October 2018

DILLON CONSULTING

TOWER HILL DEVELOPMENTS INC.

Environmental Impact Study

Millbrook

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1.0 Introduction

Dillon Consulting Limited (Dillon) was retained by Tower Hill Developments Inc. (Tower Hill) to complete an Environmental Impact Study (EIS) in support of an application for Draft Plan of Subdivision for a property legally described as Part Lots 11 & 12, Concession 6, Township of Cavan-Monaghan, Peterborough County (the "Study Area")(Figure 1). The Study Area is located at 862 Fallis 6th Line, near the Village of Millbrook, fronting on Fallis Line to the south, County Road 10 to the east, and Larmer Line to the north.

The purpose of the EIS is to document existing conditions of the natural environment; determine the potential limits of development; evaluate the potential for environmental impacts associated with the proposed development; and recommend mitigation, restoration, enhancement measures, and/or compensation measures, where necessary, to avoid impacts to the natural environment. The EIS has been prepared in general accordance with the Otonabee Region Conservation Authority (ORCA) EIS Terms of Reference & Submission Standards (December 2015), following the Terms of Reference (TOR) established in consultation with the ORCA and agreed to through correspondence between Dillon and ORCA on September 29, 2017 (see Appendix A).

MILLBROOK
EIS

FIGURE 1
PROPERTY LOCATION

Study Area

1:50,000

0 250 500 1,000 m

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W E
S

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 164800

STATUS: DRAFT

DATE: 10/3/2018

FILE LOCATION: G:\GIS\164800 - Millbrook EIS\mxd\EIS\Figure 1 Property Location.mxd

2.0 Planning Context

The following section has been prepared to identify the applicable land use planning policies related to the natural environment. Various regulatory agencies and legislative authorities have established a number of policies with the purpose of protecting ecological features and functions as outlined below. Table 1 lists the relevant policies and legislation applicable to the protection of natural heritage features within the Township of Cavan-Monaghan, and more specifically, the Study Area; as well as supporting guidance documents and resources consulted respective to each policy. This table also includes additional background information sources used to help identify and define natural heritage features within the province of Ontario, and Eco-region 6E specifically. This section is not intended to constitute a complete land use planning assessment as it focuses on the relevant environmental policies and regulations. The documents referenced below can be read in their entirety for a more detailed understanding of the land use policy framework applicable to the Study Area.

Table 1: Policies, Legislation and Background Resources Searched

POLICY	GUIDELINES AND SUPPORTING DOCUMENTS
PROVINCE OF ONTARIO	
Planning Act, 1990: Provincial Policy Statement (2014)	Policies within Section 2.1 related to natural heritage features
	Ministry of Natural Resources and Forestry (MNRF) Peterborough District Main Contact: Cara Hernould, A/District Planner · Records for sensitive species, significant wildlife habitat, and wetlands provided.
	MNRF Natural Heritage Information Centre (NHIC) Square #17QJ0491, 17QJ0492 · Species of Conservation Concern · Species at Risk · Natural heritage features
	Ecological Land Classification for Southern Ontario, Second Approximation, 2008
	Natural Heritage Reference Manual, Second Edition, March 2010
	Ontario Wetland Evaluation System, Southern Manual, Third Edition, 2013
	MNRF Significant Wildlife Habitat Technical Guide (2000) · Significant Wildlife Habitat Eco-region 6E Criterion Schedules, 2015
	Fisheries and Oceans Canada (DFO) · Ontario South West Map 6 of 34 (September 2016)
	Federal Species at Risk Public Registry, accessed June 2017
	Ontario Breeding Birds Atlas (OBBA) Square #17QJ09
	Ontario Reptile and Amphibian Atlas- online data accessed June 2017
	Ontario Butterfly Atlas- online data accessed June 2017
	Atlas of the Mammals of Ontario, 1994
Places to Grow Act, 2005: Places to Grow: Growth Plan	Section 1.2.3, 4.2.4 and Schedule 1

