaches AC-1 and AC-2 of Appleby Creek. As applicable, geotechnical erosion hazard considerations will apply. CH also regulates 7.5 m from the limit of the erosion hazard.
Floodplain Hazard	The existing floodplain for Appleby Creek (as illustrated in **Figure 9b**) is defined by Urbantech Consulting's update to CH's (HEC-RAS) hydraulic model, which was further refined by Urbantech Consulting for the EER based on the proposed cut and fill as well as removal of the online pond and reconfiguration of Appleby Creek (see **Section 4.1.7**). Urbantech's proposed floodplain is shown as a development constraint (**Figure 9c**). A full range of return period flood events (2 to 100 year and Regional) have been modeled to calculate the water levels for different storm events and to design the SWM measures. The Regional Storm flood plain is identified as the regulatory flood plain in this study. This represents a constraint in so far as for any proposed alteration of existing flood plains, the stage-storage discharge must be preserved, and the existing riparian storage is to be maintained or exceeded under proposed conditions for all return period events. New development is generally not permitted within the Regional Storm flood plain, although some exceptions do apply in CH's regulatory policies. As with the erosion hazard, a 7.5 m regulatory allowance adjacent to the flood plain is also applied by CH.

Table 23. Summary of Physical Constraints to Development - Area D

Category	Constraints to Development
Watercourses	Area D is adjacent to Sheldon Creek which is considered a minor watercourse system by CH and represents a constraint to development. Generally, no development or site alteration is permitted within a watercourse; although crossings of watercourses and realignments of watercourses may be permitted provided a study is completed to address environmental impacts and the necessary permits are obtained from CH, DFO and/or MNRF. Sheldon Creek represents less of a constraint than intact, natural watercourses because it is a minor system with very limited natural heritage functions. No alterations to the watercourse or online pond are proposed part of the proposed development. Where a watercourse provides fish habitat, development buffers of 15 m are required for warmwater fisheries by CH. Within the subject property, Sheldon Creek is considered a warmwater watercourse and a 15 m buffer has been applied to either side of the channel. The nearest proposed residential development is approx. 40 m from Sheldon Creek.
Meander Belt	A meander belt assessment was completed for the portions of Sheldon Creek that are within the Study Area and adjacent to Area D (reach SC-1). The assessment recommended a meander belt dimension of 25 m for Sheldon Creek Reach SC-1. For unconfined watercourses, the meander belt represents a component of the watercourse hazard limit, a

Category	Constraints to Development
	zone in which development is generally not permitted by CH. CH also regulates 7.5m from the limit of the erosion hazard.
Flood Plain Hazard	The existing flood plain for Sheldon Creek is defined by Urbantech Consulting's update to CH's (HEC-RAS) hydraulic model. A full range of return period flood events (2 to 100 year and Regional) have been modeled to calculate the water levels for different storm events and to design the SWM measures. The Regional Storm flood plain is identified as the regulatory flood plain in this study. This represents a constraint in so far as for any proposed alteration of existing flood plains, the stage-storage discharge must be preserved, and the existing riparian storage is to be maintained or exceeded under proposed conditions for all return period events. New development is generally not permitted within the Regional Storm flood plain however, some exceptions do apply in CH's regulatory policies. CH also regulates 7.5 m adjacent to the flooding hazard.

8.2 Natural Heritage Constraints to Development

Natural heritage constraints associated with the Study Area (primarily within the subject property) are related to protected features and related buffers and setbacks and are included in the RNHS**.** The extent of the various constraints has been determined based on a combination of site-specific assessments (**Section 4**), and application of the appropriate policies (**Section 2**).

A summary of the RNHS components and the extent to which they constrain future development on the subject property is provided in **Table 24**.

Table 24. Summary of Natural Heritage Constraints to Development

Category	Constraints to Development
Fish Habitat	S. 118.2(a) of the ROP (2018) prohibits development and site alteration within fish habitat except in accordance with applicable Federal legislation or regulations. The portion of Appleby Creek and Sheldon Creek, including the online ponds, are considered warmwater fish habitat. The ROP (2018) does not prescribe buffers for fish habitat, however CH (2016a) requires a 15 m buffer on either side of Appleby Creek and Sheldon Creek. This buffer has been applied to the watercourses within the subject property, the online pond on Sheldon Creek and the proposed reinstated channel on Appleby Creek. As the online pond on Appleby Creek is proposed to be taken offline as part of the PTTW process and redeveloped as a SWM pond that will continue to be used for irrigation purposes, for the purpose of this report the pond has not been included as fish habitat. In addition, stormwater runoff from the development will need to be controlled to comply with the requirements specified by MECP.
Other Wetlands	S. 118.2(b) of the ROP (2018) prohibits development and site alteration within wetlands not considered to be significant at the provincial or regional level unless it has been demonstrated that there will be no negative impacts on the features or their ecological functions.

Category	Constraints to Development
	One riparian wetland (ELC Polygon 2) and several small wetlands dominated by exotic species (ELC Polygons 6 and 7) are present within the subject property. The wetlands are under 2 ha in size and are not considered significant at the provincial or regional level. Furthermore, wetlands in the hydro corridor south of the maintenance yard (i.e. ELC Polygons 6a and 7) do not meet the definition of wetland per applicable ROP, City OP and CH policies due to the lack of hydric soils, and are thus not eligible for inclusion in the RNHS nor are they subject to Ontario Regulation 162/06. As detailed in **Section 5.2.2**, there are two small wetlands associated with a ditch on the western side of Area E. In the opinion of Beacon, these wetlands should be removed as part of the proposed rehabilitation of the ditch feature, as the wetlands are dominated by exotic invasive species and represent low ecological function that can be improved through implementation of the proposed rehabilitation. The ROP (2018) does not prescribe buffers for wetlands, however CH requires a 15 m buffer from wetlands less than 2 ha in size provided the wetland is not Provincially Significant and it can be demonstrated through a site-specific impact assessment that there will be no negative impact to the wetland); otherwise, a minimum 30 m buffer is applicable (Conservation Halton 2016a). This 15 m buffer has been applied to ELC Polygon 2 (Area A) and wetlands in the greater Study Area adjacent to Areas A, D and E. It is expected that two small wetlands associated with the ditch in Area E (i.e. ELC Polygons 6c and 6d) will be replicated at a minimum ratio of 1:1 through the design of the enhanced swale at the same location.

9. Implementation Plans

The following sections outline how the management plans critical to meeting the requirements of the EER and to achieving no negative impact with respect to the RNHS will be implemented. These Plans identify how the proposed RNHS will be enhanced both within and outside of Key Features, how tree retention and removals outside of the RNHS is to be addressed and how erosion / sediment is to be addressed as part of construction. The framework for comprehensive environmental monitoring to ensure that (among other parameters) water quality, quantity and erosion control targets are being met will be developed at a later date in consultation with the agencies following their review of the initial submission, though a suggested water quality monitoring plan is presented below.

The following plans are summarized below:

- Conceptual Restoration and Enhancement Plan (**Section 9.1**);
- Tree Preservation Plan (**Section 9.2**);
- Erosion and Sediment Control Plan (**Section 9.3**); and
- Water Quality Monitoring (**Section 9.4**).

9.1 Conceptual Restoration and Enhancement Plan

Enhancements within the subject property consist of taking the online pond in Area A offline through a separate PTTW process. These works include reinstatement of the channel immediately adjacent to the pond and removal of the weir at Upper Middle Road. These works represent an enhancement of water quality and fish habitat, including allowance of fish movement upstream and downstream of Upper Middle Road.

Furthermore, NAK Design Strategies has developed conceptual planting plans for Areas A - E. These plans will see an increase in urban forest canopy cover and species diversity within the subject property, as well as enhancement of habitats for urban-adapted wildlife within the subject property. For the detailed landscape design, in consultation with Beacon tree species selection shall reflect, to the extent feasible, species expected to survive past the year 2040 under a climate change scenario reflecting a Representative Concentration Pathway (RCP) of 8.5. Opportunities to provide wildlife habitat for species known or expected to occur within the Study Area will also be explored.

9.2 Tree Preservation Plan

As detailed in the Arborist Report prepared by Beacon (2020), a total of 204 trees measuring at least 10 cm DBH representing 35.4% of all trees inventoried on the subject property and adjacent public lands will be protected and subject to the City of Burlington's and CH's tree protection guidelines. Tree preservation measures follow standard arboricultural practices and include the use of tree protection fencing.

Trees within private residential rear yards adjacent to the subject property will not be subject to root impacts and are not proposed for removal, as the proposed grading plan meets existing grades at the outer edge of the proposed 6 m wide landscape buffer located between the proposed development and the rear yards of existing residential properties. Furthermore, most of the extant trees within the proposed landscape buffer that are in good condition will be preserved; some trees on the outer edge of the 6 m landscape buffer may require removal due to grading impacts.

The Arborist Report, which includes a Tree Inventory and Protection Plan, is provided under separate cover.

9.3 Erosion and Sediment Control Plan

Erosion and Sediment Control (E&SC) will be implemented for all construction activities including those related to taking the pond in Area A offline (as part of the separate PTTW process), topsoil stripping, foundation excavation and stockpiling of materials. Per Section 8 of the FSR (Urbantech 2020):

> *The erosion and sediment control plan for the site servicing program of the subject lands will be designed, approved, and implemented in conformance with the City of Burlington, CH and MECP recommendations.*
>
> *Recognizing that erosion and sediment control is a dynamic process, a detailed set of staging plans / construction sequencing will be required for the various stages of creek work, earthworks, servicing, site plan construction, and stabilization, coupled with the*



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Proposed Water Quality Monitoring Locations

Figure 10

Millcroft Golf Club

Legend

- Subject Property
- Monitoring Locations
- Proposed Design
- Watercourse (Beacon)

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proposed development phasing. Each parcel [Area] may require unique E&SC measures. The E&SC plans will be prepared by a qualified professional (i.e., CISEC, CPESC or an approved equivalent).

9.4 Water Quality Monitoring

Water quality monitoring stations are proposed upstream and downstream of the proposed reinstatement of Appleby Creek (Area A) associated with the separate PTTW process for a period of two years after construction. The purpose of the monitoring is to quantify efficacy of water quality improvement measures resulting from the removal of the online pond and proposed SWM measures. The locations of the proposed monitoring stations are shown in **Figure 10**.

Monitoring parameters will include the following:

- Oil and grease;
- Total phosphorous;
- Anions (nitrate, nitrite, phosphate, chloride);
- Ammonia;
- Total Kjeldahl Nitrogen (TKN);
- Conductivity;
- Total Solids;
- Total suspended solids (TSS);
- BOD_5;
- Dissolved oxygen;
- pH/alkalinity;
- Salinity;
- Fecal coliforms;
- Total coliforms;
- PAH; and
- Metals (including Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Sr, Tl, Sn, Ti, W, U, V, Zn and Zr).

10. Policy Conformity

The following table (**Table 25**) presents an assessment of the proposal's compliance with applicable Acts and policies.

Table 25. Policy Compliance Assessment

APPLICABLE POLICY / LEGISLATION	RELEVANT STUDY FINDINGS AND RECOMMENDATIONS	COMPLIANCE
Federal *Fisheries Act* (1985) and Fisheries Protection Policy Statement (2013)	Appleby Creek and Sheldon Creek tributaries and their respective online ponds likely support direct fish habitat. All direct fish habitat will be protected within the refined RNHS, and be improved post-development, except for the online pond on Appleby Creek, which is being dealt with separately under a PTTW application. Potential indirect impacts to fish habitat will be mitigated by implementing a range of measures, including, but not limited to: • Improved water quality through LID measures and oil and grit separators; • riparian buffers of 15 m;	Yes

APPLICABLE POLICY / LEGISLATION	RELEVANT STUDY FINDINGS AND RECOMMENDATIONS	COMPLIANCE
	• naturalization of riparian buffers; and • vegetation management to improve riparian habitat conditions.	
***Species at Risk Act* (2002)**	The Study Area does not support any federally listed threatened or endangered species. Therefore, SARA regulations only apply to migratory birds in the Study Area as per the *Migratory Birds Convention Act*.	Yes
***Endangered Species Act* (2007)**	Endangered and Threatened species were not recorded within or adjacent to the Study Area; as such *Endangered Species Act* policies do not apply to the Study Area.	N/A
Provincial Policy Statement (2020) Section 2.1 – Natural Heritage	Fish habitat is the only significant natural heritage feature identified on the subject property. See text above re: *Federal Fisheries Act.*	See text above re: *Federal Fisheries Act.*
Provincial Policy Statement (2020) Section 2.2 - Water	The proposed development includes improvements to water quality through implementation of LIDs and enhanced SWM as well as improvements to Appleby Creek.	Yes
Provincial Policy Statement (2020) Section 2.3 – Natural Hazards	With the exception of fill placement within Area A, development is proposed outside of flooding and erosion hazard lands. The FSR has demonstrated that the fill placement will result in no negative impacts to the flooding hazards and, as such, is consistent with PPS policy.	Yes
Halton Region Official Plan (2018) – RNHS	The EER has demonstrated that the ecological form and function of Key Features and components of the RNHS (i.e. fish habitat, other wetlands and watercourses) will be enhanced. Mitigation measures outlined in the EER ensure that potential negative impacts are avoided or mitigated.	Yes
Halton Region Official Plan (2018) – Environmental Quality	The EER has demonstrated that the watercourse enhancement proposed as part of the PTTW process will result in an improvement to fish habitat within Appleby Creek. Furthermore, existing trees will be integrated into the proposed development to the extent feasible. Tree losses will be offset through streetscaping and plantings associated with LID measures and the SWM pond, trails as well as ecological and landscape buffers, resulting in an overall increase to the Urban Forest canopy and species diversity on the subject property.	Yes
City of Burlington Official Plan (2017 consolidation) – Natural Heritage	This EER has demonstrated that there will be no negative impacts to the ecological form or functions of fish habitat within and adjacent to the subject property. The proposed channel reinstatement/restoration as part of the PTTW process and SWM plan result in a net improvement to fish habitat in Appleby Creek. Furthermore, the proposed development has been directed away from hazard lands with the minor exception of a pedestrian crossing. The location of the proposed pedestrian crossing of Appleby Creek will need to be reviewed by the City of Burlington and CH. See "Conservation Halton Regulations", below.	In process – review of proposed channel reinstatement and SWM plan by the City of Burlington and CH will occur following submission of the OPA and ZBA.

APPLICABLE POLICY / LEGISLATION	RELEVANT STUDY FINDINGS AND RECOMMENDATIONS	COMPLIANCE
	Compliance with s.6.4 requires that works near Appleby Creek be reviewed by the City of Burlington and CH.	
City of Burlington Official Plan (2017 consolidation) – Environmental Evaluation	This EER includes all the requirements of an Environmental Evaluation, including the identification of buffers and setbacks, as well as the requirements of the Region's EIA.	Yes
City of Burlington Official Plan (2017 consolidation) – Sustainable Design and Compatibility	The EER has demonstrated that the proposed Development Plan is compatible with existing significant natural features (i.e. fish habitat), utilizes LID measures to the extent feasible and provides opportunities for active transportation via the proposed trail system. While opportunities for tree preservation will be revisited at a subsequent design stage, it is anticipated that existing trees will be integrated into the proposed lot fabric and trail areas to the extent feasible. Furthermore, it is proposed that more trees than currently exist on site will be planted, resulting in an increase in species diversity and the City's Urban Forest Canopy.	Yes
City of Burlington Official Plan (2017 consolidation) – Stormwater Management	The SWM Plan (Urbantech Consulting 2020) includes a suite of SWM approaches, including LID measures as well as traditional end-of-pipe SWM (associated with the PTTW). The SWM Plan has demonstrated that flooding has been managed to avoid risk to life and property as well as to maintain and enhance fish habitat.	Yes
Conservation Halton Regulations (Ontario Reg. 162/06) and related policies.	The subject property includes a watercourse, wetlands, and hazard lands (i.e., floodplains, meanderbelt), all subject to CH's regulations. The EER has confirmed all features that would be subject to CH's regulations, and the proposed development plan protects all regulated features and their functions within the RNHS with appropriate setbacks and buffers, as well as other measures (with the exception of wetland ELC Polygons 6b and 6c, which are recommended for removal). Some elements of the development, such as the proposed floodplain cut and fill (Area A), and SWM outfall (Area D) will require permits from CH. Appropriate mitigation measures have been identified and will need to be implemented to mitigate potential impacts to regulated features.	Yes – agency consultation has occurred. In process – Permit applications associated with the works in Area A related to the PTTW have been submitted to CH and is separate from the work proposed as part of the residential development; obtaining permits related to the residential development will be a condition of approval

11. Conclusions

This EER has been prepared in support of a site-specific development application for the subject property on behalf of the Millcroft Greens Corporation in support of an Official Plan Amendment, Zoning By-Law Amendment and Plan of Condominium.

The information presented in this report is comprehensive and based on available background studies, site-specific field assessments and analyses completed to date. It integrates the findings of companion technical studies prepared by members of the multi-disciplinary Project Team and is intended to be read in conjunction with the FSR (Urbantech 2020) and other technical studies.

In summary, this EER has:

1. Provided a comprehensive summary of federal, provincial, regional, conservation authority and municipal environmental regulations and policies that govern land use planning and development within the Study Area;
2. Updated the existing knowledge base of biophysical resources and ecological functions within the Study Area by consolidating available background information and supplementing it with more detailed information and analyses from site-specific technical studies;
3. Identified the relative significance and sensitivities of natural heritage features and areas within the Study Area according to applicable policies and regulations;
4. Identified biophysical constraints to development based on consideration of physical constraints (utilities/infrastructure), natural heritage constraints (i.e., RNHS), and natural hazard constraints (i.e. flooding and erosion);
5. Identified opportunities for improvement/restoration/enhancement of Key Features of the RNHS;
6. Identified and refined the boundaries of the RNHS by identifying Key Features, enhancements to Key Features, Buffers and other components of the RNHS;
7. Recommended limits of development for use in the developing the proposed Development Plan;
8. Described the proposed Development Plan;
9. Described all components of the proposed development (grading, servicing, stormwater, trails, etc.);
10. Assessed and evaluated the potential impacts of these changes on the refined RNHS;
11. Recommended measures for avoiding and/or mitigating potential impacts;
12. Summarized development implementation plans, including those related to restoration, tree protection and sediment and erosion control;
13. Included a commitment to developing a framework for an Environmental Monitoring Plan in consultation with the agencies; and
14. Assessed compliance of the proposed development with applicable environmental legislation, policies and regulations.

Both the EER and the proposed Development Plan were developed with input from the Project Study Team. One of the principal design objectives for the Development Plan was to achieve environmental protection and to integrate the development into the surrounding landscape in a manner that is environmentally sensitive. Such an approach was necessary to satisfy the various regulatory requirements for protection of fish habitat and the Region's NHS policies.

To satisfy the various environmental protection requirements, it was necessary for the design to be limited to those lands that are part of the former golf course and situated outside the boundaries of the proposed RNHS. By limiting development to areas outside the RNHS, direct impacts have been largely avoided. As a consequence, the impact assessment presented in the EER is focused primarily on mitigating potential indirect impacts and reduced levels of risk.

The refined RNHS encompasses all sensitive and significant natural heritage resources associated with the subject property. Additionally, there are a number of enhancements proposed to the refined RNHS that will result in improvements to the ecological form and function of Appleby Creek, habitat improvements for fish and accommodation of a publicly accessible trail system through naturalized buffer and enhancement areas.

Furthermore, within Area A, modifications to the Regional Storm flood plain are proposed in order to create additional development area. CH's Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document (Conservation Halton 2016a) provides for consideration of such flood plain alterations. Specifically, Policy 3.19.1 states:

> *Major flood plain alterations (including placement of fill to create, or enlarge, a building lot) and major watercourse alterations (including enclosures and diversions from one watershed to another) are generally not permitted. Such alterations may be considered where justification is provided through a subwatershed study, an Environmental Assessment or similar comprehensive study and are subject to conformity with municipal planning documents. The applicable study or assessment must be current (generally within 5 years) and must be supported by Conservation Halton.*

The term 'comprehensive study' as used in Policy 3.19.1 is defined in CH's policy document as follows:

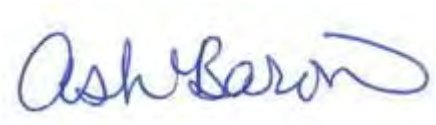
> *Means a detailed study that fully assesses existing conditions and the potential impacts of proposed development with respect to, at a minimum, hydrology, hydraulics, hydrogeology, fluvial processes, erosion, slope stability and the natural environment (including, but not limited to, ecological functions).*

The contents of the FSR, hydrogeology study and EER fulfill the requirements as outlined above in the definition of 'comprehensive study' however, CH staff have advised that, in addition to the requirements as outlined in the definition of 'comprehensive study' the Authority will also require demonstration that the proposed alteration is not only to facilitate more developable land but that it also provides additional upstream/downstream benefits and that it is in the public interest. While the Study Team does not agree that such a demonstration is required, based on the contents of Policy 3.19.1 or the definition of 'comprehensive study', in order to advance discussions with CH as it relates to a future Permit application pursuant to Ontario Regulation 162/06, a separate summary report will be submitted, upon receipt of comments on the FSR, EER and hydrogeology report, that summarizes the anticipated benefits as a result of the proposed development.

In conclusion, it is the opinion of Beacon and the Study Team that:

a) The proposed development will not negatively affect the refined RNHS provided that the recommended mitigation measures specified in this report (and in the companion technical studies) are appropriately implemented; and
b) The proposed development is in compliance with applicable environmental protection and planning policies at the federal, provincial, regional, Conservation Authority and municipal levels.

Prepared by:
Beacon Environmental



Ash Baron, B.E.S., CEERR
Senior Ecologist,
ISA Certified Arborist (ON-1821A)

Reviewed by:
Beacon Environmental



Ken Ursic, B.Sc., M.Sc.
Principal, Senior Ecologist

With technical input from:
Beacon Environmental



Joel Davey, B.B.R.M., CISEC
Aquatic Ecologist, Environmental Inspector

Beacon Environmental



Shelley Gorenc, M.Sc., P.Geo.
Senior Geomorphologist

Beacon Environmental



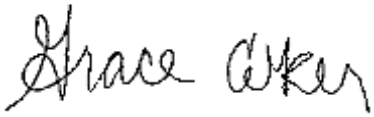
Ahmed Siddiqui, B.Sc. (Hons.), M.Sc.
River Scientist

Beacon Environmental



Sarah Aitken, B.Sc., Dipl. Env. Tech.
Aquatic Ecologist, Surface Water Specialist

Beacon Environmental



Grace Coker, B.Sc., CISEC
Ecologist, Surface Water Technician

Beacon Environmental



Anna Cunningham, B.Sc.(Hons.)
Ecologist

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Appendix A

EER Terms of Reference

July 9, 2020 BEL 216081.2

Mr. Kyle Plas
Senior Planner
City of Burlington
Community Planning
426 Brant Street, PO Box 5013
Burlington, ON L7R 3Z6

Re: Proposed Terms of Reference for Scoped Environmental Evaluation Report
Millcroft Golf Club, City of Burlington, Regional Municipality of Halton

Dear Mr. Plas,

On behalf of Argo (Millcroft) Developments Limited (the applicant), Beacon Environmental Limited (Beacon) has prepared the following Terms of Reference (TOR) for a Scoped Environmental Evaluation Report (EER) in support of a residential redevelopment proposal for portions of the Millcroft Golf Club property located at 2155 Country Club Drive, in the City of Burlington (**Figure 1**). This TOR was developed in consultation with Halton Region, the City of Burlington, and Conservation Halton.

The golf course is currently designated as Major Parks and Open Space. To facilitate the proposed redevelopment, portions of the golf course will need to be designated to Residential. The proposed redevelopment will be limited to existing golf course holes #1, #6, #7, #16 as well as the operations and maintenance yard north of hole #12 (herein referred to as the subject property). The total area of the proposed redevelopment is 13.40 hectares. For ease of reference, these redevelopment areas have been ascribed the alphabetical identifiers A - E (**Figure 1**). The remaining golf holes will be redesigned to allow for continued operation of the Millcroft Golf Club and are not the subject of this EER.

An EER is one of the studies required in support the Application for Official Plan Amendment. An EER is considered equivalent to Regional Environmental Impact Assessments (EIA). The purpose of an EER is to demonstrate that the proposed redevelopment will not negatively impact the natural environment.

Section 2.5 of City of Burlington Official Plan outlines policies relating to when an EER is required and how it must be prepared. For this application, the need for an EER was triggered by the proximity of the redevelopment to lands that are regulated by Conservation Halton, including Appleby Creek and Sheldon Creek and their associated floodplains (ref. Appendix H-24 of the City of Burlington OP). Appleby Creek flanks the western boundary of the subject property and flows into a large dug online pond at the corner of Country Club Drive and Upper Middle Road (Area A). Sheldon Creek flanks the eastern boundary of the subject property (Area D) and flows through a series of dug ponds, including a large pond at the rail line overpass of Appleby Line near Millcroft Park.

Policy 2.5g requires that the Applicant prepare Terms of Reference for the EER outlining the scope of the study. The EER will be prepared in accordance with the Region's Environmental Impact Assessment Guidelines. Given the predominantly anthropogenic conditions of the subject property and urbanized nature of the surrounding lands, it is our opinion that the EER can be scoped accordingly.

A description of the proposed approach is outlined in the subsections below.

It should be noted that core components of the field program were completed in 2018 and 2019, with supplementary investigations occurring in early 2020.

Background Review

All available background information relating to natural heritage resources on the subject property and adjacent lands will be reviewed. Resources to be consulted will include:

- Natural Heritage Information Centre (NHIC) Databases;
- Ministry of Environment, Conservation and Parks (MECP) Species at Risk (SAR) Screening;
- Ontario Nature Reptile and Amphibian Atlas;
- Atlas of the Mammals of Ontario;
- Ontario Butterfly Atlas;
- eBird/Bird Studies Canada databases;
- Conservation Halton – Biological Records; and
- Other relevant databases.

Policy Framework

Key environmental protection legislation, policies and regulations relating to the subject property and proposed development will be reviewed to establish the policy framework for evaluation through the EER. This will include the following:

- Provincial Policy Statement;
- A Place to Grow: Growth Plan for the Greater Golden Horseshoe;
- Halton Region Official Plan;
- City of Burlington Official Plan (in force);
- Conservation Halton Policies and Regulations;
- *Endangered Species Act*;
- *Species at Risk Act;*
- *Fisheries Act*; and
- *Migratory Birds Convention Act*.

Characterization of the Biophysical Environment

Aquatic and terrestrial resources on the subject property will be characterized based on the findings of the following ecological surveys:

- Breeding amphibian surveys in accordance with Marsh Monitoring Program (three surveys);
- Breeding bird surveys in accordance with Ontario Breeding Bird Atlas (two surveys);
- Reptile surveys (incidental by flipping cover objects and visual incidental surveys for basking snakes and turtles);
- Incidental observations of fauna;
- Vegetation Community Surveys (Ecological Land Classification protocol);
- Floristic surveys (summer, area search methodology);
- Review of wetland boundaries and, if applicable, a feature staking exercise with CH;
- Aquatic habitat and temperature assessment (Section 4 Module 4 of the Ontario Stream Assessment Protocol); and,
- Fish community sampling (electrofishing).

The terrestrial ecological resources of lands within 120 m from the subject property will be characterized using available background information and, where applicable, the results of the studies listed above. Characterization of aquatic communities will rely on fish sampling records available from CH at the nearest stations upstream and downstream of the subject property. The methodologies of the characterization work will be detailed in the EER. Field sheets and this TOR will be appended to the report.

To further characterize the biophysical environment, information from other technical studies will be reviewed and key findings will be integrated into the EER. Technical studies to be reviewed will include a) arborist report, b) landscaping plans, c) functional servicing and stormwater management report, d) geomorphic assessment, e) hydrogeological investigation, f) site grading, g) erosion and sediment control plans, and other relevant reports and plans including water quality monitoring upstream and downstream of the proposed works on Appleby Creek (Area A). The results of feature staking exercises with the agencies (e.g. CH) will be included, as applicable.

Assessment of Significance and Sensitivities

Beacon will review the ecological data collected through the characterization work to determine the significance and sensitivity of the natural heritage resources on the subject property. The significance of features will be evaluated using provincial and municipal criteria for the various natural heritage elements outlined in the provincial policy, regional and local official plans, and conservation authority policies, including an assessment for Significant Wildlife Habitat[1] and the characterization of the form and function of any mapped and unmapped Key Features, Linkages, Buffers, and Enhancement Areas within the study area that are part of the Regional Natural Heritage System (RNHS). Beacon will rely upon current species status lists to determine the significance of species observed. The EER will provide a summary of the significance of documented natural heritage resources and areas.

[1] *Including identification of potential nesting and hibernation habitat available to turtles based on data collected during biophysical surveys.*

Constraints and Opportunities

An analysis will be undertaken to identify constraints to development as well as opportunities to enhance the natural environment. The constraint analysis will include an evaluation of individual feature sensitivities to the effects of future land use change and development. This information will be used to establish development limits and guide design.

Included in the EER shall be a figure illustrating constraints to development based on the results of a biophysical analysis and hazard analysis, which will establish the boundary of the RNHS. The figure will identify other areas for protection and restoration including all Buffers, Linkages, and Enhancements, as applicable.

The EER will include supporting information to demonstrate whether the features within and south of Area E would meet the Conservation Authorities Act definition of a wetland and whether the feature would be considered part of the RNHS.

Opportunities for enhancements to the existing natural environment will also be identified, where feasible. Opportunities to be considered will include measures to improve and enhance water quality and aquatic habitat.

Development Proposal

The EER will include a description of the proposed development including a summary of the following:

- Statement of purpose/rationale for development;
- Development plan (including proposed lot lines);
- Grading and servicing plans;
- Stormwater management plan;
- A description of development related activities; and
- Development schedule/timeline.

Impact Assessment and Mitigation

This EER will include an assessment of potential development-related impacts to existing natural heritage features and their ecological functions. Potential impacts associated with the proposed development will be assessed by evaluating the effects of various development-related activities, (including the creation of lot lines) on the physical resources, biological resources and social resources, including natural heritage resources, hydrogeology, hydrology, and geomorphology. Impacts related to site preparation and development will be assessed and described in terms of their short and long-term effects on the biophysical environment.