POLICY	GUIDELINES AND SUPPORTING DOCUMENTS
for the Greater Horseshoe (2017)	
Endangered Species Act (2007)	MNRF Species at Risk in Ontario (SARO) List (O.Reg. 230/08), June 2017
	MNRF Peterborough District Main Contact: Cara Hernould, A/District Planner · Records for SAR within the vicinity of the Study Area received
	MNRF NHIC Square #17QJ4091, 17QJ4092 · Species at Risk occurrence records
	OBBA Square #17QJ09
	Ontario Reptile and Amphibian Atlas- online data accessed June 2017
TOWNSHIP OF CAVAN-MONAGHAN	
Township of Cavan Monaghan Official Plan(2013)	Schedules A-1, B, B-1
COUNTY OF PETERBOROUGH	
Peterborough County Official Plan (2017)	Map A
CONSERVATION AUTHORITY	
Conservation Authorities Act, 1990: Ontario Regulation 167/06	Otonabee Region Conservation Authority · Floodplain mapping

Relevant or applicable policies within each document that relate to the natural environment and apply to the Study Area are outlined in subsequent sections.

2.1 Provincial Policy Statement, 2014

The Provincial Policy Statement, 2014 (PPS) provides overall policy direction on matters of provincial interest related to land use planning and development in Ontario. The PPS sets forth a vision for Ontario's land use planning system by managing and directing land use to achieve efficient development and land use patterns, wise use and management of resources, and protecting public health and safety.

This report deals specifically with Policy 2.1, Natural Heritage, and Policy 2.2, Water, which provides for the protection and management of natural heritage and water resources, which include the following:

- significant wetlands;
- significant coastal wetlands;
- significant woodlands;
- significant valleylands;
- significant wildlife habitat;
- significant areas of natural and scientific interest (ANSIs);

- fish habitat;
- sensitive surface water features; and,
- sensitive ground water features.

The PPS defines "significant" to mean:

- in regard to wetlands, coastal wetlands and areas of natural and scientific interest, an area identified as provincially significant by the Ontario Ministry of Natural Resources using evaluation procedures established by the Province, as amended from time to time;
- in regard to woodlands, an area which is ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history. These are to be identified using criteria established by the Ontario Ministry of Natural Resources; and,
- in regard to other features and areas in policy in 2.1, ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or natural heritage system".

The PPS defines "sensitive" to mean:

- in regard to surface water features and ground water features, means areas that are particularly susceptible to impacts from activities or events, including, but not limited to, water withdrawals, and additions of pollutants.

Potential significance of natural heritage features may be evaluated based on size, age, presence of rare or sensitive species, species diversity, and linkage functions, taking into consideration factors such as adjacent land use and degree of disturbance. Criteria for determining significance follow guidance outlined in the Natural Heritage Reference Manual (MNRF, 2010) and the Significant Wildlife Habitat Technical Guide Eco-Region 6E Criterion Schedules (MNRF, 2015), where applicable.

Significance of natural features identified within the Study Area is further discussed in Section 5.0 of this report.

2.2 Growth Plan for the Greater Golden Horseshoe, 2017

Pursuant to the Places to Grow Act, 2005, the Growth Plan for the Greater Golden Horseshoe, 2017 (Growth Plan) was approved on June 16, 2006. The Growth Plan has been amended three times since its release in 2006. The first amendment was released in January 2012 and contains policies, schedules and definitions that apply in the Simcoe Sub-area. The second amendment was released in June 2013 to update and extend the Growth Plan's population and employment forecasts. The third amendment was released on May 18, 2017, and came into effect on July 1, 2017.

The Growth Plan requires the identification of water resource systems and the protection of key hydrologic features and key hydrologic areas, similar to the level of protection provided in the Greenbelt (MMAH, 2006). This provides a consistent framework for water protection across the Greater Golden Horseshoe (GGH), and builds on existing plans and policies. The Growth Plan also provides for the identification and protection of natural heritage systems in the GGH outside of the Greenbelt Area and settlement areas in order to provide consistent and long-term protection for natural heritage systems across the GGH (MMAH, 2006).

Section 1.2.3 of the Growth Plan resolves potential conflicts between the Growth Plan and other provincial plans (e.g. PPS): "The policies of this Plan take precedence over the policies of the PPS to the extent of any conflict, except where the relevant legislation provides otherwise. Where the policies of this Plan address the same, similar, related, or overlapping matters as policies in the PPS, applying the more specific policies of this Plan satisfies the requirements of the more general policies in the PPS".

The Growth Plan recognizes the Study Area as "Greater Golden Horseshoe Growth Plan Area", and no other specific designation with applicable policies. Therefore, with respect to the natural environment, the applicable policies of the PPS supersede those of the Growth Plan and will be assessed as such in this EIS.

2.3 Endangered Species Act, 2007

In June 2008, the *Endangered Species Act*, 2007 (ESA) came into effect in Ontario. The purpose of the ESA is to identify Species at Risk (SAR) based on the best available scientific information; to protect SAR and their habitats, to promote the recovery of SAR; and to promote stewardship activities to assist in the protection and recovery of SAR in Ontario. There are two applicable regulations under the ESA; *Ontario Regulation 230/08* (the SARO List); and, *Ontario Regulation 242/08* (General). These regulations serve to identify which species and habitat receive protection and provide direction on the current implementation of the ESA by the MNRF.

The potential for SAR and SAR habitat to be impacted as a result of the proposed development is discussed further in Section 3.2.7.

2.4 Peterborough County Official Plan

The County of Peterborough (the "County") Official Plan (OP) (consolidated to 2017) was prepared to direct and guide the actions of local municipalities and the County in policy planning and physical planning on a very broad basis (Peterborough County 2017). The County OP has two functions; it serves as the upper tier OP for the County, as well as the lower tier OP for four of the local municipalities. The OP implements a strategic approach to land use planning based on a watershed planning process. This Plan sets out the general direction for planning and development in Peterborough County by prescribing strategic goals, objectives and policies; and establishes a vision in which planning and stewardship

protect and enhance a diverse landscape, lifestyle and sense of community for the County. The County supports the intent of the Provincial Policy Statement, and is consistent with the 2014 Provincial Policy Statement in amending and updating the OP. Local municipal official plans complement the County OP by providing detailed strategies, policies and land use designations for the planning and development at a local municipal level.

The Study Area is located within a Settlement Area and Rural Area as indicated in Map A of the County OP (Appendix B). In accordance with Section 4.2 of the County OP, land use designations and detailed policies for existing and future growth settlement areas will continue to be the responsibility of local municipalities in their OPs.

2.5 Township of Cavan Monaghan

The Township of Cavan Monaghan (the "Township") OP (2015) has been prepared to implement the Oak Ridges Moraine Conservation Plan, the Growth Plan for the Greater Golden Horseshoe and the Provincial Policy Statement, 2005. In accordance with the provisions of the Planning Act, where conflict between this Plan and the Peterborough County Official Plan occurs, the provisions of the County Plan shall prevail except where the local plan is more restrictive.

The Settlement Areas in the Township include Millbrook; in which the majority of the Study Area falls. Millbrook will develop on the basis of full municipal services, including municipal sewage treatment and water supply services. For this reason, it is referred to as an Urban Settlement Area as shown on Schedule A and A-1 (Appendix B). Portions of the Study Area within the Millbrook Urban Settlement Area are designated as Residential, Institutional, and Urban Employment Areas. Outside of the Settlement Area boundary, lands within either "Countryside Areas" are designated as Agricultural (Schedule A, Appendix B) with Significant Woodland within the northwest portions of the Study Area (Schedule B, Appendix B).