The EER will include recommendations for a range of mitigation measures that can be used to avoid or reduce development-related impacts to natural heritage features and ecological functions on the subject

property and, where applicable, adjacent lands, including recommended buffers and setbacks, timing restrictions, placement of lot lines, stormwater management, water balance, erosion and sediment control measures, as well as specific management strategies and monitoring programs.

The net or residual effect, once mitigation measures are applied, will be determined and noted as negative, neutral or positive. Rationale for the assessment will be provided. The EER will demonstrate that the proposed development and site alteration will result in no negative impacts to the portion of the RNHS adjacent to the development as required in Section 118(3) of the Regional Official Plan and based on the systems approach outlined Section 118(2).

Monitoring

Based on the findings of the EER, a monitoring program may be recommended to monitor the effectiveness of various mitigation and environmental management strategies identified in the EER (i.e. buffers, LIDs, etc.). The need for such a program will be discussed with the City and Conservation Halton.

Water quality monitoring associated with the proposed works on Appleby Creek in Area A has been requested by CH. Sampling methods and baseline / pre-development conditions as well as recommendations for further water quality monitoring will be included in the EER. Draft water quality monitoring stations, located upstream and downstream of the proposed works on Appleby Creek, are shown in **Figure 2**.

Upon request, Beacon and key members of the proponent's consultant team can accommodate a meeting and/or, if safe to do so, a site visit with the City and other agency staff.

Should you have any questions, please do not hesitate to contact Ken Ursic at (519) 826-0419 x23.

Prepared by:
Beacon Environmental



Shelley Gorenc, M.Sc., P.Geo.
Senior Fluvial Geomorphologist

Reviewed by:
Beacon Environmental



Ken Ursic
Senior Ecologist





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Subject Property	Figure 1
Millcroft Golf Club	
BEACON ENVIRONMENTAL	Project: 216081.2 Last Revised: October, 2019
Client: Millcroft Greens Corporation	Prepared by: DU Checked by: AB
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Proposed Water Quality Monitoring Locations

Figure 2

Millcroft Golf Club

Legend

- Subject Property
- Monitoring Locations
- Proposed Design
- Watercourse (Beacon)

BEACON ENVIRONMENTAL

Project: 216081.2
Last Revised: June, 2020

Client: Millcroft Greens Corporation

Prepared by: DU
Checked by: AB

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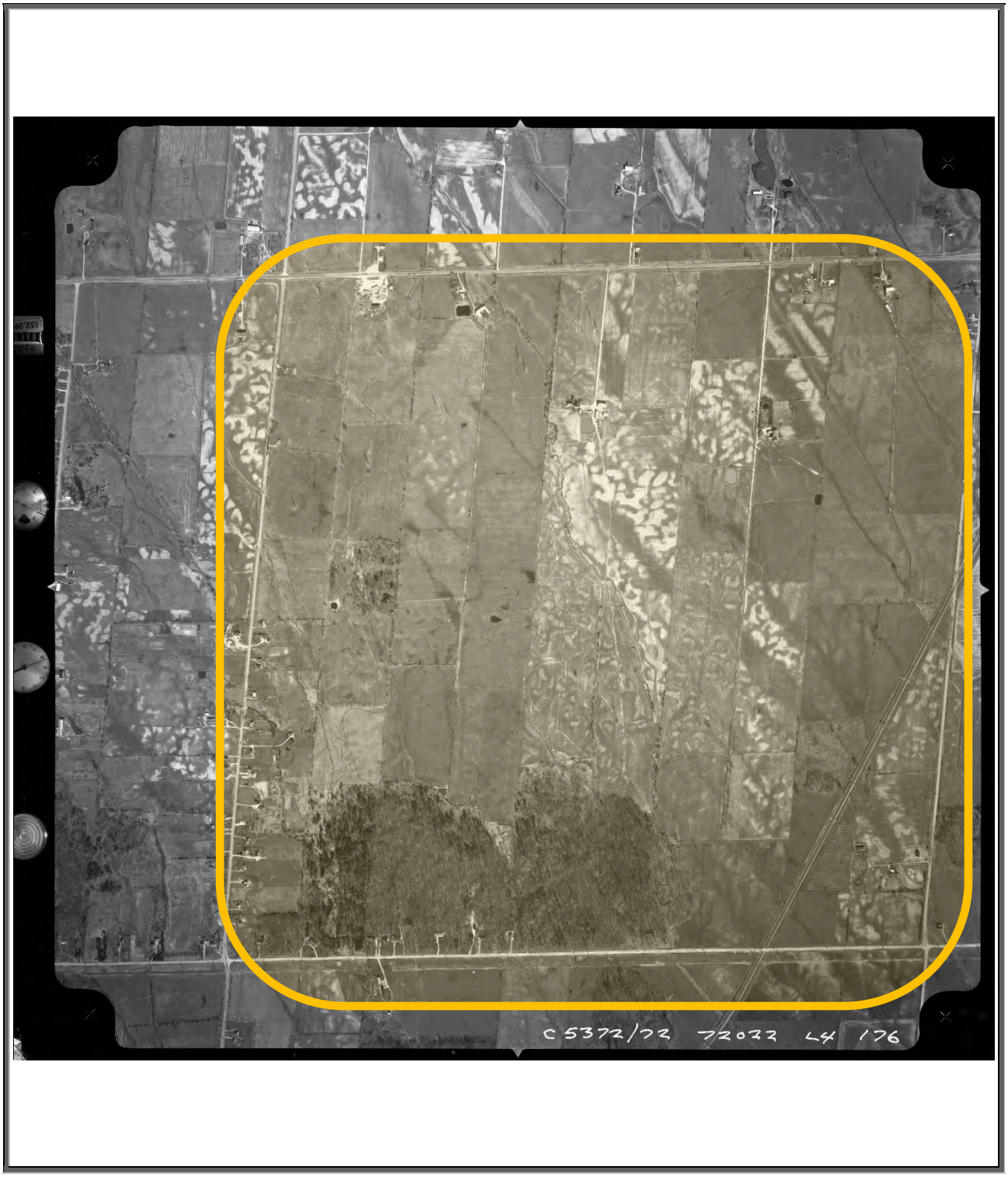
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Appendix B

Historical Assessment of Geomorphic Conditions in Appleby Creek



Coverage: Spring 1972 **Source:** Northway Photomap/Remote Sensing

Appendix C

Summary of Species Records Obtained from Background Review

Appendix C

Summary of Species Records Obtained from Background Review

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Halton NAI (d)	Assessment of Presence in Study Area	Sources (e)
AMPHIBIANS							
American Toad	*Bufo americanus americanus*			S5	HC	Not Present in Area A; Possible within the Study Area of Area D; Possible within Area E	1, 6
Tetraploid Gray Treefrog	*Hyla versicolor*			S5	HC	Habitat Not Present	1, 6
Western Chorus Frog	*Pseudacris triseriata*	THR		S3	H?	Habitat Not Present	1, 6
Spring Peeper	*Pseudacris crucifer crucifer*			S5	HC	Habitat Not Present	1, 6
Green Frog	*Rana clamitans*			S5	HC	Present in Area A; Possible within the Study Area of Area D	1, 6
Northern Leopard Frog	*Rana pipiens*			S5	HC	Not Present in Area A; Possible within the Study Area of Area D; Possible within Area E	1, 6
Wood Frog	*Rana sylvatica*			S5	HC	Habitat Not Present	1, 6
Jefferson Salamander	*Abystoma jeffersonianum*	END	END	S2	HU	Habitat Not Present	6
Blue-spotted Salamander	*Ambystoma laterale*			S4	HR	Habitat Not Present	6
Yellow (Spotted) Salamander	*Ambystoma maculatum*			S4	HU	Habitat Not Present	6
Redback Salamander	*Plethodon cinereus*			S5	HU	Habitat Not Present	6
Mudpuppy	*Necturus maculosus*			S4	HR	Habitat Not Present	6
Red-spotted Newt	*Notophtalmus viridescens viridescens*			S5	HC	Habitat Not Present	6
BIRDS							
Red-necked Grebe	*Podiceps grisegena*			S3B,S4N	HU	Not Present	1, 2
Green Heron	*Butorides virescens*			S4	HU	Present in Area A	1, 3
Trumpeter Swan	*Cygnus buccinator*			S4	N/A	Not Present	1, 3
Canada Goose	*Branta canadensis*			S5	N/A	Present in Area A	1, 2, 3
Wood Duck	*Aix sponsa*			S5	N/A	Not Present	1, 3
American Black Duck	*Anas rubripes*			S4	HU	Not Present	1, 3
Mallard	*Anas platyrhynchos*			S5	N/A	Present in Area A	1, 2, 3
Turkey Vulture	*Cathartes aura*			S5	N/A	Not Present	1, 3
Northern Harrier	*Circus cyaneus*			S4	HU	Not Present	1, 3
Sharp-shinned Hawk	*Accipiter striatus*			S5	HU	Not Present	1, 3
Cooper's Hawk	*Accipiter cooperi*			S4	HU	Not Present	1, 3
Red-tailed Hawk	*Buteo jamaicensis*			S5	N/A	Not Present	1, 2, 3
American Kestrel	*Falco sparverius*			S4	N/A	Not Present	1, 2, 3
Wild Turkey	*Meleagris gallopavo*			S5	HU	Not Present	1, 3
Ruffed Grouse	*Bonasa umbellus*			S4	N/A	Not Present	1, 3
Virginia Rail	*Rallus limicola*			S5	N/A	Not Present	1, 3
Sora	*Porzana carolina*			S4	HU	Not Present	1, 3
Killdeer	*Charadrius vociferus*			S5	N/A	Not Present	1, 3

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Halton NAI (d)	Assessment of Presence in Study Area	Sources (e)
Spotted Sandpiper	*Actitis macularia*			S5	N/A	Not Present	1, 3
American Woodcock	*Scolopax minor*			S4	N/A	Not Present	1, 3
Rock Pigeon	*Columba livia*			SNA	N/A	Not Present	1, 3
Mourning Dove	*Zenaida macroura*			S5	N/A	Present in Area A	1, 3
Black-billed Cuckoo	*Coccyzus erythropthalmus*			S5	HU	Not Present	1, 3
Yellow-billed Cuckoo	*Coccyzus americanus*			S4	HR	Not Present	1, 3
Great Horned Owl	*Bubo virginianus*			S4	N/A	Not Present	1, 3
Eastern Screech-Owl	*Megascops asio*			S4	N/A	Not Present	1, 3
Long-eared Owl	*Asio otus*			S4	HR	Not Present	1, 3
Chimney Swift	*Chaetura pelagica*	THR	THR	S4	HU	Not Present	1, 3
Ruby-throated Hummingbird	*Archilochus colubris*			S5	N/A	Not Present	1, 3
Belted Kingfisher	*Ceryle alcyon*			S4	N/A	Not Present	1, 3
Red-bellied Woodpecker	*Melanerpes carolinus*			S4	HU	Not Present	1, 3
Downy Woodpecker	*Dryobates pubescens*			S5	N/A	Not Present	1, 3
Hairy Woodpecker	*Dryobates villosus*			S5	N/A	Not Present	1, 3
Northern Flicker	*Colaptes auratus*			S4	N/A	Present in Area A	1, 3
Pileated Woodpecker	*Dryocopus pileatus*			S5	HU	Not Present	1, 3
Eastern Wood-Pewee	*Contopus virens*	SC	SC	S4	N/A	Not Present	1, 3
Alder Flycatcher	*Empidonax alnorum*			S5	N/A	Not Present	1, 3
Willow Flycatcher	*Empidonax traillii*			S5	HU	Not Present	1, 3
Least Flycatcher	*Empidonax minimus*			S4	HU	Not Present	1, 3
Eastern Phoebe	*Sayornis phoebe*			S5	N/A	Not Present	1, 3
Great Crested Flycatcher	*Myiarchus crinitus*			S4	N/A	Not Present	1, 3
Eastern Kingbird	*Tyrannus tyrannus*			S4	N/A	Not Present	1, 3
Horned Lark	*Eremophila alpestris*			S5	HU	Not Present	1, 2, 3
Purple Martin	*Progne subis*			S3B,S4N	HU	Not Present	1, 3
Tree Swallow	*Tachycineta bicolor*			S4	N/A	Not Present	1, 3
N. Rough-winged Swallow	*Stelgidopteryx serripennis*			S4	HU	Not Present	1, 3
Cliff Swallow	*Petrochelidon pyrrhonota*			S4	N/A	Not Present	1, 3
Barn Swallow	*Hirundo rustica*	THR	THR	S4	N/A	Not Present	1, 2, 3
Blue Jay	*Cyanocitta cristata*			S5	N/A	Present in Area A	1, 3
American Crow	*Corvus brachyrhynchos*			S5	N/A	Not Present	1, 3
Black-capped Chickadee	*Poecile atricapillus*			S5	N/A	Present in Area A	1, 3
White-breasted Nuthatch	*Sitta carolinensis*			S5	N/A	Not Present	1, 3
Brown Creeper	*Certhia americana*			S5	HU	Not Present	1, 3
House Wren	*Troglodytes aedon*			S5	N/A	Not Present	1, 3
Winter Wren	*Troglodytes hiemalis*			S5	HU	Not Present	1, 3
Carolina Wren	*Thryothorus ludovicianus*			S4	HR	Not Present	1, 3
Sedge Wren	*Cistothorus platensis*			S4	N/A	Not Present	1, 3

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Halton NAI (d)	Assessment of Presence in Study Area	Sources (e)
Blue-gray Gnatcatcher	*Polioptila caerulea*			S4	HU	Not Present	1, 3
Eastern Bluebird	*Sialia sialis*			S5	HU	Not Present	1, 3
Veery	*Catharus fuscescens*			S4	N/A	Not Present	1, 3
Wood Thrush	*Hylocichla mustelina*	THR	SC	S4	N/A	Not Present	1, 3
American Robin	*Turdus migratorius*			S5	N/A	Present in Area A	1, 3
Northern Mockingbird	*Mimus polyglottus*			S4	HU	Not Present	1, 3
Gray Catbird	*Dumetella carolinensis*			S4	N/A	Not Present	1, 3
Brown Thrasher	*Toxostoma rufum*			S4	N/A	Not Present	1, 3
Cedar Waxwing	*Bombycilla cedrorum*			S5	N/A	Present in Area A	1, 3
European Starling	*Sturnus vulgaris*			SE	N/A	Present in Area A	1, 3
Warbling Vireo	*Vireo gilvus*			S5	N/A	Present in Area A	1, 3
Red-eyed Vireo	*Vireo olivaceus*			S5	N/A	Not Present	1, 3
Blue-winged Warbler	*Vermivora cyanptera*			S4	HU	Not Present	1, 3
Nashville Warbler	*Oreothlypis ruficapilla*			S5	HR	Not Present	1, 3
Yellow Warbler	*Setophaga petechia*			S5	N/A	Not Present	1, 3
Chestnut-sided Warbler	*Setophaga pensylvanica*			S5	HU	Not Present	1, 3
Magnolia Warbler	*Setophaga magnolia*			S5	HR	Not Present	1, 3
Black-throated Green Warbler	*Setophaga virens*			S5	HU	Not Present	1, 3
Pine Warbler	*Setophaga pinus*			S5	HU	Not Present	1, 3
Black-and-white Warbler	*Mniotilta varia*			S5	HU	Not Present	1, 3
American Redstart	*Setophaga ruticilla*			S5	N/A	Not Present	1, 3
Ovenbird	*Seiurus aurocapillus*			S4	N/A	Not Present	1, 3
Mourning Warbler	*Geothlypis philadelphia*			S4	HU	Not Present	1, 3
Common Yellowthroat	*Geothlyphis trichas*			S5	N/A	Not Present	1, 3
Hooded Warbler	*Setophaga citrina*	THR	SC	S3	N/A	Not Present	1, 3
Scarlet Tanager	*Piranga olivacea*			S4	HR	Not Present	1, 3
Northern Cardinal	*Cardinalis cardinalis*			S5	N/A	Present in Area A	1, 3
Rose-breasted Grosbeak	*Pheucticus ludovicianus*			S4	N/A	Not Present	1, 3
Indigo Bunting	*Passerina cyanea*			S4	N/A	Not Present	1, 3
Dickcissel	*Spiza americana*			SNA	N/A	Not Present	1, 3
Eastern Towhee	*Pipilio erythrophthalmus*			S4	HU	Not Present	1, 3
Chipping Sparrow	*Spizella passerina*			S5	N/A	Present in Area A	1, 3
Field Sparrow	*Spizella pusilla*			S4	N/A	Not Present	1, 3
Vesper Sparrow	*Pooecetes gramineus*			S4	HU	Not Present	1, 3
Savannah Sparrow	*Passerculus sandwichensis*			S4	N/A	Present in Area A	1, 3
Grasshopper Sparrow	*Ammodramus savannarum*			S4	HU	Not Present	1, 3
Song Sparrow	*Melospiza melodia*			S5	N/A	Not Present	1, 3
Swamp Sparrow	*Melospiza georgiana*			S5	N/A	Not Present	1, 3
Bobolink	*Dolichonyx oryzivorus*	THR	THR	S4	N/A	Not Present	1, 3

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Halton NAI (d)	Assessment of Presence in Study Area	Sources (e)
Red-winged Blackbird	*Agelaius phoeniceus*			S4	N/A	Present in Area A	1, 3
Eastern Meadowlark	*Sturnella magna*	THR	THR	S4	N/A	Not Present	1, 3
Common Grackle	*Quiscalus quiscula*			S5	N/A	Present in Area A	1, 3
Brown-headed Cowbird	*Molothrus ater*			S4	N/A	Present in Area A	1, 3
Orchard Oriole	*Icterus spurius*			S4	HR	Not Present	1, 3
Baltimore Oriole	*Icterus galbula*			S4	N/A	Not Present	1, 3
House Finch	*Haemorhous mexicanus*			SNA	N/A	Present in Area A	1, 3
American Goldfinch	*Spinus tristis*			S5	N/A	Present in Area A	1, 3
House Sparrow	*Passer domesticus*			SNA	N/A	Present in Area A	1, 3
BUTTERFLIES							
Silver-spotted Skipper	*Epargyreus clarus*			S4	HC	Food Source Not Present	5
Northern Cloudywing	*Thorybes pylades*			S5	HC	Possible within Study Area	5
Juvenal's Duskywing	*Erynnis juvenalis*			S5	HC	Possible within Study Area	5
Mottled Duskywing	*Erynnis martialis*	END	END	S2	HC	Habitat and Food Source Not Present	5
Columbine Duskywing	*Erynnis lucilius*			S4	HU	Food Source Not Present	5
Wild Indigo Duskywing	*Erynnis baptisiae*			S4	HU	Food Source Not Present	5
Common Sootywing	*Pholisora catullus*			S4	HR	Food Source Not Present	5
Least Skipper	*Ancyloxypha numitor*			S5	HC	Possible within the Study Area of Area E	5
European Skipper	*Thymelicus lineola*			SNA	HC	Possible within Study Area	5
Peck's Skipper	*Polites peckius*			S5	HC	Possible within Study Area	5
Tawny-edged Skipper	*Polites themistocles*			S5	HC	Food Source Not Present	5
Long Dash Skipper	*Polites mystic*			S5	HC	Possible within Study Area	5
Northern Broken Dash	*Wallengrenia egeremet*			S5	HC	Possible within Study Area	5
Little Glassywing	*Pompeius verna*			S4	HC	Food Source Not Present	5
Delaware Skipper	*Atrytone logan*			S4	HC	Possible within Study Area	5
Hobomok Skipper	*Poanes hobomok*			S5	HC	Possible within Study Area	5
Black Dash	*Euphyes conspicuus*			S3	HU	Habitat Not Present	5
Dun Skipper	*Euphyes vestris*			S5	HC	Possible within the Study Area of Area A	5
Black Swallowtail	*Papilio polyxenes*			S5	HC	Food Source Not Present	5
Eastern Tiger Swallowtail	*Papilio glaucus glaucus*			S5	HC	Possible within Study Area	2, 5
Midsummer Tiger Swallowtail	*Papilio canadensis* X *glaucus*			n/a	N/A	Possible within Study Area	5
West Virginia White	*Pieris virginiensis*		SC	S3	HC	Habitat Not Present	5
Cabbage White	*Pieris rapae*			SNA	HC	Possible within Study Area	5
Clouded (Common) Sulphur	*Colias philodice*			S5	HC	Possible within Study Area	5
Orange Sulphur	*Colias eurytheme*			S5	HC	Possible within Study Area	5
American Copper	*Lycaena phlaeas*			S5	HU	Food Source Not Present	5
Acadian Hairstreak	*Satyrium acadicum*			S4	HU	Possible within Study Area	5
Coral Hairstreak	*Satyrium titus*			S5	HU	Food Source Not Present	5
Edwards' Hairstreak	*Satyrium edwardsii*			S4	HR	Possible within Study Area	5

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Halton NAI (d)	Assessment of Presence in Study Area	Sources (e)
Banded Hairstreak	*Satyrium calanus*			S4	HC	Possible within Study Area	5
Hickory Hairstreak	*Satyrium caryaevorum*			S4	HC	Possible within Study Area	5
Striped Hairstreak	*Satyrium liparops strigosum*			S5	HC	Possible within Study Area	5
Eastern Tailed Blue	*Everes comyntas*			S5	HC	Possible within Study Area	5
Azure species	*Celastrina* sp.			n/a	N/A	Possible within Study Area	5
Silvery Blue	*Glaucopsyche lygdamus couperi*			S5	HU	Habitat Not Present	5
Great Spangled Fritillary	*Speyeria cybele*			S5	HC	Food Source Not Present	5
Silvery Checkerspot	*Chlosyne nycteis*			S5	HU	Possible within Study Area	5
Pearl Crescent	*Phyciodes tharos*			S4	HC	Possible within Study Area	5
Northern Crescent	*Phyciodes cocyta*			S5	N/A	Possible within Study Area	5
Baltimore Checkerspot	*Euphydryas phaeton*			S4	HU	Possible within the Study Area of Areas A and E	5
Question Mark	*Polygonia interrogationis*			S5	HC	Possible within Study Area	5
Eastern Comma	*Polygonia comma*			S5	HC	Possible within Study Area	5
Gray Comma	*Polygonia progne*			S5	HU	Habitat Not Present	5
Compton Tortoiseshell	*Nymphalis vaualbum*			S5	HU	Possible within Study Area	5
Mourning Cloak	*Nymphalis antiopa*			S5	HC	Possible within Study Area	5
Milbert's Tortoiseshell	*Nymphalis milberti*			S5	HU	Possible within Study Area	5
American Lady	*Vanessa virginiensis*			S5	HC	Possible within Study Area	5
Painted Lady	*Vanessa cardui*			S5	HC	Possible within Study Area	5
Red Admiral	*Vanessa atalanta*			S5	HC	Possible within Study Area	5
Common Buckeye	*Junonia coenia*			SNA	HR	Food Source Not Present	5
White Admiral	*Limenitis arthemis*			S5	HU	Habitat Not Present	5
Red-spotted Purple	*Limenitis arthemis astyanax*			S5	HC	Possible within Study Area	5
Viceroy	*Limenitis archippus*			S5	HC	Possible within Study Area	5
Northern Pearly-Eye	*Enodia anthedon*			S5	HC	Habitat Not Present	5
Eyed Brown	*Satyrodes eurydice*			S5	HC	Possible within the Study Area of Area A	5
Appalachian Brown	*Satyrodes appalachia*			S4	HC	Possible within the Study Area of Area A	5
Little Wood-Satyr	*Megisto cymela*			S5	HC	Habitat Not Present	5
Common Ringlet	*Coenonympha tullia*			S5	HC	Possible within Study Area	5
Common Wood-Nymph	*Cercyonis pegala*			S5	HC	Possible within Study Area	5
Monarch	*Danaus plexippus*	SC	SC	S2	HC	Possible within Study Area with Limited Foraging Opportunities	2, 5
FISH							
Brook Stickleback	*Culaea inconstans*			S5	HR	Present in Sheldon Creek (Study Area of Area D)	2
Brown Bullhead	*Ameiurus nebulosus*			S5	HR	Present in Appleby Creek (Study Area of Area A)	1, 2
Common Carp	*Cyprinus carpio*			SNA	EXCLUDED	Present in Appleby Creek (Study Area of Area A)	1, 2
Common Shiner	*Luxilus cornutus*			S5	HU	Present in Sheldon Creek (Study Area of Area D)	2
Creek Chub	*Semotilus atromaculatus*			S5	N/A	Present in Appleby Creek (Area A) and Sheldon Creek (Study Area of Area D)	1, 2
Fathead Minnow	*Pimephales promelas*			S5	N/A	Present in Appleby Creek (Area A) and Sheldon Creek (Study Area of Area D)	1, 2
Goldfish	*Carassius auratus*			SNA	EXCLUDED	Present in Appleby Creek (Area A)	1, 2

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Halton NAI (d)	Assessment of Presence in Study Area	Sources (e)
Green Sunfish	*Lepomis cyanellus*			S4	HR	Present in Appleby Creek (Study Area of Area A)	1, 2
Largemouth Bass	*Micropterus salmoides*			S5	HU	Present in Appleby Creek (Area A) and Sheldon Creek (Study Area of Area D)	1, 2
Pumpkinseed	*Lepomis gibbosus*			S5	HU	Present in Appleby Creek (Area A) and Sheldon Creek (Study Area of Area D)	1, 2
Rainbow Darter	*Etheostoma caeruleum*			S4	HU	Present in Sheldon Creek (Study Area of Area D)	2
Smallmouth Bass	*Micropterus dolomieu*			S5	HR	Present in Sheldon Creek (Study Area of Area D)	2
Western Blacknose Dace	*Rhinichthys obtusus*			EXCLUDED	EXCLUDED	Present in Sheldon Creek (Study Area of Area D)	2
White Sucker	*Catostomus commersoni*			S5	N/A	Present in Sheldon Creek (Study Area of Area D)	2
MAMMALS							
Virginia Opossum	*Didelphis virginiana*			S4	HC	Habitat Not Present	2, 4
Smoky Shrew	*Sorex fumeus*			S5	HC	Possible within Thickets within Study Area	4
Northern Short-tailed Shrew	*Blarina brevicauda*			S5	HC	Possible within Thickets within Study Area	4
Star-nosed Mole	*Condylura cristata*			S5	HC	Habitat Not Present	4
Small-footed Bat	*Myotis leibii*		END	S2B,S3N	N/A	Habitat Not Present	1, 4
Little Brown Bat	*Myotis lucifugus*	END	END	S3	HC	Habitat Not Present	1, 4
Northern Long-eared Bat	*Myotis septentrionalis*	END	END	S3	HC	Habitat Not Present	1, 4
Silver-haired Bat	*Lasionycteris noctivagans*			S4	MIGRANT	Habitat Not Present	1, 4
Tricolored Bat	*Perimyotis subflavus*	END	END	S3?	H?	Habitat Not Present	1, 4
Big Brown Bat	*Epesicus fuscus*			S4	HC	Habitat Not Present	1, 4
Eastern Red Bat	*Lasiurus borealis*			S4	HC	Habitat Not Present	1, 4
Hoary Bat	*Lasiurus cinereus*			S4	HC	Habitat Not Present	1, 4
Eastern Cottontail	*Sylvilagus floridanus*			S5	HC	Possible within Study Area	2, 4
European Hare	*Lepus europaeus*			SNA	HC	Possible within Study Area	4
Eastern Chipmunk	*Tamias striatus*			S5	HC	Possible within Study Area	4
Woodchuck	*Marmota monax*			S5	HC	Possible within Study Area	4
Gray Squirrel	*Sciurus carolinensis*			S5	HC	Present in Area A; Possible within Study Area	1, 2, 4
Red Squirrel	*Tamiasciurus hudsonicus*			S5	HC	Possible within Study Area	4
Beaver	*Castor canadensis*			S5	HC	Habitat Not Present	4
White-footed Mouse	*Peromyscus leucopus*			S5	HC	Possible within Study Area	4
Deer Mouse	*Peromyscus maniculatus*			S5	HC	Possible within Study Area	4
Meadow Vole	*Microtus pennsylvanicus*			S5	HC	Possible within Study Area	4
Norway Rat	*Rattus norvegicus*			SNA	HC	Possible within Study Area	4
Muskrat	*Ondatra zibethicus*			S5	HC	Possible within Study Area	4
Woodland Jumping Mouse	*Napeozapus insignis*			S5	HU	Habitat Not Present	4
Coyote	*Canis latrans*			S5	HC	Present in Study Area of Area D; Possible within Study Area	2, 4
Red Fox	*Vulpes vulpes*			S5	HC	Possible within Study Area	2, 4
Raccoon	*Procyon lotor*			S5	HC	Possible within Study Area	4
Mink	*Mustela vison*			S5	HC	Marginal habitat present within Study Area	4
Striped Skunk	*Mephitis mephitis*			S5	HC	Possible within Study Area	2, 4
White-tailed Deer	*Odocoileus virginianus*			S5	HC	Habitat Not Present	4
PLANTS							

Common Name	Latin Name	COSEWIC (a)	COSSARO (b)	S-Rank (c)	Halton NAI (d)	Assessment of Presence in Study Area	Sources (e)
Blunt Spike-rush	*Eleocharis obtusa*			S5	HU	Not Present	1, 2
Christmas Fern	*Polystichum acrostichoides*			S5	HC	Not Present	1, 2
Eastern Manna Grass	*Glyceria septentrionalis*			S4	HU	Not Present	1, 2
Hop Sedge	*Carex lupulina*			S5	HC	Not Present	1, 2
Jack-in-the-pulpit	*Arisaema triphyllum*			S5	HC	Not Present	1, 2
Northeastern Lady Fern	*Athyrium filix-femina* var. *angustum*			S5	HC	Not Present	1, 2
REPTILES							
Snapping Turtle	*Chelydra serpentina*	SC	SC	S3	HC	Possible in Ponds and Watercouses in Area A and within the Study Area of Area D	2, 6
Midland Painted Turtle	*Chrysemys picta marginata*			S5	HC	Present in Area A; Possible within the Study Area of Area D	1, 2, 6
Common Map Turtle	*Graptemys geographica*	SC	SC	S3	HR	Habitat Not Present	6
Red-eared Slider	*Trachemys scripta elegans*			SE	EXCLUDED	Present in Area A; Possible within the Study Area of Area D	1, 6
Five-lined Skink	*Plestiodon fasciatus* pop. 2	SC	SC	S3	EXCLUDED	Habitat Not Present, Study Area outside of species' range	6
Ringneck Snake	*Diadophis punctatus*			S4	HR	Habitat Not Present	6
Eastern Hognose Snake	*Heterodon platyrhinos*	THR	THR	S3	EXCLUDED	Habitat Not Present, Study Area outside of species' range	6
Milk Snake	*Lampropeltis triangulum triangulum*			S4	HC	Possible within Study Area	6
Northern Water Snake	*Nerodia sipedon sipedon*			S5	HU	Habitat Not Present	6
Brown Snake	*Storeria dekayi dekayi*			S5	HC	Possible within Study Area	6
Redbelly Snake	*Storeria o. occipitomaculata*			S5	HC	Possible within Study Area	6
Eastern Garter Snake	*Thamnophis sirtalis sirtalis*			S5	HC	Possible within Study Area	2, 6
Smooth Green Snake	*Opheodrys vernalis vernalis*			S4	HR	Habitat Not Present	6

LEGEND

a Species at Risk in Canada as designated by COSEWIC (Committee on the Status of Endangered Wildlife in Canada)
Staus on shown if: 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)
Staus on shown if: 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)
SE (exotic, i.e. non-native), SU (unrankable)

c Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide (Appendix G).

d Halton Natural Areas Inventory (NAI) 2006: Volume 2 Species Checklists (ISBN 0-9732488-7-4)
HR Halton Rare
HU Halton Uncommon
HC Halton Common
H? status unknown
HE Extirpated from Halton

e Sources
1 - Beacon Environmental Ltd. field studies 2018 and/or 2019
2 - Conservation Halton Natural Heritage Background Data - received March 2020.
3 - Atlas of the Breeding Birds of Ontario - Square 17NJ90 (2007)
4 - Atlas of the Mammals of Ontario (1994)
5 - Ontario Butterfly Atlas - Square 17NJ90
6 - Ontario Nature Reptile and Amphibian Atlas - Square 17NJ90

Appendix D

Photographic Record of Rapid Assessment of Appleby Creek



Photograph 1.
Concrete weir west of Upper Middle Rd.



Photograph 2.
View of Mill Pond.



Photograph 3.
Aquatic vegetation in Mill Pond.



Photograph 4.
Mouth of downstream channel.



Photograph 5. WP 005.
Exposed plastic geocell in channel.



Photograph 6.
Debris jam in channel.



Photograph 7.
Cobble substrate.



Photograph 8.
Downstream view of channel.



Photograph 9. WP 008.
Riffle sequence.



Photograph 10.
Exposed plastic geocell.



Photograph 11.
Aquatic vegetation in channel.



Photograph 12.
Downstream view of channel.



Photograph 13.
Pedestrian crossing.



Photograph 14.
Riffle sequence facing upstream.



Photograph 15. WP 14.
Deep pool facing upstream.



Photograph 16. WP 16
Large cobble on bank facing downstream.



Photograph 17.
Storm sewer outlet at Millcroft Park drive culvert.



Photograph 18.
Twin culverts under Millcroft Park drive.



Photograph 19. WP 20.
Debris jam in channel west of Millcroft Park drive.



Photograph 20.
View of upstream pond.



Photograph 21.
Concrete crossing below upstream pond.



Photograph 22.
Downstream view of channel below upstream pond.

Appendix E

Field Data Forms

BEACON ENVIRONMENTAL

Geomorphology Group
Reach Characteristics

Date: Aug 24, 2018 **Project:** 216081.1

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-1

Land Use	☐ Forest	☐ Agricultural	☐ Residential	☐ Reach Break	
	☐ Pasture/Meadow	☑ Industrial/Commercial	☐ Other:		
Valley/Stream Type	☐ Unconfined	☑ Confined	☐ Partially Confined: _____		
	☑ Perennial	☐ Intermittent	☐ Ephemeral	☐ Reach Break	
Riparian Vegetation	Vegetation Type: ☐ Trees	☑ Shrubs	☑ Grasses	☐ Reach Break	
	☑ Herbaceous	Dominant Type: _____			
	Buffer Zone: ☐ None	☑ Fragmented	☐ Continuous		
	☐ <1 Channel Width	☑ 1-5 Channel Widths	☐ >5 Channel Widths		
	Age Class: ☑ Immature (<5 y.)	☐ Established (5-30 y.)	☐ Mature (>30 y.)		

Channel Characteristics

Planform	Sinuosity: ☐ Low	☑ Moderate	☐ High	☐ Reach Break	
	Gradient: ☑ Low	☐ Moderate	☐ High		
	Entrenchment: ☑ Low	☐ Moderate	☐ High		
	Riffle-Pool Spacing: _____	Meander Amplitude: _____			
Bank	Angle: ☑ 0° - 30°	☑ 30° - 60°	☐ 60° - 90°	Undercut: N/A	
	Erosion: ☑ <5%	☐ 5 – 30%	☐ 30 – 60%	☐ 60 – 100%	
	Failure: ☑ None	☐ Slump	☐ Planar	☐ Mass	
	Material: ☑ Clay/silt	☐ Sand	☐ Gravel	☐ Cobble	
	☐ Boulder	☐ Other: _____			
Channel	Riffle Substrate ☑ Clay/silt	☑ Sand	☑ Gravel	☑ Cobble	
	☐ Boulder	☐ Other: _____	Riffle Embeddedness: _____%		
	Pool Substrate ☑ Clay/silt	☑ Sand	☑ Gravel	☐ Cobble	
	☐ Boulder	☐ Other: _____			

	Riffles					Pools			
Bankfull Width (m)	4.1	4.6	4.3		7.0 (→ Scour Pool)		4.8		6.1
Bankfull Depth (m)	0.55	0.50	0.45		0.65		0.60		0.50
Wetted Width (m)	1.6	1.6	1.5				2.1		2.2
Wetted Depth (m)	0.15	0.14	0.10				0.38		0.25

Aquatic / Instream	Vegetation: ☑ Emergent	☐ Submergent	☐ Floating	Portion (%): 10	
	Woody Debris: ☑ Not Present	☐ Present in Cutbank	☐ Present in Channel	Density: Low/Mod/High	
Turbidity	☑ Clear	☐ Slight	☐ Moderate	☐ High	

Recorded by: AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Geomorphic Assessment (RGA)

Date: Aug 24, 2018 **Project:** 216081.1 **Reach:** AC-1

PROCESS	GEOMORPHIC INDICATOR	PRESENT		SCORE
		No	Yes	
Aggradation	1. Lobate bar formation	✓		
	2. Coarse materials in riffles embedded	✓		
	3. Siltation in pools		✓	
	4. Medial / lateral bar formation	✓		
	5. Accretion on point bars	✓		
	6. Poor longitudinal sorting of bed materials	✓		
	7. Deposition in the overbank zone	✓		
	Sum of Indices	6	1	0.14
Degradation	1. Exposed bridge/culvert footing(s)	✓		
	2. Exposed sanitary/storm sewer/pipeline	✓		
	3. Elevated stormwater outfall(s)	✓		
	4. Undermined gabion baskets/concrete aprons/crib walls	✓		
	5. Scour pool formation downstream of culvert/storm outfall		✓	
	6. Cut face on bar formations	✓		
	7. Head cutting due to knickpoint migration	✓		
	8. Terrace cut through older bar material	✓		
	9. Suspended armour layer visible in bank	✓		
	10. Channel worn into undisturbed overburden/bedrock	✓		
	Sum of Indices	9	1	0.10
Widening	1. Fallen/leaning trees/fence posts	✓		
	2. Occurrence of large organic debris	✓		
	3. Exposed tree roots	✓		
	4. Basal scour on inside meander bends		✓	
	5. Basal scour on both sides of channel through riffle		✓	
	6. Length of basal scour >50% through reach	✓		
	7. Gabion baskets/armourstone walls/etc. outflanked	✓		
	8. Exposed length of previously buried pipe	✓		
	9. Fracture lines along top of bank/slumping banks		✓	
	10. Exposed building foundation	✓		
	Sum of Indices	7	3	0.30
Planimetric Form Adjustment	1. Formation of chute(s)		✓	
	2. Single thread to multiple channel	✓		
	3. Evolution of pool-riffle form to low-bed relief form	✓		
	4. Cut-off channel(s)	✓		
	5. Formation of island(s)	✓		
	6. Thalweg alignment out of phase with meander form		✓	
	7. Bar forms poorly formed/reworked/removed	✓		
	Sum of Indices	5	2	0.29
Stability Index (SI)				0.21

Source: Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario, Ontario, Canada.

Classification:

☐ **In Regime** (≤ 0.20) ☑ **In Transition/Stressed** (0.21 – 0.40) ☐ **In Adjustment** (≥0.41)

Recorded by: AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Stream Assessment Technique (RSAT)

Date: Aug 24/18 **Project:** 216081.1

Weather: sun 23°C **Watercourse:** Appleby Ck

Location: Millcroft **Reach:** AC-1

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• <50% of bank network stable. • Recent bank sloughing, slumping or failure frequently observed.	• 50–70% of bank network stable. • Recent signs of bank sloughing, slumping or failure fairly common.	• 71–80% of bank network stable. • Infrequent signs of bank sloughing, slumping or failure.	• >80% of bank network stable. • No evidence of bank sloughing, slumping or failure.
	• Stream bend areas highly unstable. • Outer bank height 1.2 m above stream (2.1 m above stream for large mainstem areas). • Overhang >0.8–1.0 m.	• Stream bend areas unstable. • Outer bank height 0.9–1.2 m above stream (1.5–2.1 m above stream for large mainstem areas). • Bank overhang 0.8–0.9 m.	• Stream bend areas stable. • Outer bank height 0.6–0.9 m above stream bank (1.2–1.5 m above stream bank for large mainstem areas). • Overhang 0.6–0.8 m.	• Stream bend areas very stable. • Height <0.6 m above stream (<1.2 m above stream for large mainstem areas). • Bank overhang <0.6 m.
	• Young exposed tree roots abundant. • >6 recent large tree falls per stream mile.	• Young exposed tree roots common. • 4–5 recent (large) tree falls per stream mile.	• Exposed tree roots predominately old and large, smaller young roots scarce. • 2–3 recent (large) tree falls per stream mile.	• Exposed tree roots old, large and woody. • Generally 0–1 recent (large) tree falls per stream mile.
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised.	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.
	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point Range	0 1 2	3 4 5	6 7 8	9 10 11

Evaluation Category	Poor	Fair	Good	Excellent
Channel Scouring / Sediment Deposition	• >75% embedded (>85% embedded for large mainstem areas).	• 50–75% embedded (60–85% embedded for large mainstem areas).	• 25–49% embedded (35-59% embedded for large mainstem areas).	• Riffle embeddness <25% sand-silt (<35% for large mainstem areas).
	• Few, if any, deep pools. • Pool substrate >81% sand-silt.	• Low to moderate number of deep pools. • Pool substrate 60–80% sand-silt.	• Moderate number of deep pools. • Pool substrate 30–59% sand-silt.	• High number of deep pools >61 cm (>122 cm for large mainstem areas). • Pool substrate <30% composed of sand-silt.
	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits uncommon.	• Streambed streak marks and/or banana-shaped sediment deposits absent.
	• Fresh, large sand deposits very common in channel. • Moderate to heavy sand deposition along major portion of overbank area very common.	• Fresh, large sand deposits in channel common. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel uncommon. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel rare or absent. • No evidence of fresh sediment deposition on overbank.
	• Point bars moderate to large and unstable with high amount of fresh sand present at most stream bends.	• Point bars moderate to large and unstable with high amount of fresh sand common.	• Point bars small and stable, well vegetated and/or armoured with little or no fresh sand.	• Point bars few, small and stable, well vegetated and/or armoured with little or no fresh sand.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter <40% of bottom width (<45% for large mainstem areas).	• Wetted perimeter 40–60% of bottom width (45–65% for large mainstem areas).	• Wetted perimeter 61–85% of bottom width (66–90% for large mainstem areas).	• Wetted perimeter >85% of bottom channel width (>90% for large mainstem areas).
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low).	• Few pools present; riffles and runs dominant; velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate).	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow.	• Riffles, runs and pool habitat present. • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water).
	• Riffle substrate composition predominately gravel with high percentage of sand. • <5% cobble.	• Riffle substrate composition predominately small cobble, gravel and sand. • 5–24% cobble.	• Riffle substrate composition has good mix of gravel, cobble and rubble material. • 25-49% cobble.	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand. • >50% cobble.
	• Riffle depth <10 cm for large mainstem area.	• Riffle depth 10–15 cm for large mainstem area.	• Riffle depth 15–20 cm for large mainstem areas.	• Riffle depth >8% for large 20 cm mainstem areas.
	• Large pools generally <30 cm deep (<61 cm for large mainstem areas) and devoid of cover/structure.	• Large pools generally 30–46 cm deep (61–91 cm for large mainstem areas) with little or no cover/structure.	• Large pools generally 46–61 cm deep (91–122 cm for large mainstem areas) with some cover/structure.	• Large pools generally >61 cm deep (>122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration or point bar formation/enlargement.	• Moderate increase in point bar and/or in amount of channel modification.	• Slight increase in point bar formation/enlargement or slight amount of channel modification.	• No channel alteration or significant point bar formation or enlargement.
	• Riffle/pool ratio: 0.49:1<; >1.51:1	• Riffle/pool ratio: 0.5–0.69:1; 1.31-1.5:1.	• Riffle/pool ratio: 0.9–0.89:1; 1.11–1.3:1.	• Riffle/pool ratio: 0.9–1.1:1.
	• Summer afternoon H_20 temp >80°F.	• Summer afternoon H_20 temp 75–80°F.	• Summer afternoon H_20 temp 68–75°F.	• Summer afternoon H_20 temp <68°F.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Water Quality	• Substrate fouling level: High (>50%).	• Substrate fouling level: Moderate (21–50%).	• Substrate fouling level: Very Light (11–20%).	• Substrate fouling level: 0–10% (rock underside).
	• TDS: >150 mg/L; Brown.	• TDS: 101–150 mg/L; Grey.	• TDS: 50–100 mg/L; Slightly Grey.	• TDS: <50 mg/L; Clear Flow.
	• Objects visible to depth <0.15 m below surface.	• Objects visible to depth 0.15–0.5 m below surface.	• Objects visible to depth 0.5–1 m below surface.	• Clear water – objects visible to depth >1 m below surface.
	• Moderate to strong organic odour.	• Slight to moderate odour.	• Slight organic odour.	• No odour.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Riparian Habitat Conditions	• Riparian area mostly non-woody vegetation. • Narrow riparian area.	• Riparian area predominantly wooded but with major localized gaps.	• Forested buffer generally >31 m wide along major portion of both banks.	• Wide (>60 m) mature forested buffer along both banks.
	• Canopy coverage: <50% shading (30% for large mainstem areas).	• Canopy coverage: 50–60% shading (30–44% for large mainstem areas).	• Canopy coverage: 60–79% shading (45–59% for large mainstem areas).	• Canopy coverage: >80% shading (>60% for large mainstem areas).
Point Range	0 1	2 3	4 5	6 7

Source: Galli, J. 1996. Rapid stream assessment technique, field methods. Metropolitan Washington Council of Governments. 36pp.

Total Overall Score (0–42): 17.5

Ranking: ☐ Poor (<13) ☒ Fair (13–24) ☐ Good (25–34) ☐ Excellent (35–42)

Recorded by AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Photos & Notes

Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-1

Photo / WP #	Notes	Photo / WP #	Notes
933	d/s view from upper Middle Rd crossing		
934	u/s view of Upper Middle Rd culvert		
935	d/s view of creek from channel bank below culvert		
936 1926	u/s view of pool, representative		
937 1926	d/s view of representative riffle		
938	u/s view from Ironstone st. Culvert top of		
939	d/s view of Ironstone st. culvert		D/S of Railline
940	u/s view of channel at Ironstone st culvert		

Additional Notes: - reach subject to channel design

- large scour pool d/s upper Middle.

Recorded by: AC

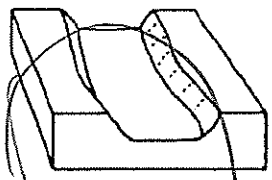
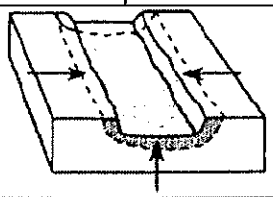
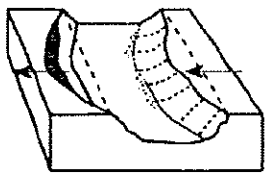
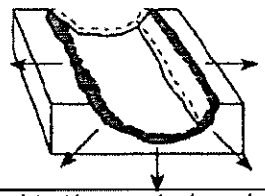
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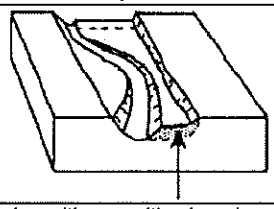
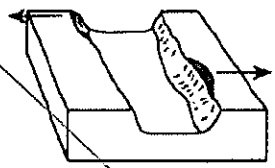
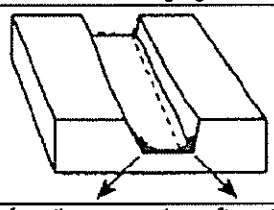
Geomorphology Group
Down's (1995) Model

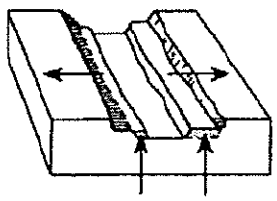
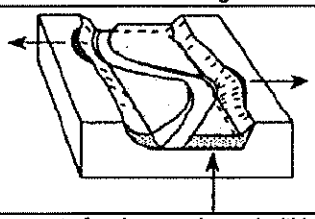
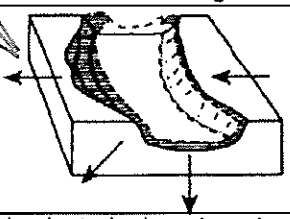
Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-1

S – 'stable'	D – 'depositional'	M – 'lateral migration'	E – 'enlarging'
			
No observable morphological adjustment in process ☐ no bank slumping/failure/undercutting ☐ old tree roots exposed ☐ no tree falls ☐ no alluvial terrace	***Consistent** decrease in channel width and/or depth* ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness) ☐ sediment deposited along banks ☒ no bank erosion ☐ no alluvial terrace	*Migration of **most** bends; cross-sectional dimensions preserved* ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting) ☐ deposition along **inner bank** (i.e. point bar development) ☐ no alluvial terrace	*Consistent increase in channel width and/or depth* ☐ erosion along **both** banks (e.g. slumping, young tree roots exposed, tree falls) ☐ no bar formation, scoured bed, low embeddedness ☐ no alluvial terrace

d – 'depositional'	m – 'lateral migration'	e – 'enlarging'
		
Selective deposition resulting in reduced channel width ☐ low-flow channel between outer banks/valley walls ☐ alluvial terrace/valley wall ☐ valley wall contacts at **few, if any** meander bends	*Initiation of alternating bank erosion in straightened channels or migration of only sharpest bends* ☐ generally straight ☐ stable except at sharp bends ☐ sharp bends with outside bank erosion, point-bar/cut bank development and undercutting ☐ no alluvial terrace	*Initiation of continuous erosion, **often** at channel toe* ☐ channel downcutting (e.g. bed scour, low embeddedness) ☐ steep, high banks above bankfull level ☐ no alluvial terrace

C – 'compound'	R – 'recovering'	U – 'undercutting'
		
Aggradation of channel bed with erosion of channel banks ☐ bank erosion (slumping, exposed tree roots) ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness) ☐ alluvial terrace with erosion	*Development of a sinuous channel within straightened channel, including erosion of alternating valley walls* ☐ straight alluvial terrace/valley wall ☐ valley wall contact and erosion at **majority** of meander bends	*Active bed and outer bank erosion; migration of bend; coarse inner bank deposits* ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting) ☐ deposition along **inner bank** (i.e. point bar development) ☐ scoured bed, low embeddedness, no bar formation ☐ no alluvial terrace

Source: Downs, P.W. 1995. Estimating the probability of river channel adjustment. *Earth Surface Processes and Landforms*. **20**: 687-705.

Recorded by: AG

BEACON ENVIRONMENTAL

Geomorphology Group
Reach Characteristics

Date: Aug 24, 2018 **Project:** 216081
Weather: Sunny 23°C **Watercourse:** Appleby Creek
Location: Millcroft GC Burlington **Reach:** AC-2

Land Use		☐ Forest	☐ Agricultural	☑ Residential	☐ Reach Break
		☐ Pasture/Meadow	☐ Industrial/Commercial	☑ Other: Golf Course	
Valley/Stream Type		☐ Unconfined	☐ Confined	☑ Partially Confined:	
		☑ Perennial	☐ Intermittent	☐ Ephemeral	☐ Reach Break
Riparian Vegetation	Vegetation Type:	☑ Trees	☑ Shrubs	☑ Grasses	☐ Reach Break
		☑ Herbaceous	Dominant Type: Herbs, manicured grass		
	Buffer Zone:	☐ None	☑ Fragmented	☐ Continuous	
		☑ <1 Channel Width	☐ 1-5 Channel Widths	☐ >5 Channel Widths	
	Age Class:	☑ Immature (<5 y.)	☐ Established (5-30 y.)	☐ Mature (>30 y.)	

Channel Characteristics

Planform	Sinuosity:	☑ Low	☐ Moderate	☐ High	☐ Reach Break
	Gradient:	☑ Low	☑ Moderate	☐ High	
	Entrenchment:	☑ Low	☐ Moderate	☐ High	
	Riffle-Pool Spacing:		Meander Amplitude:		
Bank	Angle:	☑ 0° - 30°	☐ 30° - 60°	☐ 60° - 90°	Undercut: N/A
	Erosion:	☐ <5%	☑ 5 – 30%	☐ 30 – 60%	☐ 60 – 100%
	Failure:	☑ None	☐ Slump	☐ Planar	☐ Mass
	Material:	☑ Clay/silt	☑ Sand	☐ Gravel	☐ Cobble
		☐ Boulder	☑ Other: Shale till		
Channel	Riffle Substrate	☐ Clay/silt	☑ Sand Coarse	☑ Gravel	☑ Cobble
		☐ Boulder	☐ Other:	Riffle Embeddedness:	%
	Pool Substrate	☑ Clay/silt	☑ Sand Coarse	☑ Gravel	☐ Cobble
		☐ Boulder	☐ Other:		

	Riffles					Pools				
Bankfull Width (m)	5.25	4.0	6.6			5.25	5.5			
Bankfull Depth (m)	0.4	0.45	0.5			0.5	0.65			
Wetted Width (m)	1.7	1.8	1.8			1.75	2.9			
Wetted Depth (m)	0.11	0.15	0.1			0.2	0.25			

Aquatic / Instream	Vegetation:	☑ Emergent	☑ Submergent	☐ Floating	Portion (%): 10%
	Woody Debris:	☑ Not Present	☐ Present in Cutbank	☐ Present in Channel	Density: Low/Mod/High
Turbidity		☑ Clear	☐ Slight	☐ Moderate	☐ High

Recorded by: AG / SG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Geomorphic Assessment (RGA)

Date: Aug 24, 2018 **Project:** 216081 **Reach:** AC-2

PROCESS	GEOMORPHIC INDICATOR	PRESENT No	PRESENT Yes	SCORE
Aggradation	1. Lobate bar formation		✓	2/7
	2. Coarse materials in riffles embedded	✓		
	3. Siltation in pools	✓		
	4. Medial / lateral bar formation		✓	
	5. Accretion on point bars	✓		
	6. Poor longitudinal sorting of bed materials	✓		
	7. Deposition in the overbank zone	✓		
	Sum of Indices	5	2	
Degradation	1. Exposed bridge/culvert footing(s)	✓		1/10
	2. Exposed sanitary/storm sewer/pipeline	✓		
	3. Elevated stormwater outfall(s)	✓		
	4. Undermined gabion baskets/concrete aprons/crib walls	✓		
	5. Scour pool formation downstream of culvert/storm outfall	✓		
	6. Cut face on bar formations	✓		
	7. Head cutting due to knickpoint migration	✓		
	8. Terrace cut through older bar material	✓		
	9. Suspended armour layer visible in bank	✓		
	10. Channel worn into undisturbed overburden/bedrock		✓	
	Sum of Indices	9	1	
Widening	1. Fallen/leaning trees/fence posts	✓		1/10
	2. Occurrence of large organic debris	✓		
	3. Exposed tree roots	✓		
	4. Basal scour on inside meander bends	✓		
	5. Basal scour on both sides of channel through riffle	✓		
	6. Length of basal scour >50% through reach	✓		
	7. Gabion baskets/armourstone walls/etc. outflanked	✓		
	8. Exposed length of previously buried pipe	✓		
	9. Fracture lines along top of bank/slumping banks		✓	
	10. Exposed building foundation	✓		
	Sum of Indices	9	1	
Planimetric Form Adjustment	1. Formation of chute(s)		✓	2/7
	2. Single thread to multiple channel	✓		
	3. Evolution of pool-riffle form to low-bed relief form	✓		
	4. Cut-off channel(s)	✓		
	5. Formation of island(s)	✓		
	6. Thalweg alignment out of phase with meander form		✓	
	7. Bar forms poorly formed/reworked/removed	✓		
	Sum of Indices	5	2	
Stability Index (SI)				0.193

Source: Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario, Ontario, Canada.

Classification:

☑ **In Regime** (≤ 0.20) ☐ **In Transition/Stressed** (0.21 – 0.40) ☐ **In Adjustment** (≥0.41)

Recorded by: AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Stream Assessment Technique (RSAT)

Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-7

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• <50% of bank network stable. • Recent bank sloughing, slumping or failure frequently observed.	• 50–70% of bank network stable. • Recent signs of bank sloughing, slumping or failure fairly common.	• 71–80% of bank network stable. • Infrequent signs of bank sloughing, slumping or failure.	• >80% of bank network stable. • No evidence of bank sloughing, slumping or failure.
	• Stream bend areas highly unstable. • Outer bank height 1.2 m above stream (2.1 m above stream for large mainstem areas). • Overhang >0.8–1.0 m.	• Stream bend areas unstable. • Outer bank height 0.9–1.2 m above stream (1.5–2.1 m above stream for large mainstem areas). • Bank overhang 0.8–0.9 m.	• Stream bend areas stable. • Outer bank height 0.6–0.9 m above stream bank (1.2–1.5 m above stream bank for large mainstem areas). • Overhang 0.6–0.8 m.	• Stream bend areas very stable. • Height <0.6 m above stream (<1.2 m above stream for large mainstem areas). • Bank overhang <0.6 m.
	• Young exposed tree roots abundant. • >6 recent large tree falls per stream mile.	• Young exposed tree roots common. • 4–5 recent (large) tree falls per stream mile.	• Exposed tree roots predominately old and large, smaller young roots scarce. • 2–3 recent (large) tree falls per stream mile.	• Exposed tree roots old, large and woody. • Generally 0–1 recent (large) tree falls per stream mile.
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised.	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.
	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point Range	0 1 2	3 4 5	6 (7) 8	9 10 11

Evaluation Category	Poor	Fair	Good	Excellent
Channel Scouring / Sediment Deposition	• >75% embedded (>85% embedded for large mainstem areas).	• 50–75% embedded (60–85% embedded for large mainstem areas).	• 25–49% embedded (35-59% embedded for large mainstem areas).	• Riffle embeddness <25% sand-silt (<35% for large mainstem areas).
	• Few, if any, deep pools. • Pool substrate >81% sand-silt.	• Low to moderate number of deep pools. • Pool substrate 60–80% sand-silt.	• Moderate number of deep pools. • Pool substrate 30–59% sand-silt.	• High number of deep pools >61 cm (>122 cm for large mainstem areas). • Pool substrate <30% composed of sand-silt.
	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits uncommon.	• Streambed streak marks and/or banana-shaped sediment deposits absent.
	• Fresh, large sand deposits very common in channel. • Moderate to heavy sand deposition along major portion of overbank area very common.	• Fresh, large sand deposits in channel common. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel uncommon. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel rare or absent. • No evidence of fresh sediment deposition on overbank.
	• Point bars moderate to large and unstable with high amount of fresh sand present at most stream bends.	• Point bars moderate to large and unstable with high amount of fresh sand common.	• Point bars small and stable, well vegetated and/or armoured with little or no fresh sand.	• Point bars few, small and stable, well vegetated and/or armoured with little or no fresh sand.
Point Range	0 1 2	3 4	(5) 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter <40% of bottom width (<45% for large mainstem areas).	• Wetted perimeter 40–60% of bottom width (45–65% for large mainstem areas).	• Wetted perimeter 61–85% of bottom width (66–90% for large mainstem areas).	• Wetted perimeter >85% of bottom channel width (>90% for large mainstem areas).
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low).	• Few pools present; riffles and runs dominant; velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate).	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow.	• Riffles, runs and pool habitat present. • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water).
	• Riffle substrate composition predominately gravel with high percentage of sand. • <5% cobble.	• Riffle substrate composition predominately small cobble, gravel and sand. • 5–24% cobble.	• Riffle substrate composition has good mix of gravel, cobble and rubble material. • 25-49% cobble.	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand. • >50% cobble.
	• Riffle depth <10 cm for large mainstem area.	• Riffle depth 10–15 cm for large mainstem area.	• Riffle depth 15–20 cm for large mainstem areas.	• Riffle depth >8% for large 20 cm mainstem areas.
	• Large pools generally <30 cm deep (<61 cm for large mainstem areas) and devoid of cover/structure.	• Large pools generally 30–46 cm deep (61–91 cm for large mainstem areas) with little or no cover/structure.	• Large pools generally 46–61 cm deep (91–122 cm for large mainstem areas) with some cover/structure.	• Large pools generally >61 cm deep (>122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration or point bar formation/enlargement.	• Moderate increase in point bar and/or in amount of channel modification.	• Slight increase in point bar formation/enlargement or slight amount of channel modification.	• No channel alteration or significant point bar formation or enlargement.
	• Riffle/pool ratio: 0.49:1<; >1.51:1	• Riffle/pool ratio: 0.5–0.69:1; 1.31-1.5:1.	• Riffle/pool ratio: 0.9–0.89:1; 1.11–1.3:1.	• Riffle/pool ratio: 0.9–1.1:1.
	• Summer afternoon H_20 temp >80°F.	• Summer afternoon H_20 temp 75–80°F.	• Summer afternoon H_20 temp 68–75°F.	• Summer afternoon H_20 temp <68°F.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Water Quality	• Substrate fouling level: High (>50%).	• Substrate fouling level: Moderate (21–50%).	• Substrate fouling level: Very Light (11–20%).	• Substrate fouling level: 0–10% (rock underside).
	• TDS: >150 mg/L; Brown.	• TDS: 101–150 mg/L; Grey.	• TDS: 50–100 mg/L; Slightly Grey.	• TDS: <50 mg/L; Clear Flow.
	• Objects visible to depth <0.15 m below surface.	• Objects visible to depth 0.15–0.5 m below surface.	• Objects visible to depth 0.5–1 m below surface.	• Clear water – objects visible to depth >1 m below surface.
	• Moderate to strong organic odour.	• Slight to moderate odour.	• Slight organic odour.	• No odour.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Riparian Habitat Conditions	• Riparian area mostly non-woody vegetation. • Narrow riparian area.	• Riparian area predominantly wooded but with major localized gaps.	• Forested buffer generally >31 m wide along major portion of both banks.	• Wide (>60 m) mature forested buffer along both banks.
	• Canopy coverage: <50% shading (30% for large mainstem areas).	• Canopy coverage: 50–60% shading (30–44% for large mainstem areas).	• Canopy coverage: 60–79% shading (45–59% for large mainstem areas).	• Canopy coverage: >80% shading (>60% for large mainstem areas).
Point Range	0 1	2 3	4 5	6 7

Source: Galli, J. 1996. Rapid stream assessment technique, field methods. Metropolitan Washington Council of Governments. 36pp.