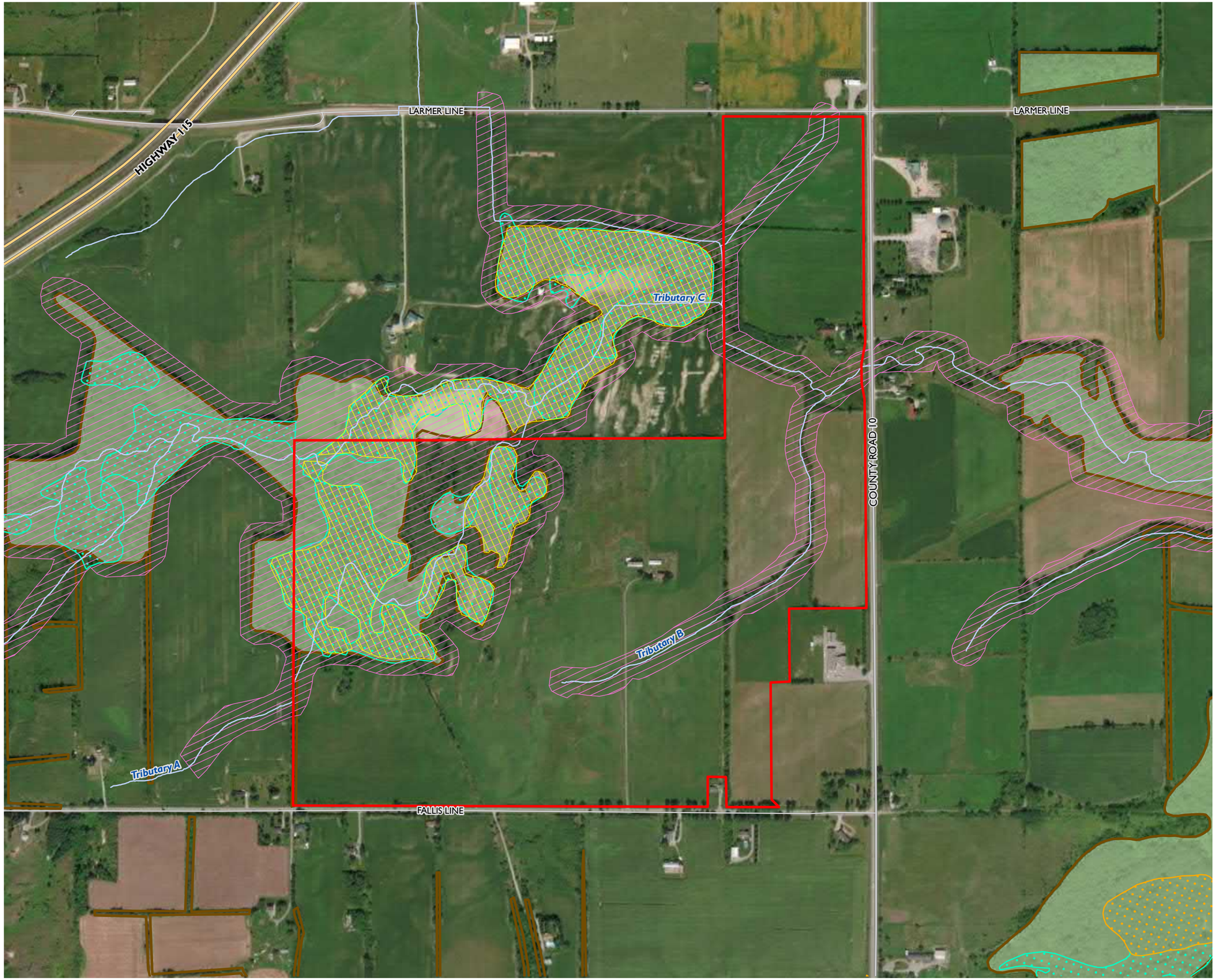
The Township's Natural Heritage System includes significant wildlife habitat, significant wetlands, significant woodlands, significant valleylands, areas of natural and scientific interest, buffer areas around these features and lands that link those areas. As depicted in Schedule A and A-1, portions of the Study Area fall within the Natural Heritage System, and are designated as Natural Linkage Areas, and Natural Core Areas (outside of Settlement boundary only) (Appendix B).

The overall objectives of the Natural Heritage System policies include maintaining, improving and where possible, restoring the health, diversity, size and connectivity of natural heritage features, hydrologically sensitive features and related ecological functions. Therefore, with respect to the natural environment, the applicable policies of the PPS and the Township OP supersede those of the County OP and will be assessed accordingly in this EIS.

2.6 Otonabee Region Conservation Authority (Ontario Regulation 167/06)

In accordance with Section 28 of the Conservation Authorities Act, 1990, ORCA is authorized to implement and enforce the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation (Ontario Regulation 167/06). Section 2(1) of this Regulation lists areas within ORCA's jurisdiction where development is prohibited without proper permissions from the ORCA. Such areas include, but are not limited to, river or stream valleys, hazardous lands, and wetlands.
In participating in the review of applications under the Planning Act and Environmental Assessment Act(s), ORCA ensures that applicants and approval authorities are aware of any Section 28 Regulation requirements under the Conservation Authorities Act, where applicable. Further, ORCA assists in the coordination of these applications to avoid ambiguity, conflict and unnecessary delay or duplication in the process.

The Study Area is located within ORCA's Regulated Area in association with the identified watercourses.



MILLBROOK
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FIGURE 2
PROVINCIAL AND AGENCY
LAND USE DESIGNATIONS

- Study Area
- Natural Core Area
- Natural Linkage Area
- Locally Significant Wetland
- Unevaluated Wetland
- Significant Woodland
- Water Body (MNRF)
- Woodlands (MNRF)

1:7,500

0 100 200 400 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, TOWNSHIP OF CAVAN MONAGHAN

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 164800
STATUS: DRAFT
DATE: 10/3/2018

FILE LOCATION: G:\GIS\164800 - Millbrook EIS\mxd\EIS\Figure 2 Provincial and Agency Land Use Designations.mxd

3.0 Results of Background Review

As mentioned in Section 2.2, several natural heritage features as defined under the PPS require consideration within the EIS. The following sections provide a summary of the existing environmental conditions within the Study Area. The information in Section 3.0 provides the background information upon which the EIS was based.

A desktop review of the Study Area indicates that the Study Area is currently comprised of active agricultural fields with areas of woodland and unevaluated wetland within the north and west portions, and several mapped watercourses within the Study Area boundary. The Study Area is bounded by Fallis Line to the south, County Road 10 to the east, Larmer Line to the north, and agricultural lands and woodland and wetland areas to the north and west.

A review of available historic aerial photos dating back to 1954 indicates that the Study Area has not experienced significant change over that time (Appendix C). The area north of the Village of Millbrook is largely agricultural in nature and has remained relatively the same for the past several decades.

Through consultation with ORCA, areas within the Study Area were identified as part of the 'Kawarthas Naturally Connected' (KNC) Natural Heritage System (NHS) (Natural Core and Natural Linkage Areas in Figure 2). The KNC landscape-scale NHS for Peterborough County and the City of Kawartha Lakes was developed by a collaborative, multi-partner technical team and is intended as technical information to support municipalities' land use planning efforts to address their responsibilities under the PPS and Planning Act (ORCA, 2017). Areas within the western section of the Study Area were therefore identified as regionally important for their woodland and wetland features. In addition, the cold water streams identified by ORCA within the Study Area, functionally link wetland and woodland areas both within the Study Area and adjacent areas.

3.1 Aquatic Environment

3.1.1 Watershed Summary

The Study Area is located within the Otonabee Region Watershed which covers an area of 1,951 km^2 and includes 12 subwatersheds. More specifically, the Study Area is located within the Baxter Creek subwatershed, which covers an area of 92 km^2 within the southwest portion of the larger Otonabee River watershed. The Otonabee Region Watershed Report Card (ORCA, 2013) has described the Baxter Creek subwatershed as a cold water fish community with 'good' conditions (grade of B) based on results of benthic invertebrate sampling and nutrient parameters. The Baxter Creek subwatershed also received a B in forest cover while the most common grade throughout the Otonabee River watershed was given a grade of D (poor). Stressors within the watershed include removal of riparian vegetation, nutrient

loading, use of water for irrigation purposes, and tile drainage within agricultural lands (ORCA, 2013).

3.1.2 Fish Habitat

Fish habitat, as defined in the Fisheries Act, means spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life process. In accordance with the guidance provided in the MNRF Natural Heritage Reference Manual (2010), all water features (except human-made off-stream ponds) are considered fish habitat by ORCA, unless it can be demonstrated that the feature does not constitute fish habitat pursuant to the Fisheries Act.