Total Overall Score (0–42): 21.5

Ranking: ☐ Poor (<13) ☑ Fair (13–24) ☐ Good (25–34) ☐ Excellent (35–42)

Recorded by AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Photos & Notes

Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny, 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-2

Photo / WP #	Notes	Photo / WP #	Notes
881	Of weir looking from u/s of Upper Middle Rd	896 1906	d/s view of exposed geocell on channel bed
882	u/s view of Pond	897 1906	u/s view of bar developed on geocell
883	d/s view of pond and twin culvert	898 1907	d/s view of geogrid exposure. Gravel accumulation in cells
884	close up of twin culvert, looking d/s	899 1908	d/s view of bar with chute formation
885	d/s view of pond from bottom of reach	900 1908	u/s view of pool formation
886-7	u/s view of geocell exposed on bed and secondary channel formation	901 1909	u/s view of riffle w/ lateral bar
888	d/s of bank scour in secondary channel		
889	Close up of bank materials w/ exposed shale and till		
1900	Head of secondary channel		
890 1901	d/s view of secondary channel initiation on left of photo		
891 1902	u/s view of geogrid. Potential channel migration towards Right bank		
892 1903	u/s of riffle with geocell		
893 1904	u/s of general conditions		
894	Potential fish spawning redds		
895 1905	u/s view of collapsed pedestrian foot bridge		

Additional Notes:

- reach subject to channel design
  - ↳ terrafix + terraweb lined along majority of reach
- morphology influenced by d/s online pond

Recorded by: AG

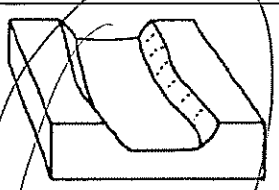
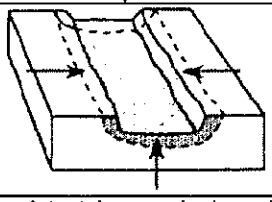
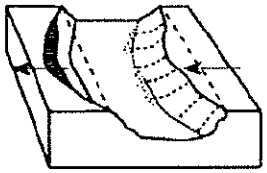
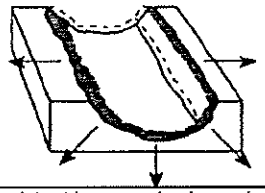
BEACON ENVIRONMENTAL

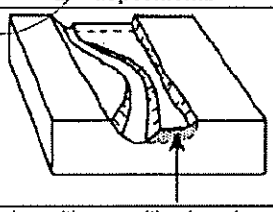
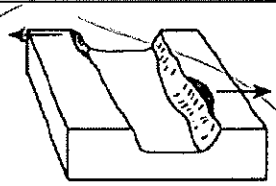
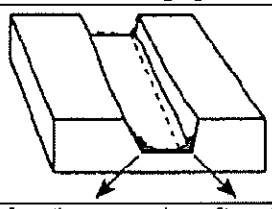
Geomorphology Group
Down's (1995) Model

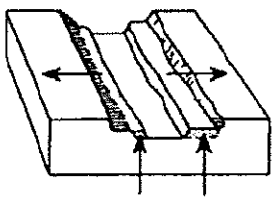
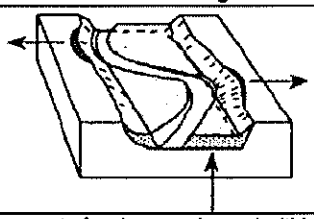
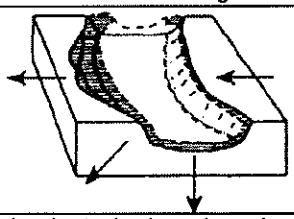
Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft & Burlington **Reach:** AC-2

S – 'stable'	D – 'depositional'	M – 'lateral migration'	E – 'enlarging'
			
No observable morphological adjustment in process ☐ no bank slumping/failure/undercutting ☐ old tree roots exposed ☐ no tree falls ☐ no alluvial terrace	***Consistent** decrease in channel width and/or depth* ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness) ☐ sediment deposited along banks ☐ no bank erosion ☐ no alluvial terrace	*Migration of **most** bends; cross-sectional dimensions preserved* ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting) ☐ deposition along **inner bank** (i.e. point bar development) ☐ no alluvial terrace	*Consistent increase in channel width and/or depth* ☐ erosion along **both** banks (e.g. slumping, young tree roots exposed, tree falls) ☐ no bar formation, scoured bed, low embeddedness ☐ no alluvial terrace

d – 'depositional'	m – 'lateral migration'	e – 'enlarging'
		
Selective deposition resulting in reduced channel width ☐ low-flow channel between outer banks/valley walls ☐ alluvial terrace/valley wall ☐ valley wall contacts at **few, if any** meander bends	*Initiation of alternating bank erosion in straightened channels or migration of only sharpest bends* ☐ generally straight ☐ stable except at sharp bends ☐ sharp bends with outside bank erosion, point-bar/cut bank development and undercutting ☐ no alluvial terrace	*Initiation of continuous erosion, **often** at channel toe* ☐ channel downcutting (e.g. bed scour, low embeddedness) ☐ steep, high banks above bankfull level ☐ no alluvial terrace

C – 'compound'	R – 'recovering'	U – 'undercutting'
		
Aggradation of channel bed with erosion of channel banks ☐ bank erosion (slumping, exposed tree roots) ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness) ☐ alluvial terrace with erosion	*Development of a sinuous channel within straightened channel, including erosion of alternating valley walls* ☐ straight alluvial terrace/valley wall ☐ valley wall contact and erosion at **majority** of meander bends	*Active bed and outer bank erosion; migration of bend; coarse inner bank deposits* ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting) ☐ deposition along **inner bank** (i.e. point bar development) ☐ scoured bed, low embeddedness, no bar formation ☐ no alluvial terrace

Source: Downs, P.W. 1995. Estimating the probability of river channel adjustment. *Earth Surface Processes and Landforms*. **20**: 687-705.

Recorded by: AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Reach Characteristics

Date: Aug 24, 2018 **Project:** 216081
Weather: Sunny 23°C **Watercourse:** Appleby Creek
Location: Millcroft GC Burlington **Reach:** AC-3

Land Use	☐ Forest	☐ Agricultural	☑ Residential	☐ Reach Break	
	☐ Pasture/Meadow	☐ Industrial/Commercial	☑ Other: Golf course		
Valley/Stream Type	☐ Unconfined	☑ Confined	☐ Partially Confined: _____		
	☑ Perennial	☐ Intermittent	☐ Ephemeral	☐ Reach Break	
Riparian Vegetation	Vegetation Type: ☑ Trees	☑ Shrubs	☐ Grasses	☐ Reach Break	
	☑ Herbaceous	Dominant Type: Willows + Herbs			
	Buffer Zone: ☐ None	☑ Fragmented	☐ Continuous		
	☑ <1 Channel Width	☐ 1-5 Channel Widths	☐ >5 Channel Widths		
	Age Class: ☑ Immature (<5 y.)	☐ Established (5-30 y.)	☐ Mature (>30 y.)		
Channel Characteristics – Planform	Sinuosity: ☑ Low	☐ Moderate	☐ High	☐ Reach Break	
	Gradient: ☑ Low	☐ Moderate	☐ High		
	Entrenchment: ☐ Low	☑ Moderate	☐ High		
	Riffle-Pool Spacing: _____	Meander Amplitude: N/A			
Bank	Angle: ☑ 0° - 30°	☑ 30° - 60°	☐ 60° - 90°	Undercut: 0.15	
	Erosion: ☐ <5%	☐ 5 – 30%	☐ 30 – 60%	☐ 60 – 100%	
	Failure: ☐ None	☑ Slump	☐ Planar	☐ Mass	
	Material: ☑ Clay/silt	☐ Sand	☐ Gravel	☐ Cobble	
	☐ Boulder	☐ Other: _____			
Channel	Riffle Substrate ☑ Clay/silt	☑ Sand Coarse	☑ Gravel	☑ Cobble	
	☐ Boulder	☑ Other: gravel	Riffle Embeddedness: _____ %		
	Pool Substrate ☑ Clay/silt	☑ Sand	☑ Gravel	☐ Cobble	
	☐ Boulder	☑ Other: gravel			

	Riffles					Pools				
Bankfull Width (m)	5.0					3.5	4.0	4.5		
Bankfull Depth (m)	0.45					0.65	0.55	0.55		
Wetted Width (m)	1.4					2.8	2.25	1.75		
Wetted Depth (m)	0.1					0.21	0.25	0.3		

Aquatic / Instream	Vegetation: ☑ Emergent	☐ Submergent	☐ Floating	Portion (%): 10-30	
	Woody Debris: ☑ Not Present	☐ Present in Cutbank	☐ Present in Channel	Density: Low/Mod/High	
Turbidity	☑ Clear	☐ Slight	☐ Moderate	☐ High	

Recorded by: AG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Geomorphic Assessment (RGA)

Date: Aug 24, 2018 **Project:** 216081 **Reach:** AC-3

PROCESS	GEOMORPHIC INDICATOR	PRESENT No	PRESENT Yes	SCORE
Aggradation	1. Lobate bar formation	✓		
	2. Coarse materials in riffles embedded	✓		
	3. Siltation in pools	✓		
	4. Medial / lateral bar formation		✓	2/7
	5. Accretion on point bars	✓		
	6. Poor longitudinal sorting of bed materials	✓		
	7. Deposition in the overbank zone		✓	
	Sum of Indices	5	2	0.29
Degradation	1. Exposed bridge/culvert footing(s)			
	2. Exposed sanitary/storm sewer/pipeline	✓		
	3. Elevated stormwater outfall(s)	✓		
	4. Undermined gabion baskets/concrete aprons/crib walls	✓		
	5. Scour pool formation downstream of culvert/storm outfall		✓	2/10
	6. Cut face on bar formations	✓		
	7. Head cutting due to knickpoint migration	✓		
	8. Terrace cut through older bar material	✓		
	9. Suspended armour layer visible in bank	✓		
	10. Channel worn into undisturbed overburden/bedrock		✓	0.2
	Sum of Indices			
Widening	1. Fallen/leaning trees/fence posts	✓		
	2. Occurrence of large organic debris	✓		
	3. Exposed tree roots	✓		
	4. Basal scour on inside meander bends	✓		
	5. Basal scour on both sides of channel through riffle	✓		0.1
	6. Length of basal scour >50% through reach	✓		
	7. Gabion baskets/armourstone walls/etc. outflanked	✓		
	8. Exposed length of previously buried pipe	✓		
	9. Fracture lines along top of bank/slumping banks		✓	
	10. Exposed building foundation	✓		
	Sum of Indices	9	1	
Planimetric Form Adjustment	1. Formation of chute(s)		✓	
	2. Single thread to multiple channel	✓		
	3. Evolution of pool-riffle form to low-bed relief form	✓		2/7
	4. Cut-off channel(s)	✓		
	5. Formation of island(s)	✓		
	6. Thalweg alignment out of phase with meander form		✓	
	7. Bar forms poorly formed/reworked/removed	✓		
	Sum of Indices	5	2	0.29
Stability Index (SI)				0.22

Source: Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario, Ontario, Canada.

Classification:

☐ **In Regime** (≤ 0.20) ☑ **In Transition/Stressed** (0.21 – 0.40) ☐ **In Adjustment** (≥0.41)

Recorded by: AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Stream Assessment Technique (RSAT)

Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-3

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• <50% of bank network stable. • Recent bank sloughing, slumping or failure frequently observed.	• 50–70% of bank network stable. • Recent signs of bank sloughing, slumping or failure fairly common.	• 71–80% of bank network stable. • Infrequent signs of bank sloughing, slumping or failure.	• >80% of bank network stable. • No evidence of bank sloughing, slumping or failure.
	• Stream bend areas highly unstable. • Outer bank height 1.2 m above stream (2.1 m above stream for large mainstem areas). • Overhang >0.8–1.0 m.	• Stream bend areas unstable. • Outer bank height 0.9–1.2 m above stream (1.5–2.1 m above stream for large mainstem areas). • Bank overhang 0.8–0.9 m.	• Stream bend areas stable. • Outer bank height 0.6–0.9 m above stream bank (1.2–1.5 m above stream bank for large mainstem areas). • Overhang 0.6–0.8 m.	• Stream bend areas very stable. • Height <0.6 m above stream (<1.2 m above stream for large mainstem areas). • Bank overhang <0.6 m.
	• Young exposed tree roots abundant. • >6 recent large tree falls per stream mile.	• Young exposed tree roots common. • 4–5 recent (large) tree falls per stream mile.	• Exposed tree roots predominately old and large, smaller young roots scarce. • 2–3 recent (large) tree falls per stream mile.	• Exposed tree roots old, large and woody. • Generally 0–1 recent (large) tree falls per stream mile.
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised.	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.
	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point Range	0 1 2	3 4 5	6 7 8	9 10 11

Evaluation Category	Poor	Fair	Good	Excellent
Channel Scouring / Sediment Deposition	• >75% embedded (>85% embedded for large mainstem areas).	• 50–75% embedded (60–85% embedded for large mainstem areas).	• 25–49% embedded (35-59% embedded for large mainstem areas).	• Riffle embeddness <25% sand-silt (<35% for large mainstem areas).
	• Few, if any, deep pools. • Pool substrate >81% sand-silt.	• Low to moderate number of deep pools. • Pool substrate 60–80% sand-silt.	• Moderate number of deep pools. • Pool substrate 30–59% sand-silt.	• High number of deep pools >61 cm (>122 cm for large mainstem areas). • Pool substrate <30% composed of sand-silt.
	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits uncommon.	• Streambed streak marks and/or banana-shaped sediment deposits absent.
	• Fresh, large sand deposits very common in channel. • Moderate to heavy sand deposition along major portion of overbank area very common.	• Fresh, large sand deposits in channel common. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel uncommon. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel rare or absent. • No evidence of fresh sediment deposition on overbank.
	• Point bars moderate to large and unstable with high amount of fresh sand present at most stream bends.	• Point bars moderate to large and unstable with high amount of fresh sand common.	• Point bars small and stable, well vegetated and/or armoured with little or no fresh sand.	• Point bars few, small and stable, well vegetated and/or armoured with little or no fresh sand.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter <40% of bottom width (<45% for large mainstem areas).	• Wetted perimeter 40–60% of bottom width (45–65% for large mainstem areas).	• Wetted perimeter 61–85% of bottom width (66–90% for large mainstem areas).	• Wetted perimeter >85% of bottom channel width (>90% for large mainstem areas).
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low).	• Few pools present; riffles and runs dominant; velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate).	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow.	• Riffles, runs and pool habitat present. • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water).
	• Riffle substrate composition predominately gravel with high percentage of sand. • <5% cobble.	• Riffle substrate composition predominately small cobble, gravel and sand. • 5–24% cobble.	• Riffle substrate composition has good mix of gravel, cobble and rubble material. • 25-49% cobble.	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand. • >50% cobble.
	• Riffle depth <10 cm for large mainstem area.	• Riffle depth 10–15 cm for large mainstem area.	• Riffle depth 15–20 cm for large mainstem areas.	• Riffle depth >8% for large 20 cm mainstem areas.
	• Large pools generally <30 cm deep (<61 cm for large mainstem areas) and devoid of cover/structure.	• Large pools generally 30–46 cm deep (61–91 cm for large mainstem areas) with little or no cover/structure.	• Large pools generally 46–61 cm deep (91–122 cm for large mainstem areas) with some cover/structure.	• Large pools generally >61 cm deep (>122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration or point bar formation/enlargement.	• Moderate increase in point bar and/or in amount of channel modification.	• Slight increase in point bar formation/enlargement or slight amount of channel modification.	• No channel alteration or significant point bar formation or enlargement.
	• Riffle/pool ratio: 0.49:1<; >1.51:1	• Riffle/pool ratio: 0.5–0.69:1; 1.31-1.5:1.	• Riffle/pool ratio: 0.9–0.89:1; 1.11–1.3:1.	• Riffle/pool ratio: 0.9–1.1:1.
	• Summer afternoon H_20 temp >80°F.	• Summer afternoon H_20 temp 75–80°F.	• Summer afternoon H_20 temp 68–75°F.	• Summer afternoon H_20 temp <68°F.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Water Quality	• Substrate fouling level: High (>50%).	• Substrate fouling level: Moderate (21–50%).	• Substrate fouling level: Very Light (11–20%).	• Substrate fouling level: 0–10% (rock underside).
	• TDS: >150 mg/L; Brown.	• TDS: 101–150 mg/L; Grey.	• TDS: 50–100 mg/L; Slightly Grey.	• TDS: <50 mg/L; Clear Flow.
	• Objects visible to depth <0.15 m below surface.	• Objects visible to depth 0.15–0.5 m below surface.	• Objects visible to depth 0.5–1 m below surface.	• Clear water – objects visible to depth >1 m below surface.
	• Moderate to strong organic odour.	• Slight to moderate odour.	• Slight organic odour.	• No odour.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Riparian Habitat Conditions	• Riparian area mostly non-woody vegetation. • Narrow riparian area.	• Riparian area predominantly wooded but with major localized gaps.	• Forested buffer generally >31 m wide along major portion of both banks.	• Wide (>60 m) mature forested buffer along both banks.
	• Canopy coverage: <50% shading (30% for large mainstem areas).	• Canopy coverage: 50–60% shading (30–44% for large mainstem areas).	• Canopy coverage: 60–79% shading (45–59% for large mainstem areas).	• Canopy coverage: >80% shading (>60% for large mainstem areas).
Point Range	0 1	2 3	4 5	6 7

Source: Galli, J. 1996. Rapid stream assessment technique, field methods. Metropolitan Washington Council of Governments. 36pp.

Total Overall Score (0–42): 23.5

Ranking: ☐ Poor (<13) ☑ Fair (13–24) ☐ Good (25–34) ☐ Excellent (35–42)

Recorded by AG

BEACON ENVIRONMENTAL

Geomorphology Group
Photos & Notes

Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-3

Photo / WP #	Notes	Photo / WP #	Notes
902 1910	u/s view of wetland channel with emergent cattails	918 1918	d/s view of pool w/ exposed geogrid substrate
903 1911	d/s view of pool towards wetland channel	919 1919	view of pond
904 1911	d/s view of vegetated bar formation		
905 1912	u/s view of channel w/ instream vegetation bar		
906 1913	u/s view of run		
907 1914	u/s view of gravel bar d/s of Millcroft Park culvert		
908 1914	d/s view of channel from gravel bar		
909 1915	u/s view of gravel deposition at Millcroft Park culvert mouth		
910	Storm sewer outlet at Millcroft Park dr		
911	u/s view of alternating bar deposits w/in 3m box culvert		
912 1916	d/s towards Millcroft Park dr culvert inlet		
913 1916	close up of toe erosion on right bank		
914 1916	distance view of toe erosion on right bank		
915 1916	u/s view of channel		
916-7 1917	u/s of channel w/ exposed geocell on left bank		

Additional Notes:

- overbank gravel deposition d/s of culvert
- channel design through reach
- channel morph influenced by road x-ing & online ponds

Recorded by: AG

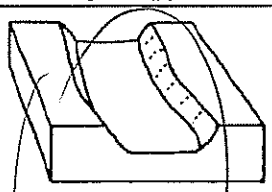
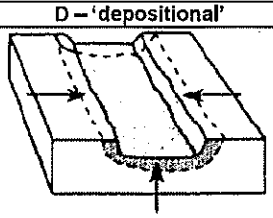
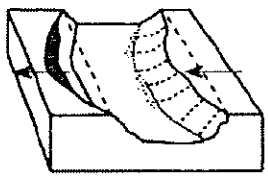
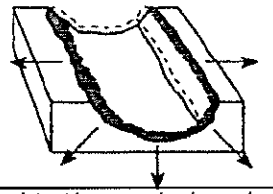
BEACON ENVIRONMENTAL

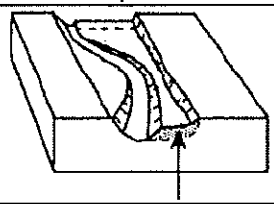
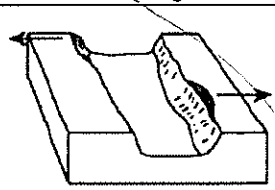
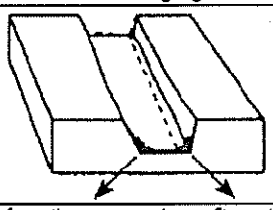
Geomorphology Group
Down's (1995) Model

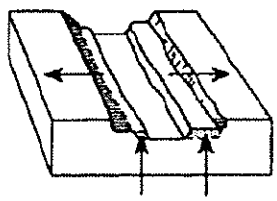
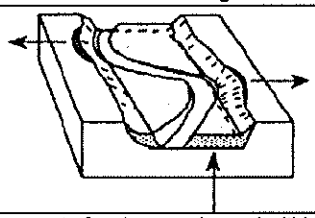
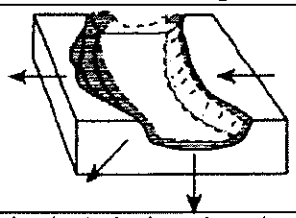
Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Mill Rd FT GC Burlington **Reach:** AC-R

S – 'stable'	D – 'depositional'	M – 'lateral migration'	E – 'enlarging'
			
No observable morphological adjustment in process ☐ no bank slumping/failure/undercutting ☐ old tree roots exposed ☐ no tree falls ☐ no alluvial terrace	***Consistent** decrease in channel width and/or depth* ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness) ☐ sediment deposited along banks ☐ no bank erosion ☐ no alluvial terrace	*Migration of **most** bends; cross-sectional dimensions preserved* ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting) ☐ deposition along **inner bank** (i.e. point bar development) ☐ no alluvial terrace	*Consistent increase in channel width and/or depth* ☐ erosion along **both** banks (e.g. slumping, young tree roots exposed, tree falls) ☐ no bar formation, scoured bed, low embeddedness ☐ no alluvial terrace

d – 'depositional'	m – 'lateral migration'	e – 'enlarging'
		
Selective deposition resulting in reduced channel width ☐ low-flow channel between outer banks/valley walls ☐ alluvial terrace/valley wall ☐ valley wall contacts at **few, if any** meander bends	*Initiation of alternating bank erosion in straightened channels or migration of only sharpest bends* ☐ generally straight ☒ stable except at sharp bends ☐ sharp bends with outside bank erosion, point-bar/cut bank development and undercutting ☐ no alluvial terrace	*Initiation of continuous erosion, **often** at channel toe* ☐ channel downcutting (e.g. bed scour, low embeddedness) ☐ steep, high banks above bankfull level ☐ no alluvial terrace

C – 'compound'	R – 'recovering'	U – 'undercutting'
		
Aggradation of channel bed with erosion of channel banks ☐ bank erosion (slumping, exposed tree roots) ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness) ☐ alluvial terrace with erosion	*Development of a sinuous channel within straightened channel, including erosion of alternating valley walls* ☐ straight alluvial terrace/valley wall ☐ valley wall contact and erosion at **majority** of meander bends	*Active bed and outer bank erosion; migration of bend; coarse inner bank deposits* ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting) ☐ deposition along **inner bank** (i.e. point bar development) ☐ scoured bed, low embeddedness, no bar formation ☐ no alluvial terrace

Source: Downs, P.W. 1995. Estimating the probability of river channel adjustment. *Earth Surface Processes and Landforms*. **20**: 687-705.

Recorded by: AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Reach Characteristics

Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-4

Land Use	☐ Forest	☐ Agricultural	☐ Residential	☐ Reach Break	
	☐ Pasture/Meadow	☐ Industrial/Commercial	☑ Other: Golf Course		
Valley/Stream Type	☑ Unconfined	☐ Confined	☐ Partially Confined: _____		
	☑ Perennial	☐ Intermittent	☐ Ephemeral	☐ Reach Break	
Riparian Vegetation	Vegetation Type: ☐ Trees	☑ Shrubs	☑ Grasses	☐ Reach Break	
	☑ Herbaceous	Dominant Type: _____			
	Buffer Zone: ☐ None	☑ Fragmented	☐ Continuous		
	☑ <1 Channel Width	☐ 1-5 Channel Widths	☐ >5 Channel Widths		
	Age Class: ☑ Immature (<5 y.)	☐ Established (5-30 y.)	☐ Mature (>30 y.)		
Channel Characteristics – Planform	Sinuosity: ☑ Low	☐ Moderate	☐ High	☐ Reach Break	
	Gradient: ☑ Low	☐ Moderate	☐ High		
	Entrenchment: ☑ Low	☐ Moderate	☐ High		
	Riffle-Pool Spacing: _____	Meander Amplitude: _____			
Bank	Angle: ☐ 0° - 30°	☑ 30° - 60°	☑ 60° - 90°	Undercut: _____	
	Erosion: ☑ <5%	☐ 5 – 30%	☐ 30 – 60%	☐ 60 – 100%	
	Failure: ☑ None	☐ Slump	☐ Planar	☐ Mass	
	Material: ☑ Clay/silt	☐ Sand	☐ Gravel	☐ Cobble	
	☐ Boulder	☐ Other: _____			
Channel	Riffle Substrate ☐ Clay/silt	☐ Sand	☑ Gravel	☐ Cobble	
	☐ Boulder	☑ Other: terra fix	Riffle Embeddedness: _____ %		
	Pool Substrate ☑ Clay/silt	☑ Sand	☑ Gravel	☑ Cobble	
	☐ Boulder	☐ Other: _____			
		Riffles		Pools	
	Bankfull Width (m)				
	Bankfull Depth (m)	did not assess for rapids			
	Wetted Width (m)	for purpose of report speak to weir			
	Wetted Depth (m)	and influence of ponds			
Aquatic / Instream	Vegetation: ☑ Emergent	☐ Submergent	☐ Floating	Portion (%): 70	
	Woody Debris: ☑ Not Present	☐ Present in Cutbank	☐ Present in Channel	Density: Low/Mod/High	
Turbidity	☐ Clear	☑ Slight	☐ Moderate	☐ High	

Recorded by: AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Geomorphic Assessment (RGA)

Date: Aug 24, 2018 **Project:** 216081 **Reach:** AC-4

PROCESS	GEOMORPHIC INDICATOR	PRESENT No	PRESENT Yes	SCORE
Aggradation	1. Lobate bar formation	✓		1/7
	2. Coarse materials in riffles embedded	✓		
	3. Siltation in pools		✓	
	4. Medial / lateral bar formation	✓		
	5. Accretion on point bars	✓		
	6. Poor longitudinal sorting of bed materials	✓		
	7. Deposition in the overbank zone	✓		
	Sum of Indices	6	1	
Degradation	1. Exposed bridge/culvert footing(s)	✓		1/10
	2. Exposed sanitary/storm sewer/pipeline	✓		
	3. Elevated stormwater outfall(s)	✓		
	4. Undermined gabion baskets/concrete aprons/crib walls	✓		
	5. Scour pool formation downstream of culvert/storm outfall		✓	
	6. Cut face on bar formations	✓		
	7. Head cutting due to knickpoint migration	✓		
	8. Terrace cut through older bar material	✓		
	9. Suspended armour layer visible in bank	✓		
	10. Channel worn into undisturbed overburden/bedrock	✓		
	Sum of Indices	9	1	
Widening	1. Fallen/leaning trees/fence posts	✓		0
	2. Occurrence of large organic debris	✓		
	3. Exposed tree roots	✓		
	4. Basal scour on inside meander bends	✓		
	5. Basal scour on both sides of channel through riffle	✓		
	6. Length of basal scour >50% through reach	✓		
	7. Gabion baskets/armourstone walls/etc. outflanked	✓		
	8. Exposed length of previously buried pipe	✓		
	9. Fracture lines along top of bank/slumping banks	✓		
	10. Exposed building foundation	✓		
	Sum of Indices	10	0	
Planimetric Form Adjustment	1. Formation of chute(s)	✓		0
	2. Single thread to multiple channel	✓		
	3. Evolution of pool-riffle form to low-bed relief form	✓		
	4. Cut-off channel(s)	✓		
	5. Formation of island(s)	✓		
	6. Thalweg alignment out of phase with meander form	✓		
	7. Bar forms poorly formed/reworked/removed	✓		
	Sum of Indices	7	0	
Stability Index (SI)				0.061

Source: Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario, Ontario, Canada.

Classification:

☑ **In Regime** (≤ 0.20) ☐ **In Transition/Stressed** (0.21 – 0.40) ☐ **In Adjustment** (≥0.41)

Recorded by: AG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Stream Assessment Technique (RSAT)

Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-4

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• <50% of bank network stable. • Recent bank sloughing, slumping or failure frequently observed.	• 50–70% of bank network stable. • Recent signs of bank sloughing, slumping or failure fairly common.	• 71–80% of bank network stable. • Infrequent signs of bank sloughing, slumping or failure.	• >80% of bank network stable. • No evidence of bank sloughing, slumping or failure.
	• Stream bend areas highly unstable. • Outer bank height 1.2 m above stream (2.1 m above stream for large mainstem areas). • Overhang >0.8–1.0 m.	• Stream bend areas unstable. • Outer bank height 0.9–1.2 m above stream (1.5–2.1 m above stream for large mainstem areas). • Bank overhang 0.8–0.9 m.	• Stream bend areas stable. • Outer bank height 0.6–0.9 m above stream bank (1.2–1.5 m above stream bank for large mainstem areas). • Overhang 0.6–0.8 m.	• Stream bend areas very stable. • Height <0.6 m above stream (<1.2 m above stream for large mainstem areas). • Bank overhang <0.6 m.
	• Young exposed tree roots abundant. • >6 recent large tree falls per stream mile.	• Young exposed tree roots common. • 4–5 recent (large) tree falls per stream mile.	• Exposed tree roots predominately old and large, smaller young roots scarce. • 2–3 recent (large) tree falls per stream mile.	• Exposed tree roots old, large and woody. • Generally 0–1 recent (large) tree falls per stream mile.
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised.	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.
	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point Range	0 1 2	3 4 5	6 7 8	9 10 11

Evaluation Category	Poor	Fair	Good	Excellent
Channel Scouring / Sediment Deposition	• >75% embedded (>85% embedded for large mainstem areas).	• 50–75% embedded (60–85% embedded for large mainstem areas).	• 25–49% embedded (35-59% embedded for large mainstem areas).	• Riffle embeddness <25% sand-silt (<35% for large mainstem areas).
	• Few, if any, deep pools. • Pool substrate >81% sand-silt.	• Low to moderate number of deep pools. • Pool substrate 60–80% sand-silt.	• Moderate number of deep pools. • Pool substrate 30–59% sand-silt.	• High number of deep pools >61 cm (>122 cm for large mainstem areas). • Pool substrate <30% composed of sand-silt.
	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits uncommon.	• Streambed streak marks and/or banana-shaped sediment deposits absent.
	• Fresh, large sand deposits very common in channel. • Moderate to heavy sand deposition along major portion of overbank area very common.	• Fresh, large sand deposits in channel common. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel uncommon. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel rare or absent. • No evidence of fresh sediment deposition on overbank.
	• Point bars moderate to large and unstable with high amount of fresh sand present at most stream bends.	• Point bars moderate to large and unstable with high amount of fresh sand common.	• Point bars small and stable, well vegetated and/or armoured with little or no fresh sand.	• Point bars few, small and stable, well vegetated and/or armoured with little or no fresh sand.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter <40% of bottom width (<45% for large mainstem areas).	• Wetted perimeter 40–60% of bottom width (45–65% for large mainstem areas).	• Wetted perimeter 61–85% of bottom width (66–90% for large mainstem areas).	• Wetted perimeter >85% of bottom channel width (>90% for large mainstem areas).
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low).	• Few pools present; riffles and runs dominant; velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate).	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow.	• Riffles, runs and pool habitat present. • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water).
	• Riffle substrate composition predominately gravel with high percentage of sand. • <5% cobble.	• Riffle substrate composition predominately small cobble, gravel and sand. • 5–24% cobble.	• Riffle substrate composition has good mix of gravel, cobble and rubble material. • 25–49% cobble.	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand. • >50% cobble.
	• Riffle depth <10 cm for large mainstem area.	• Riffle depth 10–15 cm for large mainstem area.	• Riffle depth 15–20 cm for large mainstem areas.	• Riffle depth >8% for large 20 cm mainstem areas.
	• Large pools generally <30 cm deep (<61 cm for large mainstem areas) and devoid of cover/structure.	• Large pools generally 30–46 cm deep (61–91 cm for large mainstem areas) with little or no cover/structure.	• Large pools generally 46–61 cm deep (91–122 cm for large mainstem areas) with some cover/structure.	• Large pools generally >61 cm deep (>122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration or point bar formation/enlargement.	• Moderate increase in point bar and/or in amount of channel modification.	• Slight increase in point bar formation/enlargement or slight amount of channel modification.	• No channel alteration or significant point bar formation or enlargement.
	• Riffle/pool ratio: 0.49:1<; >1.51:1	• Riffle/pool ratio: 0.5–0.69:1; 1.31-1.5:1.	• Riffle/pool ratio: 0.9–0.89:1; 1.11–1.3:1.	• Riffle/pool ratio: 0.9–1.1:1.
	• Summer afternoon H_20 temp >80°F.	• Summer afternoon H_20 temp 75–80°F.	• Summer afternoon H_20 temp 68–75°F.	• Summer afternoon H_20 temp <68°F.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Water Quality	• Substrate fouling level: High (>50%).	• Substrate fouling level: Moderate (21–50%).	• Substrate fouling level: Very Light (11–20%).	• Substrate fouling level: 0–10% (rock underside).
	• TDS: >150 mg/L; Brown.	• TDS: 101–150 mg/L; Grey.	• TDS: 50–100 mg/L; Slightly Grey.	• TDS: <50 mg/L; Clear Flow.
	• Objects visible to depth <0.15 m below surface.	• Objects visible to depth 0.15–0.5 m below surface.	• Objects visible to depth 0.5–1 m below surface.	• Clear water – objects visible to depth >1 m below surface.
	• Moderate to strong organic odour.	• Slight to moderate odour.	• Slight organic odour.	• No odour.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Riparian Habitat Conditions	• Riparian area mostly non-woody vegetation. • Narrow riparian area.	• Riparian area predominantly wooded but with major localized gaps.	• Forested buffer generally >31 m wide along major portion of both banks.	• Wide (>60 m) mature forested buffer along both banks.
	• Canopy coverage: <50% shading (30% for large mainstem areas).	• Canopy coverage: 50–60% shading (30–44% for large mainstem areas).	• Canopy coverage: 60–79% shading (45–59% for large mainstem areas).	• Canopy coverage: >80% shading (>60% for large mainstem areas).
Point Range	0 1	2 3	4 5	6 7

Source: Galli, J. 1996. Rapid stream assessment technique, field methods. Metropolitan Washington Council of Governments. 36pp.

Total Overall Score (0–42): ~~26.5~~ 26

Ranking: ☐ Poor (<13) ☐ Fair (13–24) ☑ Good (25–34) ☐ Excellent (35–42)

Recorded by AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Photos & Notes

Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-4

Photo / WP #	Notes	Photo / WP #	Notes
920 1919	AC-4 outlet into Pond. Channel is lined with terraFix		
921 1920	80cm weir		
922 1921	d/s view from cart path x-ing		
923 1921	u/s view from cart path x-ing with pipe outlet on right bank		
924 1922	Pipe outlet on right bank		
925 1922	u/s view of general pool condition		
926 1923	d/s of general conditions		
927 1924	d/s view of wetland reach Choked with Cattails		
928-9 1925	Large invasive species in pool d/s of pond		
930	view from pond towards large pool		
931	u/s view of pond		
932	u/s view of pool towards pond		

Additional Notes:

Recorded by: AG

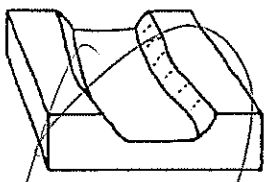
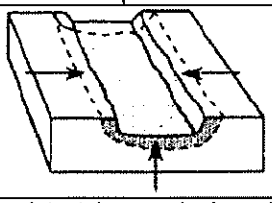
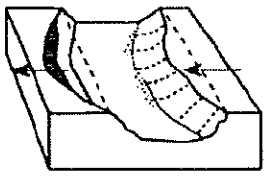
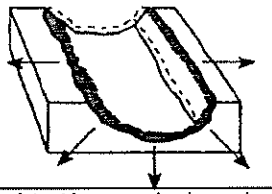
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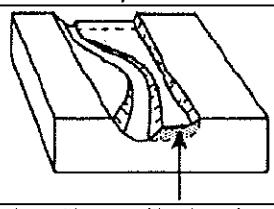
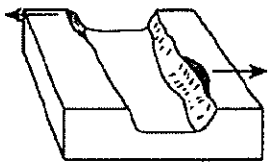
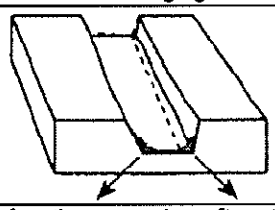
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Down's (1995) Model

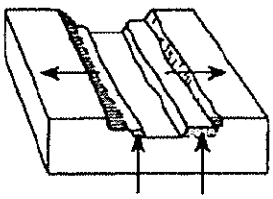
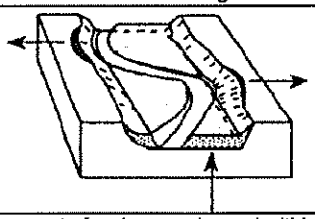
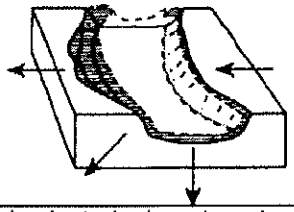
Date: Aug 24, 2018 **Project:** 216081

Weather: Sunny 23°C **Watercourse:** Appleby Creek

Location: Millcroft GC Burlington **Reach:** AC-4

S – 'stable'	D – 'depositional'	M – 'lateral migration'	E – 'enlarging'
			
No observable morphological adjustment in process ☐ no bank slumping/failure/undercutting ☐ old tree roots exposed ☐ no tree falls ☐ no alluvial terrace	***Consistent** decrease in channel width and/or depth* ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness) ☐ sediment deposited along banks ☐ no bank erosion ☐ no alluvial terrace	*Migration of **most** bends; cross-sectional dimensions preserved* ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting) ☐ deposition along **inner bank** (i.e. point bar development) ☐ no alluvial terrace	*Consistent increase in channel width and/or depth* ☐ erosion along **both** banks (e.g. slumping, young tree roots exposed, tree falls) ☐ no bar formation, scoured bed, low embeddedness ☐ no alluvial terrace

d – 'depositional'	m – 'lateral migration'	e – 'enlarging'
		
Selective deposition resulting in reduced channel width ☐ low-flow channel between outer banks/valley walls ☐ alluvial terrace/valley wall ☐ valley wall contacts at **few, if any** meander bends	*Initiation of alternating bank erosion in straightened channels or migration of only sharpest bends* ☐ generally straight ☐ stable except at sharp bends ☐ sharp bends with outside bank erosion, point-bar/cut bank development and undercutting ☐ no alluvial terrace	*Initiation of continuous erosion, **often** at channel toe* ☐ channel downcutting (e.g. bed scour, low embeddedness) ☐ steep, high banks above bankfull level ☐ no alluvial terrace

C – 'compound'	R – 'recovering'	U – 'undercutting'
		
Aggradation of channel bed with erosion of channel banks ☐ bank erosion (slumping, exposed tree roots) ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness) ☐ alluvial terrace with erosion	*Development of a sinuous channel within straightened channel, including erosion of alternating valley walls* ☐ straight alluvial terrace/valley wall ☐ valley wall contact and erosion at **majority** of meander bends	*Active bed and outer bank erosion; migration of bend; coarse inner bank deposits* ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting) ☐ deposition along **inner bank** (i.e. point bar development) ☐ scoured bed, low embeddedness, no bar formation ☐ no alluvial terrace

Source: Downs, P.W. 1995. Estimating the probability of river channel adjustment. *Earth Surface Processes and Landforms.* **20**: 687-705.

Recorded by: AG/SG

BEACON ENVIRONMENTAL

Geomorphology Group
Reach Characteristics

Date: Oct 25/19 **Project:** 216081.1.
Weather: overcast 12°C **Watercourse:** Sheldon Creek
Location: Millcroft GC **Reach:** SC-1

Land Use	☐ Forest	☐ Agricultural	☑ Residential	☐ Reach Break
	☐ Pasture/Meadow	☐ Industrial/Commercial	☑ Other: Golf Course	
Valley/Stream Type	☑ Unconfined	☐ Confined	☐ Partially Confined: _____	
	☐ Perennial	☐ Intermittent	☐ Ephemeral	☐ Reach Break
Riparian Vegetation	Vegetation Type: ☑ Trees	☑ Shrubs	☑ Grasses	☐ Reach Break
	☐ Herbaceous	Dominant Type: manicured grass		
	Buffer Zone: ☐ None	☑ Fragmented	☐ Continuous	
	☐ <1 Channel Width	☑ 1-5 Channel Widths	☐ >5 Channel Widths	
	Age Class: ☐ Immature (<5 y.)	☑ Established (5-30 y.)	☐ Mature (>30 y.)	

Channel Characteristics

Planform	Sinuosity:	☑ Low	☐ Moderate	☐ High	☐ Reach Break
	Gradient:	☑ Low	☐ Moderate	☐ High	
	Entrenchment:	☑ Low	☐ Moderate	☐ High	
	Riffle-Pool Spacing: N/A		Meander Amplitude: N/A		
Bank	Angle:	☑ 0° - 30°	☐ 30° - 60°	☐ 60° - 90°	Undercut: _____
	Erosion:	☑ <5%	☐ 5 – 30%	☐ 30 – 60%	☐ 60 – 100%
	Failure:	☑ None	☐ Slump	☐ Planar	☐ Mass
	Material:	☑ Clay/silt	☑ Sand	☐ Gravel	☐ Cobble
		☐ Boulder	☐ Other: _____		
Channel	Riffle Substrate	☐ Clay/silt	☐ Sand	☐ Gravel	☐ Cobble
		☐ Boulder	☐ Other: _____	Riffle Embeddedness: _____ %	
	Pool Substrate	☑ Clay/silt	☑ Sand	☐ Gravel	☐ Cobble
		☐ Boulder	☐ Other: _____		

	Riffles u/s of road				Pools d/s of road			
Bankfull Width (m)	2.7	2.8	4.4	3.6	8 (backwater)			
Bankfull Depth (m)	0.50	0.50	0.50	0.60	0.65			
Wetted Width (m)	2.0	2.0	2.0	2.0	7.0			
Wetted Depth (m)	0.25	0.15	0.15	0.20	0.25			

Aquatic / Instream	Vegetation: ☑ Emergent	☐ Submergent	☐ Floating	Portion (%): 80	
	Woody Debris: ☑ Not Present	☐ Present in Cutbank	☐ Present in Channel	Density: Low/Mod/High	
Turbidity	☑ Clear	☐ Slight	☐ Moderate	☐ High	

Recorded by: SG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Geomorphic Assessment (RGA)

Date: Oct 25/19 **Project:** 216081.1 **Reach:** SC-1

PROCESS	GEOMORPHIC INDICATOR	PRESENT No	PRESENT Yes	SCORE
Aggradation	1. Lobate bar formation	/		0
	2. Coarse materials in riffles embedded	/		
	3. Siltation in pools	/		
	4. Medial / lateral bar formation	/		
	5. Accretion on point bars	/		
	6. Poor longitudinal sorting of bed materials	/		
	7. Deposition in the overbank zone	/		
	Sum of Indices			
Degradation	1. Exposed bridge/culvert footing(s)	/		0
	2. Exposed sanitary/storm sewer/pipeline			
	3. Elevated stormwater outfall(s)	/		
	4. Undermined gabion baskets/concrete aprons/crib walls	/		
	5. Scour pool formation downstream of culvert/storm outfall			
	6. Cut face on bar formations	/		
	7. Head cutting due to knickpoint migration	/		
	8. Terrace cut through older bar material	/		
	9. Suspended armour layer visible in bank	/		
	10. Channel worn into undisturbed overburden/bedrock	/		
	Sum of Indices			
Widening	1. Fallen/leaning trees/fence posts	/		0
	2. Occurrence of large organic debris	/		
	3. Exposed tree roots	/		
	4. Basal scour on inside meander bends	/		
	5. Basal scour on both sides of channel through riffle	/		
	6. Length of basal scour >50% through reach	/		
	7. Gabion baskets/armourstone walls/etc. outflanked	/		
	8. Exposed length of previously buried pipe	/		
	9. Fracture lines along top of bank/slumping banks	/		
	10. Exposed building foundation	/		
	Sum of Indices			
Planimetric Form Adjustment	1. Formation of chute(s)	/		0
	2. Single thread to multiple channel	/		
	3. Evolution of pool-riffle form to low-bed relief form	/		
	4. Cut-off channel(s)	/		
	5. Formation of island(s)	/		
	6. Thalweg alignment out of phase with meander form	/		
	7. Bar forms poorly formed/reworked/removed	/		
	Sum of Indices			
Stability Index (SI)				0

Source: Ministry of the Environment. 2003. Stormwater Management Planning and Design Manual. Document # 4329e. Queen's Printer for Ontario, Ontario, Canada.

Classification:

☑ **In Regime** (≤ 0.20) ☐ **In Transition/Stressed** (0.21 – 0.40) ☐ **In Adjustment** (≥0.41)

Recorded by: SG

BEACON ENVIRONMENTAL

Geomorphology Group
Rapid Stream Assessment Technique (RSAT)

Date: Oct 25/19 **Project:** 216081-1

Weather: overcast 12°C **Watercourse:** Sheldon Creek

Location: Millcroft GC **Reach:** SC-1

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• <50% of bank network stable. • Recent bank sloughing, slumping or failure frequently observed.	• 50–70% of bank network stable. • Recent signs of bank sloughing, slumping or failure fairly common.	• 71–80% of bank network stable. • Infrequent signs of bank sloughing, slumping or failure.	• >80% of bank network stable. • No evidence of bank sloughing, slumping or failure.
	• Stream bend areas highly unstable. • Outer bank height 1.2 m above stream (2.1 m above stream for large mainstem areas). • Overhang >0.8–1.0 m.	• Stream bend areas unstable. • Outer bank height 0.9–1.2 m above stream (1.5–2.1 m above stream for large mainstem areas). • Bank overhang 0.8–0.9 m.	• Stream bend areas stable. • Outer bank height 0.6–0.9 m above stream bank (1.2–1.5 m above stream bank for large mainstem areas). • Overhang 0.6–0.8 m.	• Stream bend areas very stable. • Height <0.6 m above stream (<1.2 m above stream for large mainstem areas). • Bank overhang <0.6 m.
	• Young exposed tree roots abundant. • >6 recent large tree falls per stream mile.	• Young exposed tree roots common. • 4–5 recent (large) tree falls per stream mile.	• Exposed tree roots predominately old and large, smaller young roots scarce. • 2–3 recent (large) tree falls per stream mile.	• Exposed tree roots old, large and woody. • Generally 0–1 recent (large) tree falls per stream mile.
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised.	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material.
	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally trapezoidally-shaped.	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point Range	0 1 2	3 4 5	6 7 8	9 10 11

Evaluation Category	Poor	Fair	Good	Excellent
Channel Scouring / Sediment Deposition	• >75% embedded (>85% embedded for large mainstem areas).	• 50–75% embedded (60–85% embedded for large mainstem areas).	• 25–49% embedded (35-59% embedded for large mainstem areas).	• Riffle embeddedness <25% sand-silt (<35% for large mainstem areas).
	• Few, if any, deep pools. • Pool substrate >81% sand-silt.	• Low to moderate number of deep pools. • Pool substrate 60–80% sand-silt.	• Moderate number of deep pools. • Pool substrate 30–59% sand-silt.	• High number of deep pools >61 cm (>122 cm for large mainstem areas). • Pool substrate <30% composed of sand-silt.
	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits common.	• Streak marks and/or "banana" deposits uncommon.	• Streambed streak marks and/or banana-shaped sediment deposits absent.
	• Fresh, large sand deposits very common in channel. • Moderate to heavy sand deposition along major portion of overbank area very common.	• Fresh, large sand deposits in channel common. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel uncommon. • Small localized areas of fresh sand deposits along top of low banks.	• Fresh, large sand deposits in channel rare or absent. • No evidence of fresh sediment deposition on overbank.
	• Point bars moderate to large and unstable with high amount of fresh sand present at most stream bends.	• Point bars moderate to large and unstable with high amount of fresh sand common.	• Point bars small and stable, well vegetated and/or armoured with little or no fresh sand.	• Point bars few, small and stable, well vegetated and/or armoured with little or no fresh sand.
Point Range	0 1 2	3 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter <40% of bottom width (<45% for large mainstem areas).	• Wetted perimeter 40–60% of bottom width (45–65% for large mainstem areas).	• Wetted perimeter 61–85% of bottom width (66–90% for large mainstem areas).	• Wetted perimeter >85% of bottom channel width (>90% for large mainstem areas).
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low).	• Few pools present; riffles and runs dominant; velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate).	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow.	• Riffles, runs and pool habitat present. • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water).
	• Riffle substrate composition predominately gravel with high percentage of sand. • <5% cobble.	• Riffle substrate composition predominately small cobble, gravel and sand. • 5–24% cobble.	• Riffle substrate composition has good mix of gravel, cobble and rubble material. • 25-49% cobble.	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand. • >50% cobble.
	• Riffle depth <10 cm for large mainstem area.	• Riffle depth 10–15 cm for large mainstem area.	• Riffle depth 15–20 cm for large mainstem areas.	• Riffle depth >8% for large 20 cm mainstem areas.
	• Large pools generally <30 cm deep (<61 cm for large mainstem areas) and devoid of cover/structure.	• Large pools generally 30–46 cm deep (61–91 cm for large mainstem areas) with little or no cover/structure.	• Large pools generally 46–61 cm deep (91–122 cm for large mainstem areas) with some cover/structure.	• Large pools generally >61 cm deep (>122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration or point bar formation/enlargement.	• Moderate increase in point bar and/or in amount of channel modification.	• Slight increase in point bar formation/enlargement or slight amount of channel modification.	• No channel alteration or significant point bar formation or enlargement.
	• Riffle/pool ratio: 0.49:1<; >1.51:1	• Riffle/pool ratio: 0.5–0.69:1; 1.31-1.5:1.	• Riffle/pool ratio: 0.9–0.89:1; 1.11–1.3:1.	• Riffle/pool ratio: 0.9–1.1:1.
	• Summer afternoon H_20 temp >80°F.	• Summer afternoon H_20 temp 75–80°F.	• Summer afternoon H_20 temp 68–75°F.	• Summer afternoon H_20 temp <68°F.
Point Range	0 1 2	(3) 4	5 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Water Quality	• Substrate fouling level: High (>50%).	• Substrate fouling level: Moderate (21–50%).	• Substrate fouling level: Very Light (11–20%).	• Substrate fouling level: 0–10% (rock underside).
	• TDS: >150 mg/L; Brown.	• TDS: 101–150 mg/L; Grey.	• TDS: 50–100 mg/L; Slightly Grey.	• TDS: <50 mg/L; Clear Flow.
	• Objects visible to depth <0.15 m below surface.	• Objects visible to depth 0.15–0.5 m below surface.	• Objects visible to depth 0.5–1 m below surface.	• Clear water – objects visible to depth >1 m below surface.
	• Moderate to strong organic odour.	• Slight to moderate odour.	• Slight organic odour.	• No odour.
Point Range	0 1 2	3 4	(5) 6	7 8

Evaluation Category	Poor	Fair	Good	Excellent
Riparian Habitat Conditions	• Riparian area mostly non-woody vegetation. • Narrow riparian area.	• Riparian area predominantly wooded but with major localized gaps.	• Forested buffer generally >31 m wide along major portion of both banks.	• Wide (>60 m) mature forested buffer along both banks.
	• Canopy coverage: <50% shading (30% for large mainstem areas).	• Canopy coverage: 50–60% shading (30–44% for large mainstem areas).	• Canopy coverage: 60–79% shading (45–59% for large mainstem areas).	• Canopy coverage: >80% shading (>60% for large mainstem areas).
Point Range	0 (1)	2 3	4 5	6 7

Source: Galli, J. 1996. Rapid stream assessment technique, field methods. Metropolitan Washington Council of Governments. 36pp.

Total Overall Score (0–42): 21

Ranking: ☐ Poor (<13) ☑ Fair (13–24) ☐ Good (25–34) ☐ Excellent (35–42)

Recorded by SG

BEACON ENVIRONMENTAL

Geomorphology Group
Photos & Notes

Date: Oct 25, 2019 **Project:** 216081.1

Weather: overcast 12°C **Watercourse:** Sheldon Ck

Location: Millcroft GC **Reach:** SG-1

Photo / WP #	Notes	Photo / WP #	Notes
2343 PL1	d/s view from Turnberry Wet width extends to wing walls	2358 PL7	d/s cart path
2344 PL1	u/s view twin concrete culverts under Turnberry	2359 PL8	u/s typical
2345 PL1	d/s @ channel → concrete lining @ culvert w/ accumulation of fines	2360 PL9	d/s) cart path
2346 PL2	u/s) stagnant water	2361 PL10	u/s)
2347 PL2	d/s view) extensive backwater from pond	2362 PL10	d/s view of pond
2348 PL3	d/s view to rail line) pond	2363 PL11	u/s view from pond
2349 PL3	u/s view towards rd)	2364 PL11	Storm outlet to pond
2350 PL4	u/s from Turnberry	2365 PL12	d/s view of pond
2351 PL4	d/s @ culverts - minor flow	2366 PL12	u/s view of creek from pond (@ u/s of SC-1)
2352 PL5	d/s view - terrafix lined - debris from cattails	2367 PL13	view of reach u/s of SC-1
2353 PL5	u/s view backwater - back of [illegible] house		
2354 PL6	d/s view		
2355 PL6	u/s view		
2356 PL7	d/s) cart path		
2357 PL7	u/s)		

Additional Notes: - reach d/s of road w/in backwater influence of Appleby pond

- channelized

Recorded by: SG

BEACON ENVIRONMENTAL

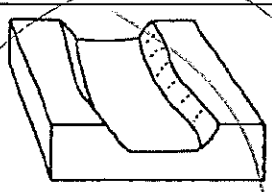
Geomorphology Group
Down's (1995) Model

Date: Oct 25/19 **Project:** 216081.1

Weather: overcast 12°C **Watercourse:** Sheldon Ck

Location: Millcroft GC **Reach:** SC-1

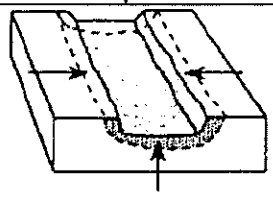
S – 'stable'



No observable morphological adjustment in process

- ☐ no bank slumping/failure/undercutting
- ☐ old tree roots exposed
- ☐ no tree falls
- ☐ no alluvial terrace

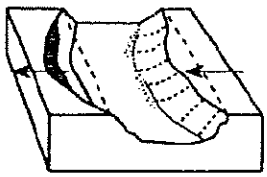
D – 'depositional'



***Consistent** decrease in channel width and/or depth*

- ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness)
- ☐ sediment deposited along banks
- ☐ no bank erosion
- ☐ no alluvial terrace

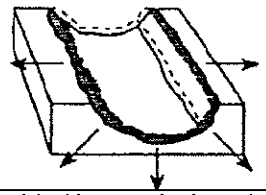
M – 'lateral migration'



*Migration of **most** bends; cross-sectional dimensions preserved*

- ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting)
- ☐ deposition along **inner bank** (i.e. point bar development)
- ☐ no alluvial terrace

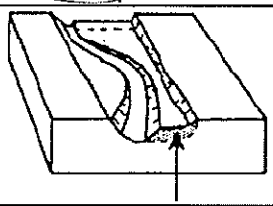
E – 'enlarging'



Consistent increase in channel width and/or depth

- ☐ erosion along **both** banks (e.g. slumping, young tree roots exposed, tree falls)
- ☐ no bar formation, scoured bed, low embeddedness
- ☐ no alluvial terrace

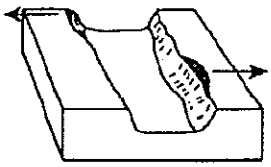
d – 'depositional'



Selective deposition resulting in reduced channel width

- ☐ low-flow channel between outer banks/valley walls
- ☐ alluvial terrace/valley wall
- ☐ valley wall contacts at **few, if any** meander bends

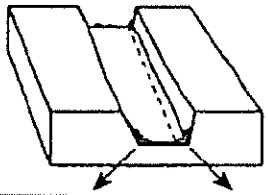
m – 'lateral migration'



Initiation of alternating bank erosion in straightened channels or migration of only sharpest bends

- ☐ generally straight
- ☐ stable except at sharp bends
- ☐ sharp bends with outside bank erosion, point-bar/cut bank development and undercutting
- ☐ no alluvial terrace

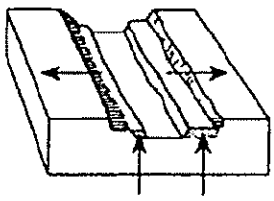
e – 'enlarging'



*Initiation of continuous erosion, **often** at channel toe*

- ☐ channel downcutting (e.g. bed scour, low embeddedness)
- ☐ steep, high banks above bankfull level
- ☐ no alluvial terrace

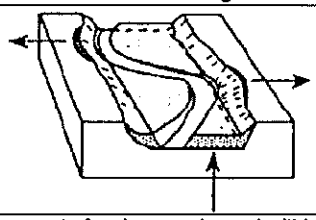
C – 'compound'



Aggradation of channel bed with erosion of channel banks

- ☐ bank erosion (slumping, exposed tree roots)
- ☐ sediment deposition on bed (e.g. bar development, shadow deposits, high embeddedness)
- ☐ alluvial terrace with erosion

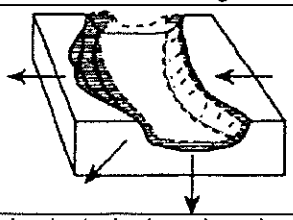
R – 'recovering'



Development of a sinuous channel within straightened channel, including erosion of alternating valley walls

- ☐ straight alluvial terrace/valley wall
- ☐ valley wall contact and erosion at **majority** of meander bends

U – 'undercutting'



Active bed and outer bank erosion; migration of bend; coarse inner bank deposits

- ☐ erosion along **outer bank** (e.g. slumping, young tree roots exposed, tree falls, undercutting)
- ☐ deposition along **inner bank** (i.e. point bar development)
- ☐ scoured bed, low embeddedness, no bar formation
- ☐ no alluvial terrace

Source: Downs, P.W. 1995. Estimating the probability of river channel adjustment. *Earth Surface Processes and Landforms*. **20**: 687-705.