Based on the presence of several mapped watercourses within the Study Area, there is potential for fish habitat to be present. Water features generally support three major types of aquatic communities: coldwater, coolwater and warmwater communities. The community types reflect the thermal conditions of the waterbody and are often defined by either temperature or the composition of fish and invertebrate species present.

Through communications with ORCA, the Study Area was identified as part of Management Zone B of the Peterborough Area Cold Water Streams Strategy (CWSS), and ORCA has indicated that watercourses within the property are considered to be cold water fish habitat. Coldwater and coolwater streams are particularly sensitive to land use impacts, which is due to the relatively narrow habitat requirements of resident fishes (e.g., requiring clean cold water, high levels of dissolved oxygen, etc.). Fish species identified within the system include Brook Stickleback (*Culaea inconstans*), Brassy Minnow (*Hybognathus hakinsoni*), Pearl Dace (*Margariscus margarita*), Common Shiner (*Luxilus cornutus*), Bluntnose Minnow (*Pimephales notatus*), Eastern Blacknose Dace (*Rhinichthys atratulus*), White Sucker (*Catostomus commersonii*), and Northern Redbelly Dace (*Chrosomus eos*).

Maintaining healthy fish communities is important for the preservation of fish species biodiversity, supporting subsistence and sport fisheries as well as commercial and tourism-based industries, and protecting associated aquatic species, ecological processes and aesthetic and natural values.

Fish habitat will be discussed further in Section 5.1.

3.2 Terrestrial Environment

3.2.1 Landforms, Soils, and Geology

The Study Area lies over Paleozoic Middle Ordovician bedrock consisting of limestone, dolostone, shale, arkose, sandstone (Ministry of Northern Development and Mines 1991). The Study Area is situated in the physiographic region known as the Peterborough Drumlin field (Chapman and Putnam, 1984). To the south along the border of the Oak Ridges Moraine, the till in somewhat more sandy with site and fine sand. Locally, the site is identified to be within an area known as “sand plains” (Department of Mines and Northern Affairs, 1972) with drumlinized till pains to the south and north.

The Ontario Geological Survey indicates the Quaternary geology to be of glaciofluvial ice deposits in the southern area and glaciofluvial outwash deposits in the northern area with till materials to the north and west. The available MOECC well records indicated that soils were generally clay with sand and gravel layers and limestone at depth. More specifically, soils consists of Otonabee Loam (brown loam and light brown loam over brownish clayey loam underlain by grey stony loam; high in lime and moderately stony); Schomberg Clay Loam (grey-brown clay loam and greyish loam over brownish clay underlying material mainly stonefree clay with some stony clay loam,; high in lime); Bottomland (land lying along stream courses and subject to flooding); Lyons Loam (dark greyish brown loam over highly mottles greyish stony loam with numerous boulders and stones). Bedrock was encountered at depths ranging from 30 m to 94 m.

According to Valdor Water Resources (Valdor), 2018, the topography in within Study Area exhibits rolling to hilly topography; generally sloping down in a north-easterly direction from Fallis Line (252 m) towards Baxter Creek to the north (241 m). The 11 m differential equates to an overall average slope of 1.5%, which is considered to be relatively moderate (Valdor, 2018). Surface water runoff would flow according to the local topography and eventually to Baxter Creek. In addition, seepage areas were observed within the forested areas on the south slope of the Study Area. The relief drops 20 m in this area where groundwater appears to seep from the slope. Borehole logs conducted by Geo-Logic Inc. in 2015 concluded that test holes typically encountered a surficial layer of topsoil, over native soils consisting predominantly of clayey/ sandy silt till. Groundwater seepage or accumulation was observed in several of the open test holes during the fieldwork at depth ranging from 0.0 to 4.6 m below existing grade (mbeg). Water levels obtained March 24, 2014 from temporary piezometers installed in three of the test holes in the Study Area yielded water levels ranging from approximately 0.3 to 3.2 mbeg. These results are consistent with the published mapping with respect to glaciofluvial deposits across the Study Area; comprised of deposits of clay and sandy soils.