Recorded by: JS

Project # 216081.2

ELC — COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Millcroft GC, Burlington		POLYGON: 1
SURVEYOR(S): A Baron	DATE: 23 Oct '18	TIME: start / finish
UTMZ: 17	UTME: 597477	UTMN: 4804686

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
G TERRESTRIAL	G ORGANIC	G LACUSTRINE	G NATURAL	G PLANKTON	G LAKE
G WETLAND	G MINERAL SOIL	G RIVERINE	G CULTURAL	G SUBMERGED	G POND
G AQUATIC	G PARENT MIN.	G BOTTOMLAND		G FLOATING-LVD.	G RIVER
	G ACIDIC BEDRK.	G TERRACE		G GRAMINOID	G STREAM
SITE	G BASIC BEDRK.	G VALLEY SLOPE	**COVER**	G FORB	G MARSH
G OPEN WATER	G CARB. BEDRK.	G TABLELAND	G OPEN	G LICHEN	G SWAMP
G SHALLOW WATER		G ROLL. UPLAND	G SHRUB	G BRYOPHYTE	G FEN
G SURFICIAL DEP.		G CLIFF	G TREED	G DECIDUOUS	G BOG
G BEDROCK		G TALUS		G CONIFEROUS	G BARREN
		G CREVICE / CAVE		G MIXED	G MEADOW
		G ALVAR			G PRAIRIE
		G ROCKLAND			G THICKET
		G BEACH / BAR			G SAVANNAH
		G SAND DUNE			G WOODLAND
		G BLUFF			G FOREST
					G PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY		0	
2	SUB-CANOPY		0	
3	UNDERSTOREY		4	POAPRAT >> ASTLANC > MENARVE
4	GRD. LAYER		1	Milfoil sp.

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR < 10% 2= 10 < CVR < 25% 3= 25 < CVR < 60% 4= CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		SA
COMMUNITY SERIES:		SAS
ECOSITE:		SAS1
VEGETATION TYPE:	Water milfoil Submerged Shallow Aquatic	SAS1-4
INCLUSION		
COMPLEX		

Notes: Human-made pond on golf course.

ELC — STAND CHARACTERISTICS

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

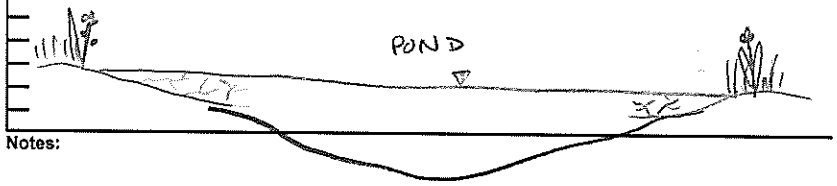
TREE TALLY BY SPECIES:

PRISM FACTOR

SPECIES	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AVG
TOTAL							100
BASAL AREA (BA)							
DEAD							

STAND COMPOSITION:

COMMUNITY PROFILE DIAGRAM



Notes:

ELC

SOILS ONTARIO

SITE:

POLYGON:

DATE:

SURVEYOR(S):

Slope

UTM

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL TEXTURE x HORIZON	1	2	3	4	5
A TEXTURE					
COURSE FRAGMENTS					
B TEXTURE					
COURSE FRAGMENTS					
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					

DEPTH TO / OF

MOTTLES					
GLEY					
BEDROCK					
WATER TABLE					
CARBONATES					
DEPTH OF ORGANICS					
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					

SOIL SURVEY MAP					
LEGEND CLASS					

ELC

PLANT SPECIES LIST

SITE: Millcroft G.C.

POLYGON:

DATE: 23 Oct 2018

SURVEYOR(S): AVS

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.

SPECIES CODE	LAYER 1	2	3	4	COL.
MYR_SP				O	
algae,				A	
filamentous					
IRIPSE				R	
MENARVE				A	
ASTLANC				A	
LYCUNIF				A	
BIDCERN				O	
POAPRAT				D	
OENBIEN				O	
LYTSALI				O	
GALPALU				O	

+ water edge to 3

edge

Project #21806112

ELC — COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Millcroft GC		POLYGON: 2	
SURVEYOR(S): A. Baron	DATE: 23 Oct '18	TIME: start / finish	
UTMZ: 17	UTME: 597368	UTMN: 4804769	

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
G TERRESTRIAL	G ORGANIC	G LACUSTRINE	G NATURAL	G PLANKTON	G LAKE
G WETLAND	G MINERAL SOIL	G RIVERINE	G CULTURAL	G SUBMERGED	G POND
G AQUATIC	G PARENT MIN.	G BOTTOMLAND		G FLOATING-LVD.	G RIVER
	G ACIDIC BEDRK.	G TERRACE		G GRAMINOID	G STREAM
SITE	G BASIC BEDRK.	G VALLEY SLOPE	**COVER**	G FORB	G MARSH
G OPEN WATER	G CARB. BEDRK.	G TABLELAND	G OPEN	G LICHEN	G SWAMP
G SHALLOW WATER		G ROLL UPLAND	G SHRUB	G BRYOPHYTE	G FEN
G SURFICIAL DEP		G CLIFF	G TREED	G DECIDUOUS	G BOG
G BEDROCK		G TALUS		G CONIFEROUS	G BARREN
		G CREVICE / CAVE		G MIXED	G MEADOW
		G ALVAR			G PRAIRIE
		G ROCKLAND			G THICKET
		G BEACH / BAR			G SAVANNAH
		G SAND DUNE			G WOODLAND
		G BLUFF			G FOREST
					G PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	2	SALALBA > FRAMMER > SALSERU
2	SUB-CANOPY	3	3	SALPETI > SALDISC > SALERIO
3	UNDERSTOREY	3	4	SALEXIG > CORSTOL > SALERIO
4	GRD. LAYER	5	4	POAPALU > PHAARU = TYPPHYLA

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION: BA:

	< 10	10 - 24	25 - 50	> 50
SIZE CLASS ANALYSIS:				
STANDING SNAGS:				
DEADFALL / LOGS:				

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER	X	YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE: SiCL	DEPTH TO MOTTLES / GLEY	g = 9	G = /
MOISTURE: 6, V.moist	DEPTH OF ORGANICS:	0 (cm)	
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:	>120 (cm)	

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		SW
COMMUNITY SERIES:		SWT
ECOSITE:		SWT2
VEGETATION TYPE:	Willow mineral thicket swamp.	SWT2-2
INCLUSION		
COMPLEX		

Notes: Feature looks wider on air photo than it actually is; adjacent trees have mown/managed understory.

ELC — STAND CHARACTERISTICS

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

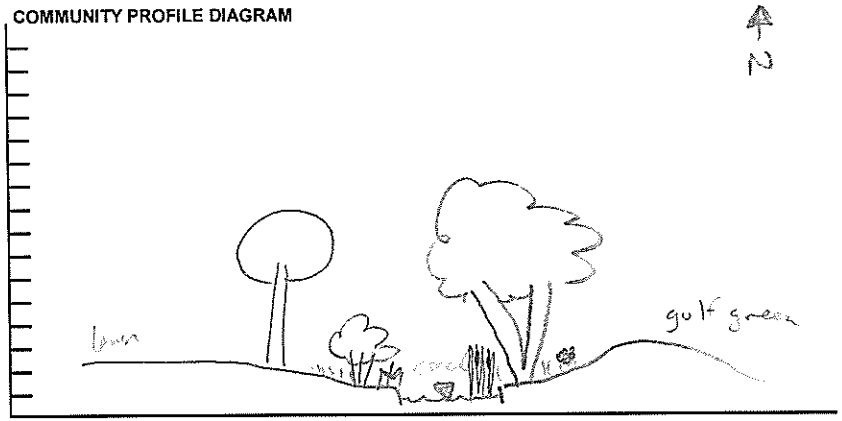
TREE TALLY BY SPECIES:

PRISM FACTOR

SPECIES	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AVG
TOTAL							100
BASAL AREA (BA)							
DEAD							

STAND COMPOSITION:

COMMUNITY PROFILE DIAGRAM



Notes:

polygon 2

ELC

SOILS ONTARIO

SITE:
POLYGON:
DATE:
SURVEYOR(S):

Slope UTM

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1									17	597368	4804709
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON	A 0-10 B 10-60 C 60-120				
A TEXTURE	SICL				
COURSE FRAGMENTS	none				
B TEXTURE	SC				
COURSE FRAGMENTS	none				
C TEXTURE	C				
COURSE FRAGMENTS	Yes - shale				
EFFECTIVE TEXTURE	SICL				
SURFACE STONINESS	none				
SURFACE ROCKINESS	none				
DEPTH TO / OF					
MOTTLES	9				
GLEY	none				
BEDROCK	>120				
WATER TABLE	>120				
CARBONATES	Y				
DEPTH OF ORGANICS	0				
PORE SIZE DISC #1	/				
PORE SIZE DISC #2	/				
MOISTURE REGIME	6, v. moist				
SOIL SURVEY MAP					
LEGEND CLASS					

ELC PLANT SPECIES LIST

SITE: Millcroft G.C.
POLYGON: 2
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

	SPECIES CODE	LAYER 1	2	3	4	COL.
likely planted	FRAAME ER	R	O	O	C	
	ACERREC	R		R	R	
	SALSEPU	R				
planted	SALALBA	O	O			
	POPDELT	R		R		
	SALEXIG			A		
	CORSTOL			A		
	RHACATH		O	O		
	SALDISC		O			
	RUBIDID			R		
	VIBOPUL			R		
	SALPETI		O			
planted →	VIB CASS			R		
	SALERIO		O	A		
	ROSMULT			R		
	CORRACE			R		
	VIBLENT			R		
	VITRIPA			R		

SPECIES CODE	LAYER 1	2	3	4	COL.
SOLALTI				A	
ASTLANC				A	
SOLCANA				O	
ROAPRAT				A	
CIRARVE				O	
GEUALEP				O	
ROAPALU				A	
LYTSALI				O	
TYPANGU				A	
ARCMIMI				O	
PHLPRAT				A	
DAUCARO				O	
PASSATI				O	
VERHAST				O	
IMPCAPE				O	
CAR - SP				K	first
cultivar				R	
CARVULP				R	
LYCUNIF				O	
SCIATRO				R	
PHHARUN				A	
ALIPETI				R	
SICANGU				O	
MENARVE				O	
SOLDULC				O	
EUTGRAM				O	
ASTNOVA				O	
DIPFULL				A	

ELC

MANAGEMENT / DISTURBANCE

SITE:
POLYGON:
DATE:
SURVEYOR(S):

DISTURBANCE / EXTENT	0	1	2	3	SCORE †
TIME SINCE LOGGING	> 30 YRS	15 - 30 YRS	5 - 15 YRS	0 - 5 YEARS	
INTENSITY OF LOGGING	NONE	FUEL WOOD	SELECTIVE	DIAMETER LIMIT	
EXTENT OF LOGGING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
SUGAR BUSH OPERATIONS	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF OPERATIONS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
GAPS IN FOREST CANOPY	NONE	SMALL	INTERMEDIATE	LARGE	
EXTENT OF GAPS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
LIVESTOCK (GRAZING)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF LIVESTOCK	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
ALIEN SPECIES	NONE	OCCASIONAL	ABUNDANT	DOMINANT	
EXTENT OF ALIEN SPECIES	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
PLANTING (PLANTATION)	NONE	OCCASIONAL	ABUNDANT	DOMINANT	
EXTENT OF PLANTING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
TRACKS AND TRAILS	NONE	FAINT TRAILS	WELL MARKED	TRACKS OR	
EXTENT OF TRACKS/TRAILS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
DUMPING (RUBBISH)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DUMPING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
EARTH DISPLACEMENT	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DISPLACEMENT	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
RECREATIONAL USE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF RECR. USE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
NOISE	NONE	SLIGHT	MODERATE	INTENSE	
EXTENT OF NOISE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
DISEASE/DEATH OF TREES	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DISEASE / DEATH	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
WIND THROW (BLOW DOWN)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF WIND THROW	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
BROWSE (e.g. DEER)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF BROWSE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
BEAVER ACTIVITY	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF BEAVER	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
FLOODING (pools & puddling)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF FLOODING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
FIRE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF FIRE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
ICE DAMAGE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF ICE DAMAGE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
OTHER	NONE	LIGHT	MODERATE	HEAVY	
EXTENT	NONE	LOCAL	WIDESPREAD	EXTENSIVE	

† INTENSITY x EXTENT = SCORE

ELC

WILDLIFE

SITE:
POLYGON:
DATE:
SURVEYOR(S):
START TIME:
END TIME:

TEMP (°C):	CLOUD (10th):	WIND:	PRECIPITATION:

CONDITIONS:

POTENTIAL WILDLIFE HABITAT:

	VERNAL POOLS		SNAGS
	HIBERNACULA		FALLEN LOGS

SPECIES LIST:

TY	SP. CODE	EV	NOTES	#	TY	SP. CODE	EV	NOTES	#
M	rabbit sp.	SC							
B	chickadee	OB		2					

FAUNAL TYPE CODES (TY):
B = BIRD M = MAMMAL H = HERPETOFAUNA L = LEPIDOPTERA F = FISH O = OTHER

EVIDENCE CODES (EV):

BREEDING BIRD - POSSIBLE:
SH = SUITABLE HABITAT SM = SINGING MALE

BREEDING BIRD - PROBABLE:
T = TERRITORY D = DISPLAY P = PAIR
A = ANXIETY BEHAVIOUR N = NEST BUILDING V = VISITING NEST

BREEDING BIRD - CONFIRMED:
DD = DISTRACTION NU = USED NEST FY = FLEDGED YOUNG
NE = EGGS NY = YOUNG FS = FOOD/FAECAL SACK
AE = NEST ENTRY

OTHER WILDLIFE EVIDENCE:
OB = OBSERVED VO = VOCALIZATION CA = CARCASS
DP = DISTINCTIVE PARTS HO = HOUSE/DEN FY = EGGS OR YOUNG
TK = TRACKS FE = FEEDING EVIDENCE SC = SCAT
SI = OTHER SIGNS (specify)

Project # 21606.12

ELC — COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Millcroft Golf Club		POLYGON: 3	
SURVEYOR(S): A. Baron	DATE: 23 Oct '18	TIME: start	
		finish	
UTMZ: 17	UTME: 597579	UTMN: 4804815	

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
G TERRESTRIAL	G ORGANIC	G LACUSTRINE	G NATURAL	G PLANKTON	G LAKE
G WETLAND	G MINERAL SOIL	G RIVERINE	G CULTURAL	G SUBMERGED	G POND
G AQUATIC	G PARENT MIN.	G BOTTOMLAND		G FLOATING-LVD.	G RIVER
	G ACIDIC BEDRK.	G TERRACE		G GRAMINOID	G STREAM
SITE	G BASIC BEDRK.	G VALLEY SLOPE	COVER	G FORB	G MARSH
	G CARB. BEDRK.	G TABLELAND		G LICHEN	G SWAMP
G OPEN WATER		G ROLL. UPLAND	G OPEN	G BRYOPHYTE	G FEN
G SHALLOW WATER		G CLIFF	G SHRUB	G DECIDUOUS	G BOG
G SURFICIAL DEP.		G TALUS	G TREED	G CONIFEROUS	G BARREN
G BEDROCK		G CREVICE / CAVE		G MIXED	G MEADOW
		G ALVAR			G PRAIRIE
		G ROCKLAND			G THICKET
		G BEACH / BAR			G SAVANNAH
		G SAND DUNE			G WOODLAND
		G BLUFF			G FOREST
					G PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	1	ACER HT > MACRUM = MALBACC
2	SUB-CANOPY	4	1	FRAAMER
3	UNDERSTOREY	4	1	LONTATA
4	GRD. LAYER	5	4	SOLCANA > BROININ > POAPRAT > VICCRAC

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION: BA:

SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		CU
COMMUNITY SERIES:		CUM
ECOSITE:		CUM1
VEGETATION TYPE:	Dry-moist old field meadow.	CUM1-1
INCLUSION		
COMPLEX		

Notes:

ELC — STAND CHARACTERISTICS

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

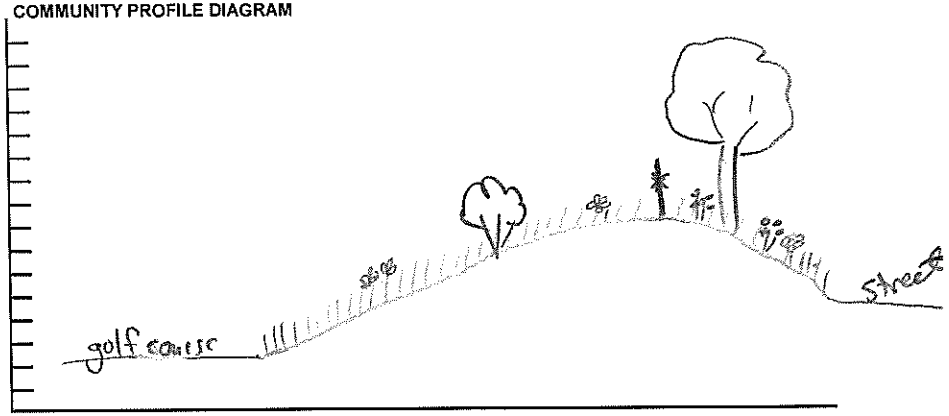
TREE TALLY BY SPECIES:

PRISM FACTOR

SPECIES	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AVG
TOTAL							100
BASAL AREA (BA)							
DEAD							

STAND COMPOSITION:

COMMUNITY PROFILE DIAGRAM



Notes:

polygon 3

ELC

SOILS ONTARIO

SITE:
POLYGON:
DATE:
SURVEYOR(S):

Slope | UTM

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
6											

SOIL	1	2	3	4	5
TEXTURE x HORIZON					
A TEXTURE	–				
COURSE FRAGMENTS					
B TEXTURE					
COURSE FRAGMENTS					
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES					
GLEY					
BEDROCK					
WATER TABLE					
CARBONATES					
DEPTH OF ORGANICS					
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

cultural component not completed

soil

ELC PLANT SPECIES LIST

SITE: Millcroft G.C.
POLYGON: 3
DATE: 23 October 2018
SURVEYOR(S): A. Baron

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRO.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
MALPUMI	R				
MALBACC	R				
ACEPLAT	R				
FRAAMER		R			
ACEPRET	R				
LONTATA			R		

SPECIES CODE	LAYER 1	2	3	4	COL.
VICCRAC				A	
SOLCANA				D	
DIPFULL				A	
butter + eggs				O	
DACGLOM				O	
ASTNOVA				C	
POAPRAT				A	
SOLDULC				O	
DAUCARO				R	
OENBIEN				R	
TAROFFI				C	
ASTLANC				C	
GEUALEP				O	
Small thistle				O	
MELALBA				C	
BROININ				A	
ELYREPE				A	

Project # 21606.2

ELC — COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Millcroft Golf Club		POLYGON: 4	
SURVEYOR(S): H. Bacon	DATE: 23 Oct 16	TIME: start / finish	
UTMZ: 17	UTME: 597608	UTMN: 4805000	

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
G TERRESTRIAL	G ORGANIC	G LACUSTRINE	G NATURAL	G PLANKTON	G LAKE
G WETLAND	G MINERAL SOIL	G RIVERINE	G CULTURAL	G SUBMERGED	G POND
G AQUATIC	G PARENT MIN.	G BOTTOMLAND		G FLOATING-LVD.	G RIVER
	G ACIDIC BEDRK.	G TERRACE		G GRAMINOID	G STREAM
	G BASIC BEDRK.	G VALLEY SLOPE		G FORB	G MARSH
	G CARB. BEDRK.	G TABLELAND		G LICHEN	G SWAMP
		G ROLL. UPLAND		G BRYOPHYTE	G FEN
		G CLIFF		G DECIDUOUS	G BOG
		G TALUS		G CONIFEROUS	G BARREN
		G CREVICE / CAVE		G MIXED	G MEADOW
		G ALVAR			G PRAIRIE
		G ROCKLAND			G THICKET
		G BEACH / BAR			G SAVANNAH
		G SAND DUNE			G WOODLAND
		G BLUFF			G FOREST
					G PLANTATION
SITE			COVER		
G OPEN WATER			G OPEN		
G SHALLOW WATER			G SHRUB		
G SURFICIAL DEP.			G TREED		
G BEDROCK					

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	4	RHUTYPH >> FRAAMER
2	SUB-CANOPY	4	3	RHUTYPH >> ROSCANI = RHACATH
3	UNDERSTOREY	5	3	RHUTYPH >> RHACATH > ROSCANI = LONTATA
4	GRD. LAYER	5	4	POAPRAT > SOLCANA > CIRARV = BROINN

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR < 10% 2= 10 < CVR < 25% 3= 25 < CVR < 60% 4= CVR > 60%

STAND COMPOSITION: BA:

SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50	
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50	
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50	

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER	X	YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		CU
COMMUNITY SERIES:		CUT
ECOSITE:		CUT1
VEGETATION TYPE:	Sumac cultural thicket	CUT1-1
INCLUSION		
COMPLEX		

Notes: Sumac thicket

ELC — STAND CHARACTERISTICS

SITE:	
POLYGON:	
DATE:	
SURVEYOR(S):	

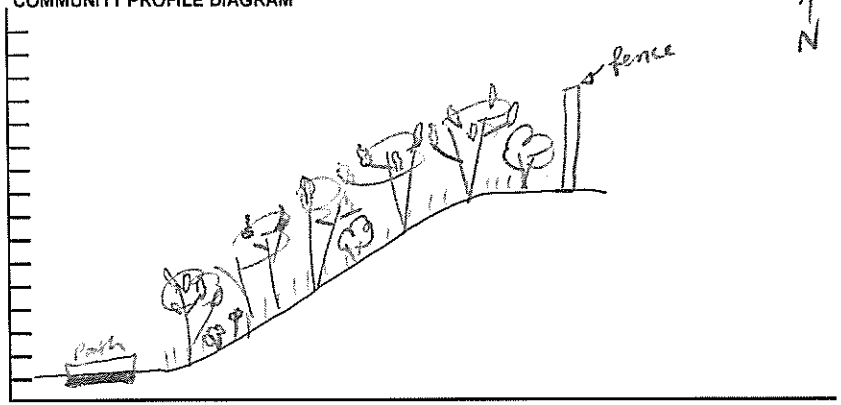
TREE TALLY BY SPECIES:

PRISM FACTOR

SPECIES	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AVG
TOTAL							100
BASAL AREA (BA)							
DEAD							

STAND COMPOSITION:

COMMUNITY PROFILE DIAGRAM



Notes:

polygon 4

ELC

SOILS ONTARIO

SITE:

POLYGON:

DATE:

SURVEYOR(S):

Slope UTM

	P/A	PP	Dr	Position	Aspect	%	Type	Class	Z	EASTING	NORTHING
1											
2											
3											
4											
5											

SOIL	1	2	3	4	5
TEXTURE x HORIZON					
A TEXTURE					
COURSE FRAGMENTS					
B TEXTURE					
COURSE FRAGMENTS					
C TEXTURE					
COURSE FRAGMENTS					
EFFECTIVE TEXTURE					
SURFACE STONINESS					
SURFACE ROCKINESS					
DEPTH TO / OF					
MOTTLES					
GLEY					
BEDROCK					
WATER TABLE					
CARBONATES					
DEPTH OF ORGANICS					
PORE SIZE DISC #1					
PORE SIZE DISC #2					
MOISTURE REGIME					
SOIL SURVEY MAP					
LEGEND CLASS					

Cultivated / old field

Sandy loam

ELC PLANT SPECIES LIST

SITE: Millcroft G.C.

POLYGON: 4

DATE: 23 Oct 2018

SURVEYOR(S): A. Brown

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
FRAAMER	O				
TILCORD			R		
JUNCINE			R		
RHUTYPH	D	D	D	O	
ROSCANI		O	O		
RHAFATH		O	O		
ROS_SP			R		
LONTATA			O		
VITRIPA					

SPECIES CODE	LAYER 1	2	3	4	COL.
SOLCANA				A	
ALIPETI				O	
POAPRAT				A	
DACGLOM				O	
DAPPULL				A	
CIRARVE				A	
BROINN				A	
SOLDULC				O	
ELEREPE				O	
ARCMIMI				R	
LEOCARD				R	

ELC

MANAGEMENT / DISTURBANCE

SITE:
POLYGON:
DATE:
SURVEYOR(S):

DISTURBANCE / EXTENT	0	1	2	3	SCORE †
TIME SINCE LOGGING	> 30 YRS	15 - 30 YRS	5 - 15 YRS	0 - 5 YEARS	
INTENSITY OF LOGGING	NONE	FUEL WOOD	SELECTIVE	DIAMETER LIMIT	
EXTENT OF LOGGING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
SUGAR BUSH OPERATIONS	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF OPERATIONS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
GAPS IN FOREST CANOPY	NONE	SMALL	INTERMEDIATE	LARGE	
EXTENT OF GAPS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
LIVESTOCK (GRAZING)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF LIVESTOCK	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
ALIEN SPECIES	NONE	OCCASIONAL	ABUNDANT	DOMINANT	
EXTENT OF ALIEN SPECIES	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
PLANTING (PLANTATION)	NONE	OCCASIONAL	ABUNDANT	DOMINANT	
EXTENT OF PLANTING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
TRACKS AND TRAILS	NONE	FAINT TRAILS	WELL MARKED	TRACKS OR ,	
EXTENT OF TRACKS/TRAILS	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
DUMPING (RUBBISH)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DUMPING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
EARTH DISPLACEMENT	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DISPLACEMENT	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
RECREATIONAL USE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF RECR. USE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
NOISE	NONE	SLIGHT	MODERATE	INTENSE	
EXTENT OF NOISE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
DISEASE/DEATH OF TREES	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF DISEASE / DEATH	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
WIND THROW (BLOW DOWN)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF WIND THROW	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
BROWSE (e.g. DEER)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF BROWSE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
BEAVER ACTIVITY	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF BEAVER	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
FLOODING (pools & puddling)	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF FLOODING	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
FIRE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF FIRE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
ICE DAMAGE	NONE	LIGHT	MODERATE	HEAVY	
EXTENT OF ICE DAMAGE	NONE	LOCAL	WIDESPREAD	EXTENSIVE	
OTHER	NONE	LIGHT	MODERATE	HEAVY	
EXTENT	NONE	LOCAL	WIDESPREAD	EXTENSIVE	

† INTENSITY x EXTENT = SCORE

ELC

WILDLIFE

SITE: Millcroft G.C.
POLYGON: 4
DATE: 23 Oct. 2018
SURVEYOR(S): A. Baron
START TIME: END TIME:

TEMP (°C):	CLOUD (10th):	WIND:	PRECIPITATION:
CONDITIONS:			

POTENTIAL WILDLIFE HABITAT:

	VERNAL POOLS		SNAGS
	HIBERNACULA		FALLEN LOGS

SPECIES LIST:

TY	SP. CODE	EV	NOTES	#	TY	SP. CODE	EV	NOTES	#
B	D. Woodpecker	OV	excavating cavity	1					

FAUNAL TYPE CODES (TY):
B = BIRD M = MAMMAL H = HERPETOFAUNA L = LEPIDOPTERA F = FISH O = OTHER

EVIDENCE CODES (EV):

BREEDING BIRD - POSSIBLE:
SH = SUITABLE HABITAT SM = SINGING MALE

BREEDING BIRD - PROBABLE:
T = TERRITORY D = DISPLAY P = PAIR
A = ANXIETY BEHAVIOUR N = NEST BUILDING V = VISITING NEST

BREEDING BIRD - CONFIRMED:
DD = DISTRACTION NU = USED NEST FY = FLEDGED YOUNG
NE = EGGS NY = YOUNG FS = FOOD/FAECAL SACK
AE = NEST ENTRY

OTHER WILDLIFE EVIDENCE:
OB = OBSERVED VO = VOCALIZATION CA = CARCASS
DP = DISTINCTIVE PARTS HO = HOUSE/DEN FY = EGGS OR YOUNG
TK = TRACKS FE = FEEDING EVIDENCE SC = SCAT
SI = OTHER SIGNS (specify)

Beacon Environmental Project # d16081.a

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Millcroft GC works yard | POLYGON: 1
SURVEYOR(S): Ash Bacon | DATE: Sept 17, '19 | TIME: start / finish
UTMZ: 17 | UTME: 595949 | UTMN: 4805840

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
G TERRESTRIAL	G ORGANIC	G LACUSTRINE	G NATURAL	G PLANKTON	G LAKE
G WETLAND	G MINERAL SOIL	G RIVERINE	G CULTURAL	G SUBMERGED	G POND
G AQUATIC	G PARENT MIN.	G BOTTOMLAND		G FLOATING-LVD.	G RIVER
	G ACIDIC BEDRK.	G TERRACE		G GRAMINOID	G STREAM
	G BASIC BEDRK.	G VALLEY SLOPE		G FORB	G MARSH
	G CARB. BEDRK.	G TABLELAND		G LICHEN	G SWAMP
SITE		G ROLL. UPLAND		G BRYOPHYTE	G FEN
G OPEN WATER		G CLIFF	COVER	G DECIDUOUS	G BOG
G SHALLOW WATER		G TALUS	G OPEN	G CONIFEROUS	G BARREN
G SUBSURFICIAL DEP.		G CREVICE / CAVE	G SHRUB	G MIXED	G MEADOW
G BEDROCK		G ALVAR	G TREED		G PRAIRIE
		G ROCKLAND			G THICKET
		G BEACH / BAR			G SAVANNAH
		G SAND DUNE			G WOODLAND
		G BLUFF			G FOREST
					G PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY		O	
2	SUB-CANOPY	3	1	ACENEGU
3	UNDERSTOREY	4	1	ELAANGU > SAMCANA
4	GRD. LAYER	5	4	SOLCANA > BROININ = POAPRAT

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT<10 m 4 = 1<HT≤2 m 5 = 0.5<HT<1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION: | BA:

		< 10	10 - 24	25 - 50	> 50
SIZE CLASS ANALYSIS:					
STANDING SNAGS:		< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:		< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER	Y	YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

unknown, could not access hydro corridor

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:	Cultural	CU
COMMUNITY SERIES:	Cultural meadow	CUM
ECOSITE:	Mineral Cultural Meadow	CUM1
VEGETATION TYPE:	Dry-moist old field meadow	CUM1-1
INCLUSION		
COMPLEX		

Notes: Surveyed from adjacent lands.