Refer to the Hydrogeological Assessment Report (Geo-Logic Inc. 2015) and Geotechnical Investigation Report (Geo-Logic Inc. 2015) for further details on soils and geology.

3.2.2 Wetlands

Wetlands within the vicinity of the Study Area are considered southern wetlands based on their location south of the northern limit of Ecoregions 5E, 6E, and 7E as shown on Figure 1 of the PPS, 2014. Unevaluated wetlands were identified through background mapping within and adjacent to the Study Area, as shown on Figure 2. In addition, two Evaluated- Other wetlands were identified within the vicinity of the Study Area; Tapley South, and Millbrook Northeast, the latter located just south of Fallis Line Road and County Road 10 approximately 350 m south of the Study Area boundary.

In addition, distinctive landscape features were identified within the unevaluated wetland area through both background review and consultation with ORCA, as visible in aerial imagery on Figure 2. These

distinctive wetland formations have been noted in the Cavan Township Environmentally Sensitive Areas Study as "ice-block ridges" and associated wetland depressions; which, according to ORCA, form a unique type of habitat in Peterborough County. These areas are presumed to be in various stages of succession and may provide valuable habitat for waterfowl, wading birds and furbearers (ORCA, 2017). Based on this, ORCA requested that a wetland evaluation be completed on wetlands within the Study Area and considered as part of the larger unevaluated wetland area.

Wetlands are discussed further in Section 5.2.3.

3.2.3 Woodlands

Woodlands were identified through background review in association with the wetland areas to the within the north and west portions of the Study Area and continuing west of the property. These woodlands are identified as Significant Woodland in the Cavan Monaghan Official Plan (Schedule B, Figure 2). No other woodlands were identified within the Study Area.

Woodlands are discussed further in Section 5.2.4.

3.2.4 Valleylands

No significant valleylands were identified within or adjacent to the Study Area.

3.2.5 Areas of Natural and Scientific Interest

No significant ANSIs were identified within or adjacent to the Study Area.

3.2.6 Significant Wildlife Habitat

The Significant Wildlife Habitat Technical Guide (MNRF 2000) defines Species of Conservation Concern as globally, nationally, provincially, regionally, or locally rare (S-Rank of S2 or S3)and federally endangered and threatened species; but do not include SAR (listed as *endangered* or *threatened* under the ESA, 2007). Through background review, several Species of Conservation Concern listed in Table 2 have been identified with the potential to occur within or adjacent to the Study Area, and will help to determine the potential for Significant Wildlife Habitat (SWH).

Table 2: Species of Conservation Concern with potential to occur within the Study Area

SCIENTIFIC NAME	COMMON NAME	SARA[1]	ESA[2]	S-RANK[3]	INFO SOURCE[4]
BIRDS					
Ammodramus savannarum	Grasshopper Sparrow	---	SC	S4B	OBBA
Chordeiles minor	Common Nighthawk	THR	SC	S4B	OBBA
Contopus virens	Eastern Wood-pewee	---	SC	S4B	MNRF, OBBA
Hylocichla mustelina	Wood Thrush	---	SC	S4B	MNRF, OBBA
Melanerpes erythrocephalus	Red-headed Woodpecker	THR	SC	S4B	MNRF

SCIENTIFIC NAME	COMMON NAME	SARA[1]	ESA[2]	S-RANK[3]	INFO SOURCE[4]
Vermivora chrysoptera	Golden-winged Warbler	THR	SC	S4B	OBBA
HERPETOZOA					
Chelydra serpentina	Snapping Turtle	SC	SC	S3	MNRF, ON
Graptemys geographica	Northern Map Turtle	SC	SC	S3	ON
Thamnophis sauritus septentrionalis	Eastern Ribbonsnake	SC	SC	S3	ON
LEPIDOPTERA					
Danaus plexippus	Monarch	SC	SC	S2N, S4B	TEA

[1]Federal Species at Risk Act (THR= threatened; SC= Special Concern); [2]Provincial Endangered Species Act (SC= Special Concern); [3]S-Rank is an indicator of commonness in the Province of Ontario. A scale between 1 and 5, with 5 being very common and 1 being the least common. [4]Information sources include MNRF = Ministry of Natural Resources and Forestry; OBBA = Ontario Breeding Bird Atlas; ON = Ontario Nature: Ontario Reptile and Amphibian Atlas; TEA = Toronto Entomologists' Association; --- denotes no information or not applicable.