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
ACENEGU		R			
SAMCANA			R		
CORRACE				R	
ELAANGU			R		

SPECIES CODE	LAYER 1	2	3	4	COL.
SOLCANA				D	
ASTNOVA				A	
DAUCARO				A	
BROININ				A	
tansel				O	
MELALBA				O	
LIGVULG				O	
ASCSYRY				O	
URTDIDI				O	
NEPCATA				R	
Phil. fleabane				O	
VERHAST				R	
deadly nightshade				O	
CIRARVE				O	
ASTLANC				R	
PHRAUST				R	
OENBIEN				R	
POAPRAT				A	
PHAARUN				A	

Beacon Environmental Project # 216081.2

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Millcroft Works Yard		POLYGON: 2	
SURVEYOR(S): AVB	DATE: 17 Sept. '19	TIME: start / finish	
UTMZ: 17	UTME: 595938	UTMN: 4805757	

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
G TERRESTRIAL	G ORGANIC	G LACUSTRINE	G NATURAL	G PLANKTON	G LAKE
G WETLAND	G MINERAL SOIL	G RIVERINE	G CULTURAL	G SUBMERGED	G POND
G AQUATIC	G PARENT MIN.	G BOTTOMLAND		G FLOATING-LVD.	G RIVER
	G ACIDIC BEDRK.	G TERRACE		G GRAMINOID	G STREAM
SITE	G BASIC BEDRK.	G VALLEY-SLOPE	**COVER**	G FORB	G MARSH
	G CARB. BEDRK.	G TABLELAND		G LICHEN	G SWAMP
G OPEN WATER		G ROLL. UPLAND	G OPEN	G BRYOPHYTE	G FEN
G SHALLOW WATER		G CLIFF	G SHRUB	G DECIDUOUS	G BOG
G SURFICIAL DEP.		G TALUS	G TREED	G CONIFEROUS	G BARREN
G BEDROCK		G CREVICE / CAVE		G MIXED	G MEADOW
		G ALVAR			G PRAIRIE
		G ROCKLAND			G THICKET
		G BEACH / BAR			G SAVANNAH
		G SAND DUNE			G WOODLAND
		G BLUFF			G FOREST
					G PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY		0	
2	SUB-CANOPY		0	
3	UNDERSTOREY		0	
4	GRD. LAYER	3	4	PHRAUST >> ASTLANC

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	< 10	10 - 24	25 - 50	> 50
STANDING SNAGS:	< 10	10 - 24	25 - 50	> 50
DEADFALL / LOGS:	< 10	10 - 24	25 - 50	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :	PIONEER	YOUNG	MID-AGE	MATURE	OLD GROWTH
		✓			

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		MA
COMMUNITY SERIES:		MAM
ECOSITE:	Mineral meadow marsh	MAMZ
VEGETATION TYPE:		
INCLUSION		
COMPLEX		

Notes:

Phragmites patch.

Also spreading along road blvd.

ELC PLANT SPECIES LIST

SITE:

POLYGON:

DATE:

SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER

ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2	3	4	COL.
PHRAUST				D	
ASTLANC				O	

SPECIES CODE	LAYER 1	2	3	4	COL.

Beacon Environmental Project # 216081.2

ELC COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: Millcroft GC Works Yard | POLYGON: 3
SURVEYOR(S): Ash Bacon | DATE: 19 Sept. 19 | TIME: start / finish
UTMZ: 17 | UTME: 595975 | UTMN: 4805727

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
G TERRESTRIAL	G ORGANIC	G LACUSTRINE	G NATURAL	G PLANKTON	G LAKE
G WETLAND	G MINERAL SOIL	G RIVERINE	G CULTURAL	G SUBMERGED	G POND
G AQUATIC	G PARENT MIN.	G BOTTOMLAND		G FLOATING-LVD.	G RIVER
	G ACIDIC BEDRK.	G TERRACE		G GRAMINOID	G STREAM
SITE	G BASIC BEDRK.	G VALLEY SLOPE	**COVER**	G FORB	G MARSH
G OPEN WATER	G CARB. BEDRK.	G TABLELAND	G OPEN	G LICHEN	G SWAMP
G SHALLOW WATER		G ROLL. UPLAND	G SHRUB	G BRYOPHYTE	G FEN
G SURFICIAL DEP.		G CLIFF	G TREED	G DECIDUOUS	G BOG
G BEDROCK		G TALUS		G CONIFEROUS	G BARREN
		G CREVICE / CAVE		G MIXED	G MEADOW
		G ALVAR			G PRAIRIE
		G ROCKLAND			G THICKET
		G BEACH / BAR			G SAVANNAH
		G SAND DUNE			G WOODLAND
		G BLUFF			G FOREST
					G PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY		0	
2	SUB-CANOPY		0	
3	UNDERSTOREY		0	
4	GRD. LAYER	4	4	TYPANGU >> LYTSALI > ASTLANC

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m
CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION: | BA:

SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER	>	YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

No access in hydro corridors.

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:		MA
COMMUNITY SERIES:		MAS
ECOSITE:	1 /	MAS 2
VEGETATION TYPE:	Cattail Mineral Shallow Marsh	MAS 2-1
INCLUSION		
COMPLEX		

Notes:

ELC PLANT SPECIES LIST

SITE:
POLYGON:
DATE:
SURVEYOR(S):

LAYERS: 1 = CANOPY 2 = SUB-CANOPY 3 = UNDERSTOREY 4 = GROUND (GRD.) LAYER
ABUNDANCE CODES: R = RARE O = OCCASIONAL A = ABUNDANT D = DOMINANT

SPECIES CODE	LAYER 1	2			COL.
TYPANGU				D	
ASTLANC				O	
SOLCANA				O	
LYTSALI				A	
VERHAST				O	

SPECIES CODE	LAYER 1	2	3	4	COL.

216081,2

Millcroft Greens Area E, ↓ soils

March 30, 2020

Phrag. wetland behind GC maintenance yard:
595932, 4805437

Horizon	Soil Type
A, 0-10 cm	SiC
B, 10-46 cm	SiC ~ gravel fill, diff. to auger through.

↳ practical refusal @ 46cms.
↳ thick thatch, no mottles or gley.

Cattail wetland behind GC maintenance yard:

Horizon	Soil Type
A, 0-12cm	SiC
B, 12-14cm	mS
C, 14-65cm	SiC ~ gravel fill, diff. to auger through.

↳ practical refusal @ 65cms
↳ no mottles or gley.
sample @ 595976, 4805731

end.

QE, Non Botanic, 2 Notify Confidential Burlington KCFAC

Project: 216081.2 Millcroft
Project Manager: SG Mesnotify Confidential
Field Staff: ~~AB~~ RPC, AC
Date of Site Visit(s): June 7/19
Type of Data Collected: Onsite: 6:05 – 6:50 am
Data Collected With:
Notes: Nice
Weather: 14°C, windo, Cloud 0%

Run Country Club Dr

Wandering Meadow Rd

Parklane Crescent
Hadfield Court
Millcroft Park Drive
Country Club Drive
Simcoe Drive
Susan Court
Mckerlie Crescent
Upper Middle Road

597000 597100 597200 597300 597400 597500 597600 597700 597800
4805100 4805000 4804900 4804800 4804700

0 25 50 100 Metres

N W E S

FY = Pledged young

Project: 216081.2
Project Manager: SG
Field Staff: AB
Date of Site Visit(s):
Type of Data Collected:
Data Collected With:
Notes:

Parklane Crescent
Hadfield Court
Millcroft Park Drive
Country Club Drive
Simcoe Drive
Susan Court
Mckerlie Crescent
Upper Middle Road

597000 597100 597200 597300 597400 597500 597600 597700 597800
4805100 4805000 4804900 4804800 4804700

0 25 50 100 Metres
N W E S

July 3/19 RFLAC 6:40am - 7:35am Weather: 23°C, wind 0/1 Cloud: 20% → 100%

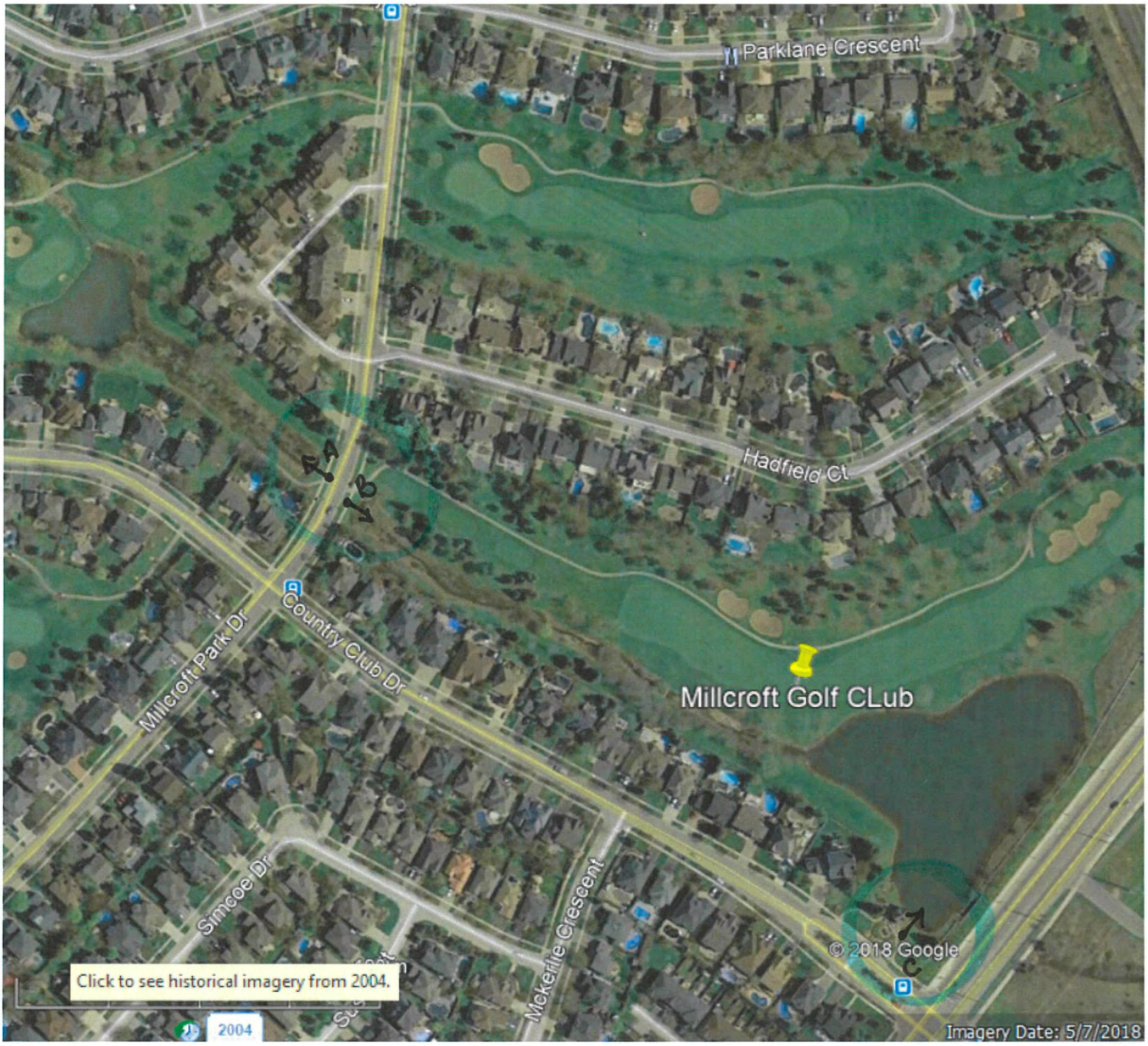
2160081.2 - Turtle Survey Oct 10 2018

26°C, sunny w clouds
on site 330pm - 4pm

- 2 turtles spotted in pond but none basking (Midland painted)

- pond temp 21°C
- channel connecting into pond 19°C.

Rite in the Rain



Millcroft GC.
216081

Anuran calling survey stations
A-C.

Amphibian Data Form

BEACON ENVIRONMENTAL

Visit Information

Project Name: Millcroft GC
Project #: 216081
Observer Name: A. Baron
Visit #: 1
Date: April 18, 2019
Cloud Cover (%): 100
Temperature (°C): 16 air | 14 water @ C
Beaufort Wind Scale (0-6): 2
Precipitation (check one): ☐ None/Dry ☐ Damp/Haze/Fog ☐ Drizzle ☒ Rain

Call Level Codes

Code 1: Calls not simultaneous, number of individuals can be accurately counted.

Code 2: Some calls simultaneous, number of individuals can be reliably estimated.

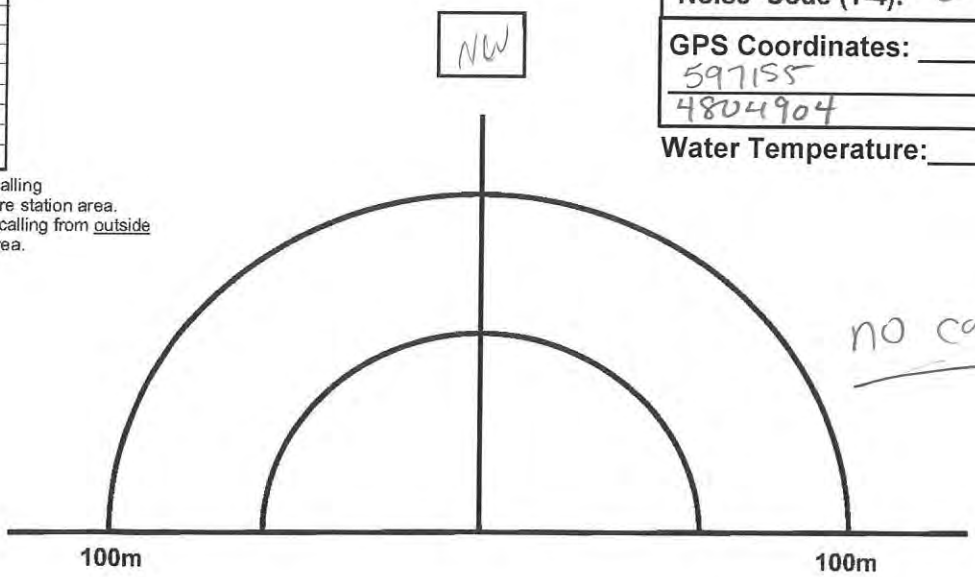
Code 3: Full chorus, call continuous and overlapping, number of individuals cannot be reliably estimated.

Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

Station A

Station Start Time (24 hr): 1017
Background Noise Code (1-4): 2
GPS Coordinates: 597155 4804904
Water Temperature: ____



no calls

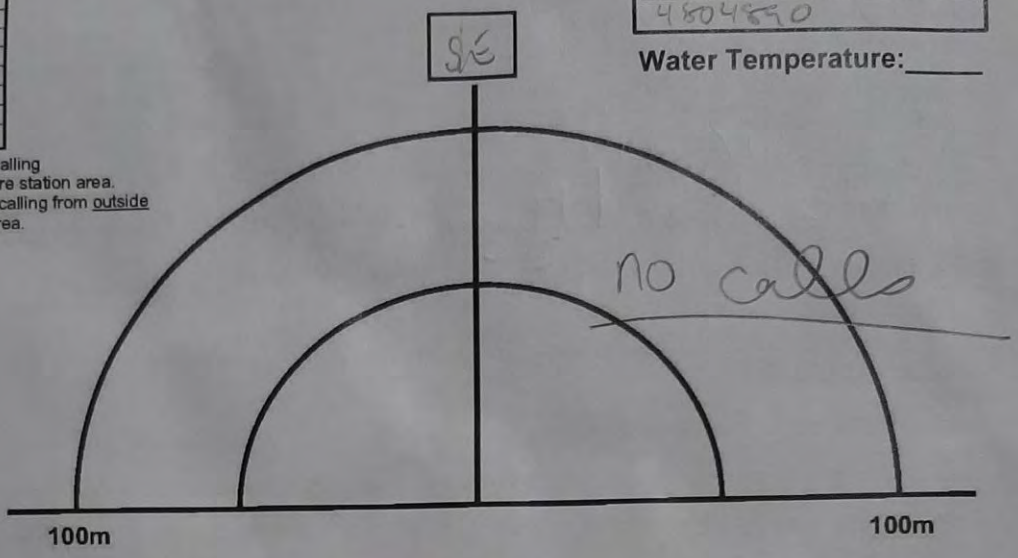
Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

Station B

Station Start Time (24 hr):	10:21
Background Noise Code (1-4):	2
GPS Coordinates:	
597170	
4804890	

Water Temperature:____



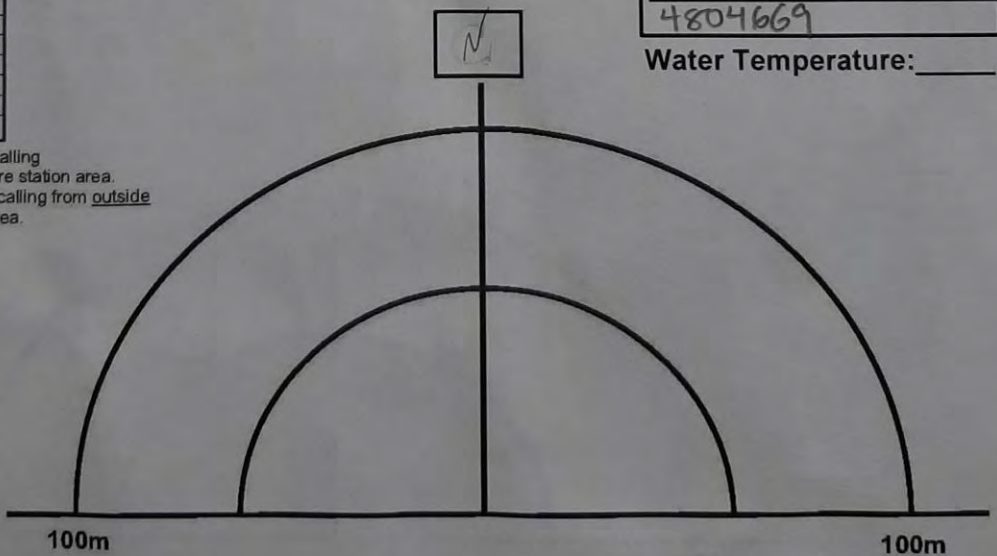
Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

Station C

Station Start Time (24 hr):	10 30
Background Noise Code (1-4):	2
GPS Coordinates:	
597475	
4804669	

Water Temperature:____



no calls

Amphibian Data Form

BEACON ENVIRONMENTAL

Visit Information

Project Name: Millcroft GC

Project #: 216081.2

Observer Name: A. Baron

Visit #: 2

Date: 27 May 2019

Cloud Cover (%): 100

Air Temperature (°C): 17

Beaufort Wind Scale (0-6): 0

Precipitation (check one): ☒ None/Dry ☐ Damp/Haze/Fog ☐ Drizzle ☐ Rain

Call Level Codes

Code 1: Calls not simultaneous, number of individuals can be accurately counted.

Code 2: Some calls simultaneous, number of individuals can be reliably estimated.

Code 3: Full chorus, call continuous and overlapping, number of individuals cannot be reliably estimated.

Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

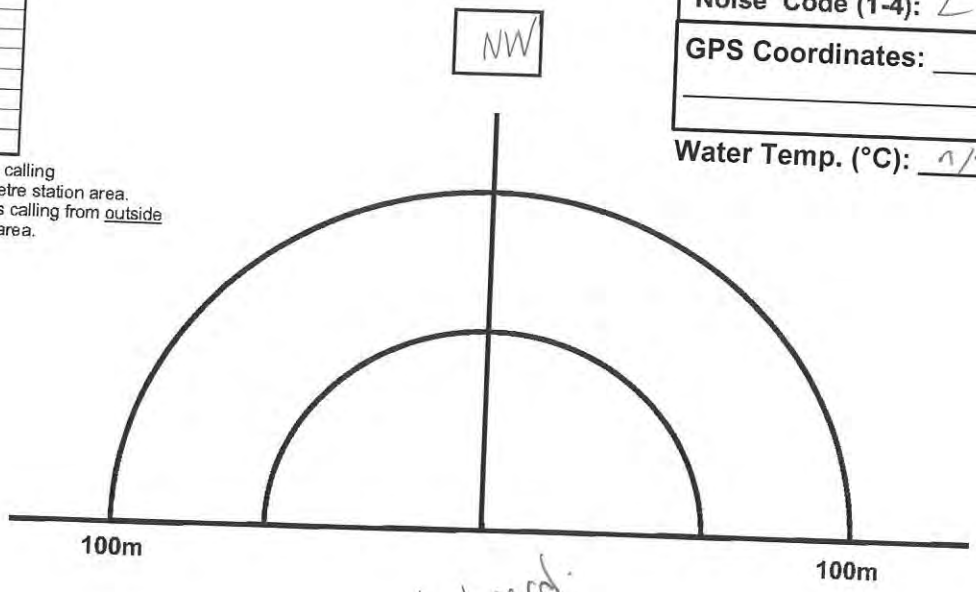
Station A

Station Start Time (24 hr): 21:44

Background Noise Code (1-4): 2

GPS Coordinates:

Water Temp. (°C): n/a



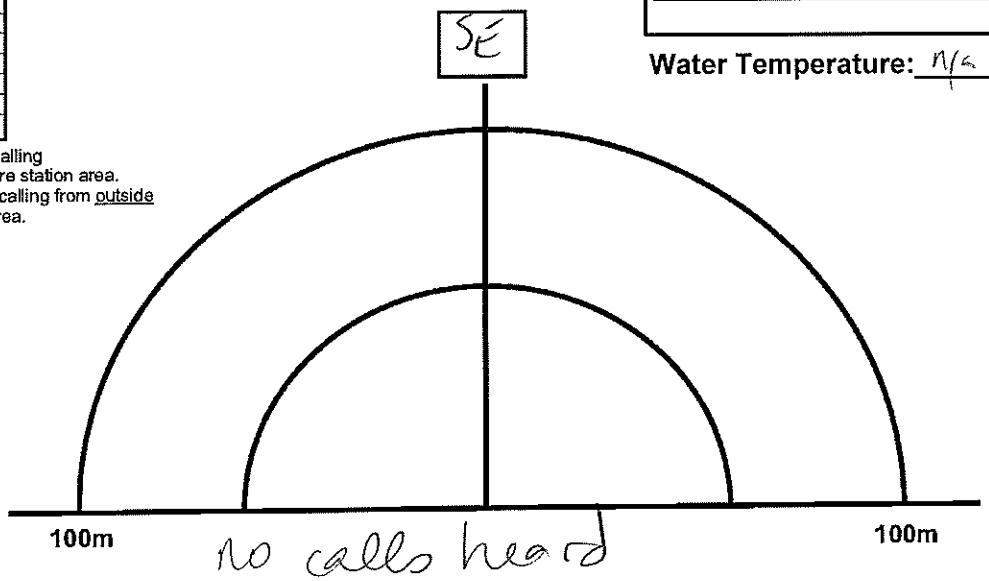
no calls heard.

Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

Station B

Station Start Time (24 hr):	21:51
Background Noise Code (1-4):	3
GPS Coordinates:	
Water Temperature:	n/a



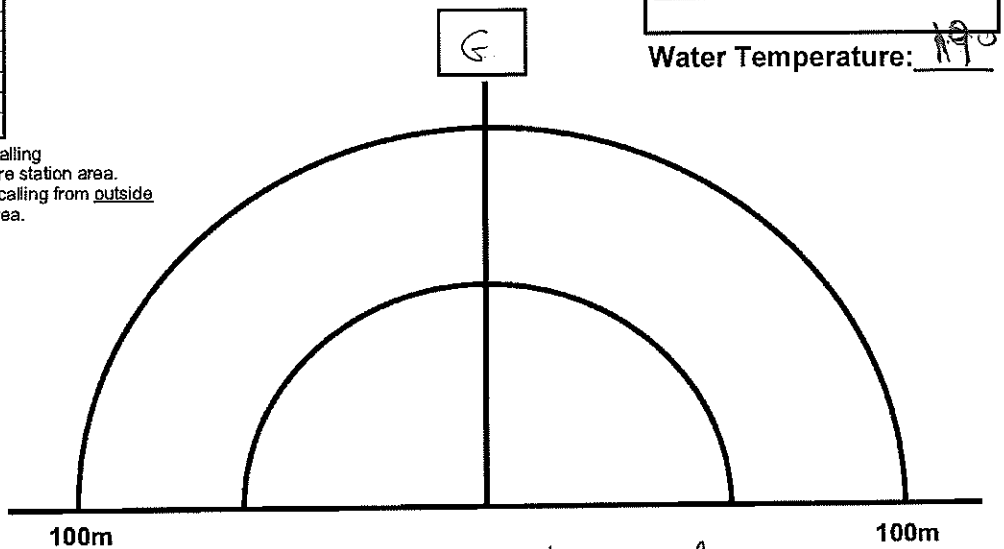
no calls heard

Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

Station C

Station Start Time (24 hr):	22:00
Background Noise Code (1-4):	3
GPS Coordinates:	
Water Temperature:	19°



saw a fish leap out of the pond

no calls heard.

Amphibian Data Form

BEACON ENVIRONMENTAL

Visit Information

Project Name: Millcroft GC
Project #: 216081.2
Observer Name: A. Corrigan
Visit #: 3
Date: June 26, 2019
Cloud Cover (%): 10%
Temperature (°C): 19°C
Beaufort Wind Scale (0-6): 0
Precipitation (check one): ☒ None/Dry ☐ Damp/Haze/Fog ☐ Drizzle ☐ Rain
↳ humid

Call Level Codes

Code 1: Calls not simultaneous, number of individuals can be accurately counted.

Code 2: Some calls simultaneous, number of individuals can be reliably estimated.

Code 3: Full chorus, call continuous and overlapping, number of individuals cannot be reliably estimated.

Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR	✓	
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

Station C

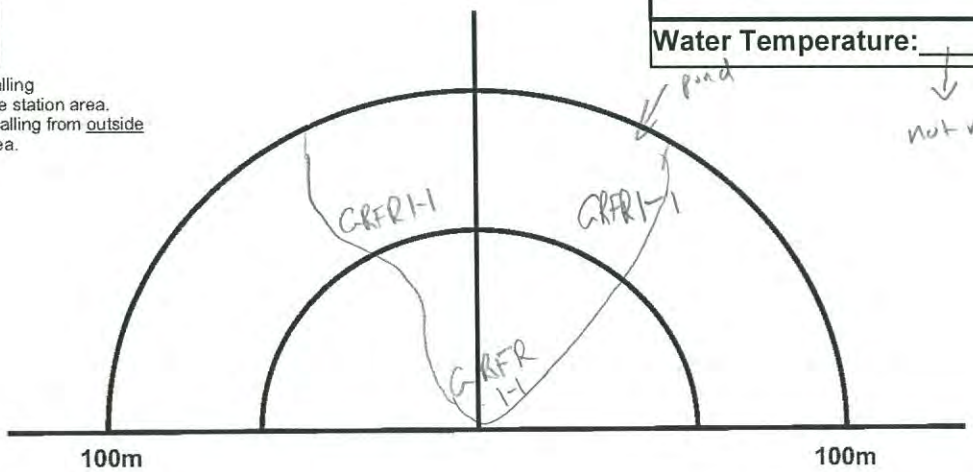
NE

Station Start Time (24 hr): 22:25pm

Background Noise Code (1-4): 3

GPS Coordinates: see previous notes

Water Temperature: not recorded



Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

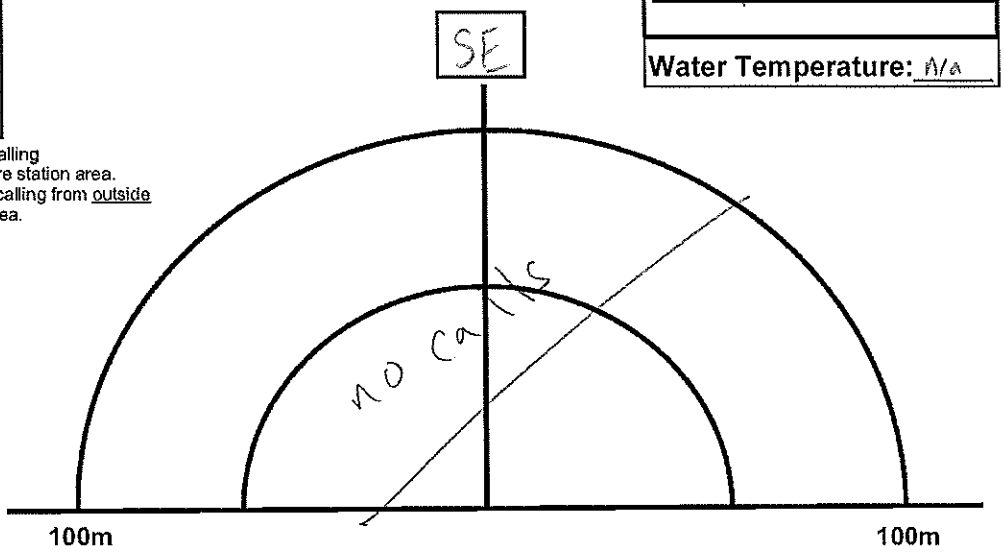
Station B

Station Start Time (24 hr): 22:35

Background Noise Code (1-4): 3

GPS Coordinates: See previous notes

Water Temperature: N/A



Species	In*	Out**
AMTO		
BCFR		
BULL		
CHFR		
CGTR		
FOTO		
GRTR		
GRFR		
MIFR		
NLFR		
PIFR		
SPPE		
WOFR		

* Check if species is calling from inside 100-metre station area.
** Check if species is calling from outside 100-metre station area.

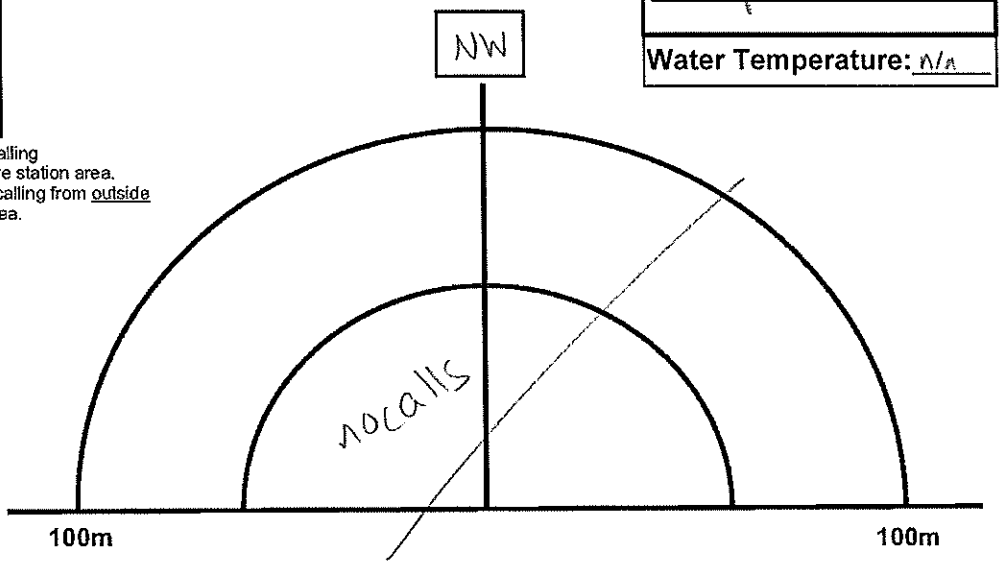
Station A

Station Start Time (24 hr): 22:39

Background Noise Code (1-4): 3

GPS Coordinates: See previous notes

Water Temperature: N/A



216081.2 - Millcroft Oct 23
Aquatic Habitat Assess. 2018

below weir 8.1°C

WP001 - 8°C
WP 002 - 6.9°C

photo 66 - below weir
photos 67-70 pond

WP 003 - 7.1°C
WP 004 - 7.6°C in mouth of creek

WP 005, photo 74+75 fish baracade
- sand + cobble

- bottom to top of blockage 21cm
- black blockage height = 11cm

- WP 005 tree roots + woody debris
  ↳ cobble substrate

- WP 006 clay bottom → photo 82
- WP 007 H2O depth = 8cm

photo 83 + 84 → DS + US

- cobble on clay. - photo 85
- photo 86 riffle WP 008
- WP 9 fish block - 11 cm tall
  ↳ cobble substrate above block
- photo 90 → oil in H2O
- 91 + 92 → aquatic veg
- photo 94 + 95 → US & DS view
- WP 10 → H2O 15 cm deep
- WP 11 → fish barrier photo 98.
- WP 12, photo 100 facing US.
- WP 13 photo 101 → riffle.
- photo 102 → fish barrier 10cm
- photo 103 + 104 → facing DS tall.
- WP 14 → pool 31+cm + US.
- WP 15 + photo 105 facing US.
- WP 16 - larger cobble photo 106 facing DS
- camera died → using phone
- WP 17 → cobble riffle
- WP 18 → fish barrier
- WP 19 → 7.8°C, 16cm deep
- WP 20 → fish barrier across street.

Rite in the Rain

2nd pond - 7.7 °C.
WP a1 - 8.8° C
WP a2 - 8.9° C

Sept 26 2019

Millcroft Aquatic Hab Assessment

Sheldon Creek

- silt sand clay
- cat tails
- no instream veg
- low water movement
- very shaded
- golf course surrounding

Rite in the Rain

BEACON ENVIRONMENTAL

Aquatic Field Investigations
Fish Community Sampling

Date: 2019-Sep-26
Weather: Sunny 20°C
Licence #: 1094220
Waypoint #: N/a
Length of Channel Fished: Pond 1 → pond 3

Project: 216081
Watercourse: Appleby Creek
Reach: N/a

pond 1 → 502.1 s
channel to bridge → 1452 (minus the pond)

Sampled Fish Common Name	Total Count (Dot Tally)	Photo #
Large-mouth Bass	Pond 1 → ⊠ ⊠ •• channel 1 → ⊠ •• pond 2 → ⊠	
Goldfish	Pond → ⊠ ⊠ ⊠ ⊠ ⊠ channel 1 → ⊠ pond 2 → ⊠	
pumpkin	pond 1 → •• pond 2 → ••	
creek chub	pond 1 → • channel 1 → ⊠ ⊠ ⊠ ⊠ ⊠ ⊠ ⊠ ⊠ ⊠ pond 2 •	
creek chub	Channel 2 ⊠ ⊠ ⊠ ••	
fathead minnow	channel 2 •	
pumkin seed	channel 2 • pond 3 ••	

Field Crew: GC/JD
Protocol: N/a

2578.2 s ← total seconds for the day.

Recorded by: GC

Appendix F

List of Vascular Plants

Appendix F

Plant List

Species		CC	CW	Status					Introduced 0=n 1=y	Vegetation Community						
Scientific Name	Common Name			COSEWIC	COSSARO	G-Rank	S-Rank	Halton		ELC Com. 1: SAS1-4	ELC Com. 2: SWT2-2	ELC Com. 3: CUM1-1	ELC Com. 4: CUT1-1	ELC Com. 5: CUM1-1	ELC Com. 6: MAM2	ELC Com. 7: MAS2-1
Acer negundo	Manitoba Maple	0	-2			G5	S5		0					X		
Acer platanoides	Norway Maple	0	5			G?	SE5	I	I			X				
Acer X freemanii	Freeman's Maple					G?	S5	HC	0		X	X				
Alliaria petiolata	Garlic Mustard	0	0			G?	SE5	I	I		X		X			
Arctium minus ssp. minus	Common Burdock	0	5			G?	SE5	I	I		X		X			
Bidens cernua	Nodding Beggar-ticks	2	-5			G5	S5	HC	0	X						
Bromus inermis ssp. inermis	Smooth Brome	0	5			G4G5	SE5	I	I			X	X			
Carex sp.	Sedge Species								0		X					
Carex vulpinoidea	Fox Sedge	3	-5			G5	S5	HC	0		X					
Cirsium arvense	Canada Thistle	0	3			G?	SE5	I	I		X		X	X		
Cornus foemina ssp. racemosa	Grey Dogwood	2	-2			G5	S5	HC	0		X			X		
Cornus stolonifera	Red-osier Dogwood	2	-3			G5	S5	HC	0		X					
Dactylis glomerata	Orchard Grass	0	3			G?	SE5	I	I			X	X			
Daucus carota	Wild Carrot	0	5			G?	SE5	I	I		X	X		X		
Dipsacus fullonum ssp. sylvestris	Common Teasel	0	5			G?	SE5	I	I		X	X	X			
Elaeagnus angustifolia	Russian Olive	0	4			G?	SE3		I					X		
Elymus repens	Quack Grass	0	3			G5	SE5	I	I			X	X			
Erigeron philadelphicus ssp. philadelphicus	Philadelphia Fleabane	1	-3			G5	S5		0					X		
Euthamia graminifolia	Grass-leaved Goldenrod	2	-2			G5	S5	HC	0		X					
Fraxinus americana	White Ash	4	3			G5	S5	HC	0		X	X	X			
Galium palustre	Marsh Bedstraw	5	-5			G5	S5	HC	0	X						
Geum aleppicum	Yellow Avens	2	-1			G5	S5	HC	0		X	X				
Impatiens capensis	Spotted Touch-me-not	4	-3			G5	S5	HC	0		X					
Iris pseudacorus	Yellow Iris	0	-5			G?	SE3	I	I	X						
Juniperus chinensis	Chinese Juniper								I							
Leonurus cardiaca ssp. cardiaca	Motherwort	0	5			G?	SE5	I	I				X			
Ligustrum vulgare	Common Privet	0	1			G?	SE5		I					X		
Linaria vulgaris	Butter-and-eggs	0	5			G?	SE5	I	I			X				
Lonicera tatarica	Tartarian Honeysuckle	0	3			G?	SE5	I	I			X	X			
Lycopus uniflorus	Northern Water-horehound	5	-5			G5	S5	HC	0	X	X					
Lythrum salicaria	Purple Loosestrife	0	-5			G5	SE5	I	I	X	X					X
Malus baccata	Crabapple (planted)							I	I			X				
Malus pumila	Common Apple	0	5			G5	SE5	I	I			X				
Melilotus alba	White Sweet-clover	0	3			G5	SE5	I	I			X		X		

Species		CC	CW	Status					Introduced 0=n 1=y	Vegetation Community						
Scientific Name	Common Name			COSEWIC	COSSARO	G-Rank	S-Rank	Halton		ELC Com. 1: SAS1-4	ELC Com. 2: SWT2-2	ELC Com. 3: CUM1-1	ELC Com. 4: CUT1-1	ELC Com. 5: CUM1-1	ELC Com. 6: MAM2	ELC Com. 7: MAS2-1
Mentha arvensis ssp. borealis	Wild Mint	3	-3			G5	S5	HC	0	X	X					
Myriophyllum sp	Water-milfoil Species								0	X						
Nepeta cataria	Catnip	0	1			G?	SE5		I					X		
Oenothera biennis	Common Evening-primrose	0	3			G5	S5	H?	0	X		X		X		
Pastinaca sativa	Wild Parsnip	0	5			G?	SE5	I	I		X					
Phalaris arundinacea	Reed Canary Grass	0	-4			G5	S5	HC	0		X					
Phleum pratense	Timothy	0	3			G?	SE5	I	I		X					
Phragmites australis	Common Reed	0	-4			G5	S5		0					X	X	
Poa palustris	Fowl Blue Grass	5	-4			G5	S5	HC	0		X					
Poa pratensis ssp. pratensis	Kentucky Blue Grass	0	1			G?	S5	HC	0	X	X	X	X			
Populus deltoides ssp. deltoides	Eastern Cottonwood	4	-1			G5	S5	HC	0		X					
Rhamnus cathartica	Common Buckthorn	0	3			G?	SE5	I	I		X		X			
Rhus typhina	Staghorn Sumac	1	5			G5	S5	HC	0				X			
Rosa canina	Dog Rose	0	5			G?	SE2	I	I				X			
Rosa multiflora	Multiflora Rose	0	3			G?	SE4	I	I		X					
Rosa sp	Rose Species (horticultural)								0				X			
Rubus idaeus ssp. idaeus	Red Raspberry	0	5			G5	SE1	I	I		X					
Salix alba	White Willow	0	-3			G5	SE4	I	I		X					
Salix discolor	Pussy Willow	3	-3			G5	S5	HC	0		X					
Salix eriocephala	Woolly-headed Willow	4	-3			G5	S5	HC	0		X					
Salix exigua	Sandbar Willow	3	-5			G5	S5	HC	0		X					
Salix petiolaris	Slender Willow	3	-4			G5	S5	HC	0		X					
Salix sepulcralis	Hybrid Willow							I	0		X					
Sambucus canadensis	Common Elderberry	5	-2			G5	S5		0					X		
Scirpus atrovirens	Black Bulrush	3	-5			G5?	S5	HC	0		X					
Sicyos angulatus	One-seeded Bur Cucumber	5	-2			G5	S5	HR	0		X					
Solanum dulcamara	Bittersweet Nightshade	0	0			G?	SE5	I	I		X	X	X	X		
Solidago altissima var. altissima	Tall Goldenrod	1	3			G?	S5	HC	0		X					
Solidago canadensis var. canadensis	Canada Goldenrod	1	3			G5	S5	HC	0		X	X	X			X
Sonchus arvensis ssp. arvensis	Field Sow-thistle	0	1			G?	SE5	I	I			X				
Symphyotrichum lanceolatum ssp. lanceolatum	Panicled Aster	3	-3			G5	S5	HC	0	X	X	X		X	X	X
Symphyotrichum novae-angliae	New England Aster	2	-3			G5	S5	HC	0		X	X		X		
Taraxacum officinale	Common Dandelion	0	3			G5	SE5	I	I			X				
Tiarella cordifolia	Foamflower	6	1			G5	S5	HC	0				X			
Typha angustifolia	Narrow-leaved Cattail	3	-5			G5	S5	I	0		X					X
Urtica dioica ssp. dioica	European Stinging Nettle	0	-1			G5T?	SE2		I					X		
Verbena hastata	Blue Vervain	4	-4			G5	S5	HC	0		X			X		X
Viburnum cassinoides	Wild Raisin	7	-3			G5	S5	HR	0		X					
Viburnum lentago	Nannyberry	4	-1			G5	S5	HC	0		X					
Viburnum opulus	European Highbush Cranberry	0	0			G5	SE4	I	I		X					

Species		CC	CW	Status					Introduced 0=n 1=y	Vegetation Community						
Scientific Name	Common Name			COSEWIC	COSSARO	G-Rank	S-Rank	Halton		ELC Com. 1: SAS1-4	ELC Com. 2: SWT2-2	ELC Com. 3: CUM1-1	ELC Com. 4: CUT1-1	ELC Com. 5: CUM1-1	ELC Com. 6: MAM2	ELC Com. 7: MAS2-1
Vicia cracca	Cow Vetch	0	5			G?	SE5	I	I			X				
Vitis riparia	Riverbank Grape	0	-2			G5	S5	HC	0		X		X			
Xanthium strumarium	Cocklebur	2	0			G?	S5	HC	0		X					

Appendix G

Development Plan



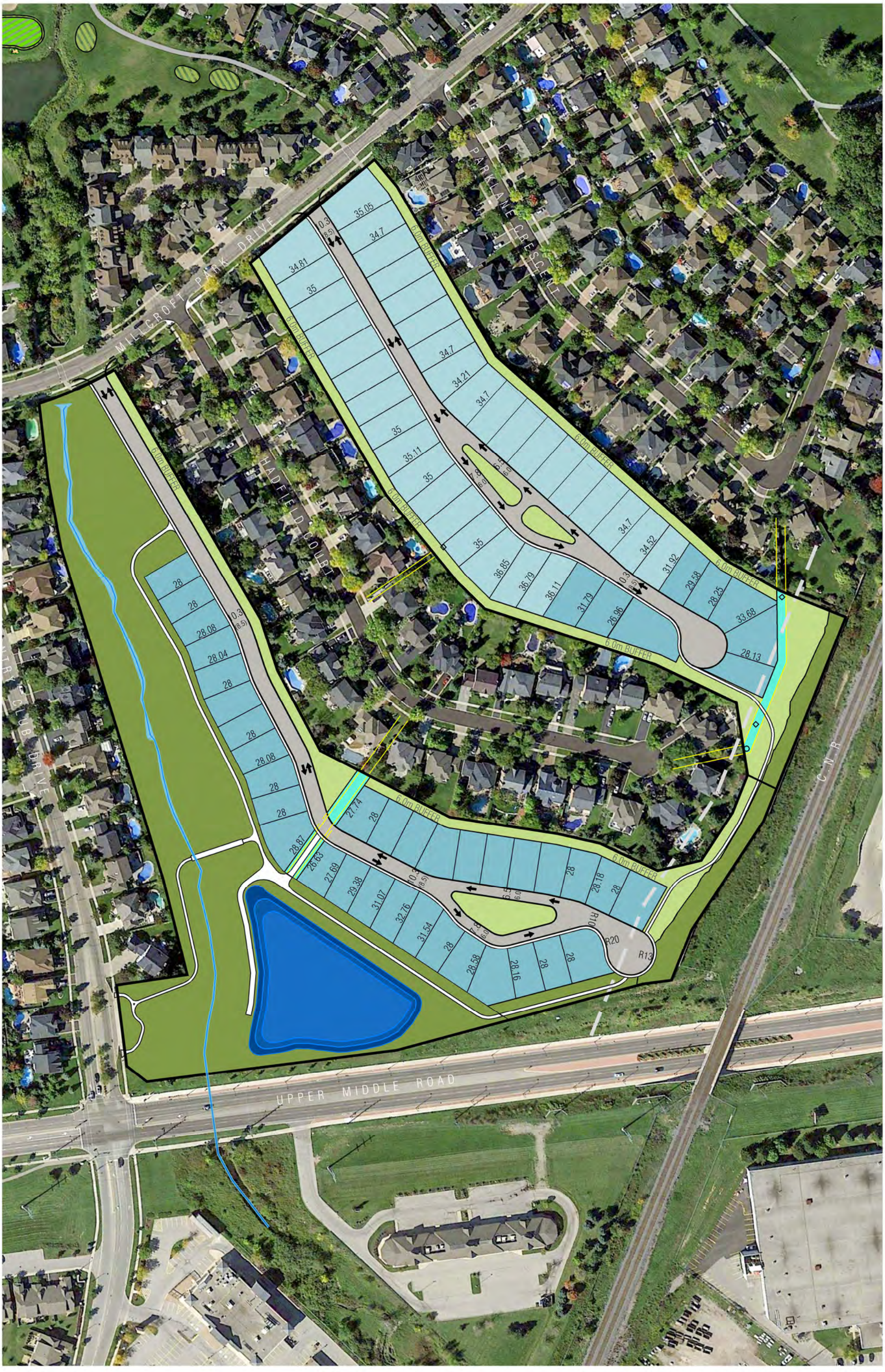
- All Units In Metric Unless Otherwise Noted.
- Base Information Obtained From Various Sources And Is Approximate.
- Schedule / Plan Information Is Conceptual And Requires Verification by Appropriate Agency.
- Aerial Photo: Google Earth, Approx. Spring 2015

GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT

PROJECT 1516
DATE OCT 5, 2020
SCALE NTS



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GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT - AREAS A & B

PROJECT 1516
DATE OCT 5, 2020
SCALE 1:2000

SK-53A&B





- All Units In Metric Unless Otherwise Noted.
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GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT - AREAS C & D

PROJECT 1516
DATE OCT 5, 2020
SCALE 1:1250

SK-53C&D



- All Units In Metric Unless Otherwise Noted.
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- Aerial Photo: Google Earth, Approx. Spring 2015

GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT - AREA 'E'

PROJECT 1516
DATE OCT 5, 2020
SCALE 1:1250

SK-53E

LAND USE SUMMARY

Total Site Area	12.34 ha.	30.49 ac.	
NON-DEVELOPABLE			
NHS	3.15 ha.	7.78 ac.	
Net Developable Area	9.19 ha.	22.71 ac.	100.0%
DEVELOPABLE			
Residential (see 'UNIT SUMMARY')	5.89 ha.	14.55 ac.	64.1%
Easement	0.09 ha.	0.22 ac.	1.0%
Landscape /Amenity Area	1.56 ha.	3.85 ac.	17.0%
Right of Way / Sidewalks	1.65 ha.	4.08 ac.	18.0%
TOTAL (Net Developable)	9.19 ha.	22.71 ac.	100.0%

UNIT SUMMARY

		Unit *width*		Unit Depth	Unit Count	Lot Mix	Frontage *(m)*	Area		% Net Res
SITE A										
Detached Homes	*(50')*	**15.24**	x	28.0	**33**	34%	502.9	1.54 ha.	3.81 ac.	z e
SITE B										
Detached Homes	*(50')*	**15.24**	x	28.0	**8**	8%	121.9	0.46 ha.	1.14 ac.	7.8%
Detached Homes	*(50')*	**15.24**	x	34.5	**34**	35%	518.2	1.88 ha.	4.65 ac.	31.9%
SITE C										
Custom Lot					1	1%	0.0	0.07 ha.	0.17 ac.	1.2%
Detached Homes	*(50')*	**15.24**	x	25.7	2	2%	30.5	0.11 ha.	0.27 ac.	1.9%
Detached Homes	*(50')*	**15.24**	x	28.0	5	5%	76.2	0.27 ha.	0.67 ac.	4.6%
Detached Homes	*(50')*	**15.24**	x	34.5	8	8%	121.9	0.49 ha.	1.21 ac.	8.3%
SITE D										
Detached Homes	*(50')*	**15.24**	x	25.7	1	1%	15.2	0.06 ha.	0.15 ac.	1.0%
Detached Homes	*(50')*	**15.24**	x	28.0	2	2%	30.5	0.12 ha.	0.30 ac.	2.0%
Detached Homes	*(50')*	**15.24**	x	34.5	4	4%	61.0	0.23 ha.	0.57 ac.	3.9%
SITE E										
Condo Units @ 6 Storeys					130			0.66 ha.	1.63 ac.	11.2%
TOTAL					228	100%	1,478.3	5.89 ha.	12.92 ac.	73.9%

ROW SCHEDULE

	(m) *width*	*(lin.m)*	*(lin.m)* *Half*
Local Road	**8.5**	961.8	0.0
Window Road	**6.0**	377.1	0.0
ROW TOTAL		1338.9	0.0

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GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT

PROJECT 1516

DATE OCT 5, 2020

SK-53



PROPOSED REFINED CH ARL

EXISTING CH ARL

- All Units In Metric Unless Otherwise Noted.
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- Aerial Photo: Google Earth, Approx. Spring 2015

GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT

PROJECT 1516

DATE NOV 16, 2020

SCALE NTS



EXISTING DEVELOPMENT CONSTRAINT LIMIT

PROPOSED DEVELOPMENT CONSTRAINT LIMIT

NOTES:

- BUILDING ENVELOPES & GARAGE LOCATIONS ARE SHOWN CONCEPTUALLY AND THESE LOCATIONS WILL BE FURTHER REFINED THROUGH DETAILED DESIGN AND ENGINEERING.
- PROVISIONS FOR ON STREET PARKING IS BEING ACCOMODATED FOR IN THE CONDO ROW CROSS-SECTION

- All Units In Metric Unless Otherwise Noted.
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GERRARD DESIGN

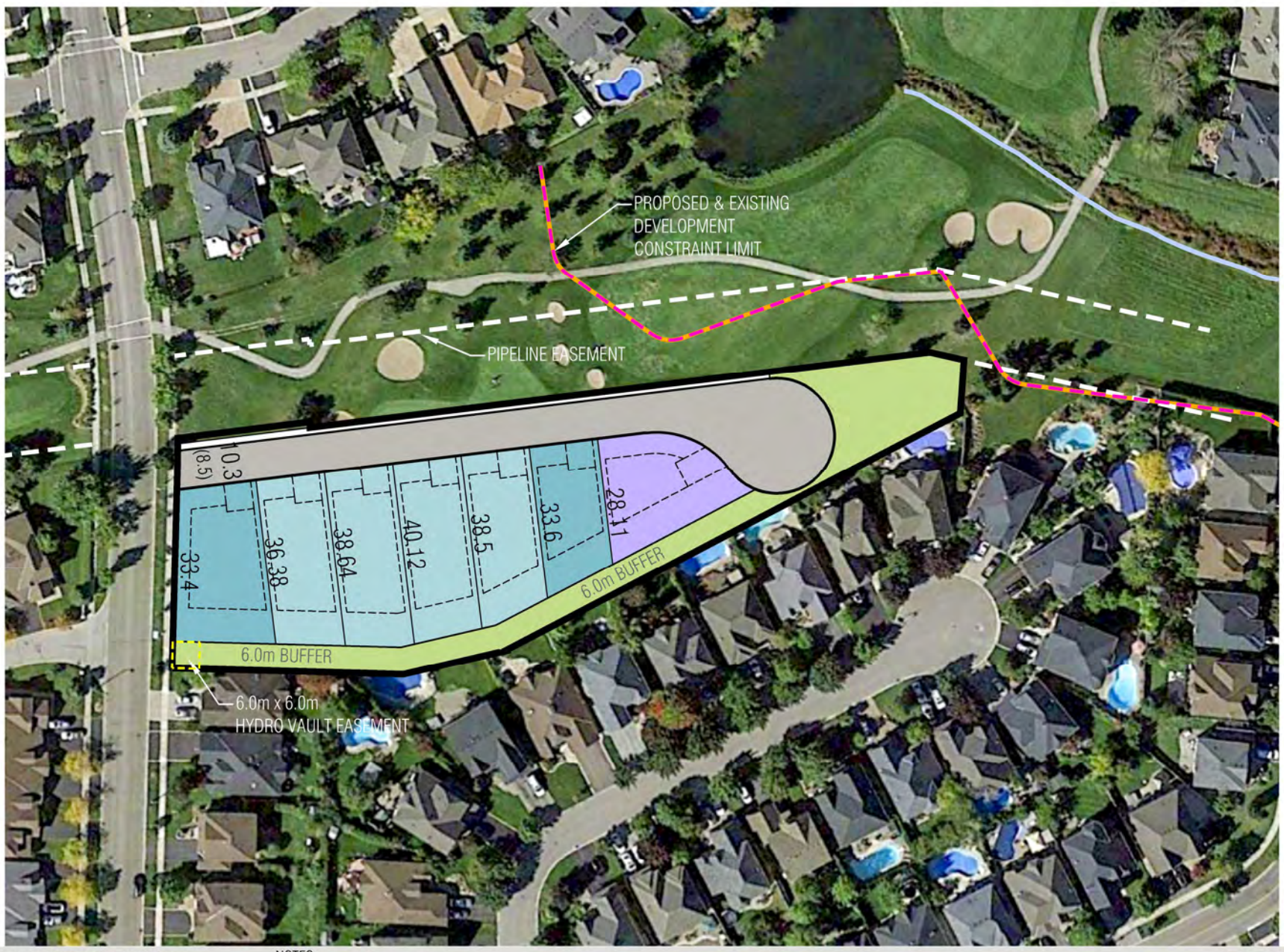
Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT - AREAS A & B

PROJECT 1516
DATE NOV 16, 2020
SCALE 1:2000

SK-53A&B





EXISTING DEVELOPMENT CONSTRAINT LIMIT

PROPOSED DEVELOPMENT CONSTRAINT LIMIT

NOTES:

- BUILDING ENVELOPES & GARAGE LOCATIONS ARE SHOWN CONCEPTUALLY AND THESE LOCATIONS WILL BE FURTHER REFINED THROUGH DETAILED DESIGN AND ENGINEERING.
- PROVISIONS FOR ON STREET PARKING IS BEING ACCOMODATED FOR IN THE CONDO ROW CROSS-SECTION

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- Schedule / Plan Information Is Conceptual And Requires Verification by Appropriate Agency.
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GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT - AREAS C & D

PROJECT 1516
DATE NOV 16, 2020
SCALE 1:1250

SK-53C&D



EXISTING DEVELOPMENT CONSTRAINT LIMIT

PROPOSED DEVELOPMENT CONSTRAINT LIMIT

NOTES:

- BUILDING ENVELOPES & GARAGE LOCATIONS ARE SHOWN CONCEPTUALLY AND THESE LOCATIONS WILL BE FURTHER REFINED THROUGH DETAILED DESIGN AND ENGINEERING.
- PROVISIONS FOR ON STREET PARKING IS BEING ACCOMODATED FOR IN THE CONDO ROW CROSS-SECTION

- All Units In Metric Unless Otherwise Noted.
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- Schedule / Plan Information Is Conceptual And Requires Verification by Appropriate Agency.
- Aerial Photo: Google Earth, Approx. Spring 2015

GERRARD DESIGN

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT - AREA 'E'

PROJECT 1516
DATE NOV 16, 2020
SCALE 1:1250

SK-53E

LAND USE SUMMARY

Total Site Area	12.35 ha.	30.52 ac.	
NON-DEVELOPABLE			
NHS	3.30 ha.	8.15 ac.	
Net Developable Area	9.05 ha.	22.36 ac.	100.0%
DEVELOPABLE			
Residential (see 'UNIT SUMMARY')	5.90 ha.	14.58 ac.	65.2%
Easement	0.09 ha.	0.22 ac.	1.0%
Landscape /Amenity Area	1.44 ha.	3.56 ac.	15.9%
Right of Way	1.62 ha.	4.00 ac.	17.9%
TOTAL (Net Developable)	9.05 ha.	22.36 ac.	100.0%

UNIT SUMMARY

		Unit *width*		Unit Depth	Unit Count	Lot Mix	Frontage *(m)*	Area		% Net Res
SITE A										
Detached Homes	*(50')*	**15.24**	x	28.0	**33**	34%	502.9	1.54 ha.	3.81 ac.	z e
SITE B										
Detached Homes	*(50')*	**15.24**	x	28.0	**8**	8%	121.9	0.46 ha.	1.14 ac.	7.8%
Detached Homes	*(50')*	**15.24**	x	34.5	**34**	35%	518.2	1.88 ha.	4.65 ac.	31.9%
SITE C										
Custom Lot					1	1%	0.0	0.07 ha.	0.17 ac.	1.2%
Detached Homes	*(50')*	**15.24**	x	25.7	2	2%	30.5	0.11 ha.	0.27 ac.	1.9%
Detached Homes	*(50')*	**15.24**	x	28.0	5	5%	76.2	0.27 ha.	0.67 ac.	4.6%
Detached Homes	*(50')*	**15.24**	x	34.5	8	8%	121.9	0.50 ha.	1.24 ac.	8.5%
SITE D										
Detached Homes	*(50')*	**15.24**	x	25.7	1	1%	15.2	0.06 ha.	0.15 ac.	1.0%
Detached Homes	*(50')*	**15.24**	x	28.0	2	2%	30.5	0.12 ha.	0.30 ac.	2.0%
Detached Homes	*(50')*	**15.24**	x	34.5	4	4%	61.0	0.23 ha.	0.57 ac.	3.9%
SITE E										
Condo Units @ 6 Storeys					130			0.66 ha.	1.63 ac.	11.2%
TOTAL					228	100%	1,478.3	5.90 ha.	12.95 ac.	73.9%

ROW SCHEDULE

	(m) *width*	*(lin.m)*	*(lin.m)* *Half*
Local Road	**8.5**	961.8	0.0
Window Road	**6.0**	377.1	0.0
ROW TOTAL		1338.9	0.0

- 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

Millcroft Greens Corporation | Burlington, Ontario

PRELIMINARY DEVELOPMENT CONCEPT

PROJECT 1516

DATE NOV 16, 2020

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