A review of the MNRF background data suggests that several SWH types may occur in association with woodland and wetland communities within the Study Area:

- Bat maternity colonies;
- Colonially-nesting bird breeding habitat (trees/shrub);
- Waterfowl nesting;
- Seeps and springs;
- Amphibian breeding habitats (woodlands);
- Amphibian breeding habitats (wetlands); and,
- Special concern and rare wildlife species.

The potential for SWH to be present within the Study Area is discussed further in Section 5.2.5.

3.2.7 Species at Risk

A number of SAR listed as *endangered* and *threatened* under the ESA have been identified with potential to occur within the vicinity of the Study Area (see Table 3).

Table 3: Species at Risk with potential to occur within the Study Area

SCIENTIFIC NAME	COMMON NAME	SARA[1]	ESA[2]	S-RANK[3]	INFO SOURCE[4]
VASCULAR PLANTS					
Juglans cinerea	Butternut	END	END	S3?	MNRF
BIRDS					
Caprimulgus vociferus	Eastern Whip-poor-will	THR	THR	S4B	OBBA
Chaetura pelagica	Chimney Swift	THR	THR	S4B, S4N	OBBA

SCIENTIFIC NAME	COMMON NAME	SARA[1]	ESA[2]	S-RANK[3]	INFO SOURCE[4]
Dolichonyx oryzivorus	Bobolink	---	THR	S4B	MNRF, OBBA
Hirundo rustica	Barn Swallow	---	THR	S4B	MNRF, OBBA
Riparia riparia	Bank Swallow	---	THR	S4B	OBBA
Sturnella magna	Eastern Meadowlark	---	THR	S4B	MNRF, OBBA
MAMMALS					
Myotis lucifugus	Little Brown Myotis	END	END	S4	OMA
Myotis septentrionalis	Northern Myotis	END	END	S3	OMA
Pipistrellus subflavus	Tri-coloured Bat	END	END	S3?	OMA
Myotis leibii	Eastern Small-footed Bat	---	END	S2S3	OMA

[1]Federal Species at Risk Act (END= Endangered, THR= Threatened); [2]Provincial Endangered Species Act (END= Endangered, THR= Threatened);[3]S-Rank is an indicator of commonness in the Province of Ontario. A scale between 1 and 5, with 5 being very common and 1 being the least common. [4]Information sources include MNRF = Ministry of Natural Resources and Forestry; OBBA = Ontario Breeding Bird Atlas; ON = Ontario Nature: Ontario Reptile and Amphibian Atlas; TEA = Toronto Entomologists' Association; --- denotes no information or not applicable.

3.2.7.1 Species at Risk Habitat

An information request was submitted to the MNRF Peterborough District Office in order to obtain SAR records to help narrow our focus on potential SAR and/or SAR habitat within the Study Area (Appendix D). The MNRF identified the following *endangered* and *threatened* species within the vicinity of the Study Area;

- Butternut;
- Bobolink;
- Eastern Meadowlark; and,
- Barn Swallow.

In addition, based on MNRF and ORCA consultation, as well as a review of applicable background resources including NHIC, and Fisheries and Oceans Canada (DFO) Ontario South West Map 6 of 34, no rare fish species or aquatic SAR have been flagged within this area.

The potential for SAR and SAR habitat within the Study Area is discussed further in Section 5.0.

3.2.8 Incidental Wildlife

A review of aerial photos and local knowledge suggests that there are several common wildlife species found within the general area with potential to occur in the Study Area.

Incidental wildlife occurrences are discussed further in Section 5.2.5.

4.0 Field Work Methodology

The results of the background review were used to assist in scoping the 2017 field program. Fieldwork conducted for the EIS occurred between October 2016 and July 2017 when weather conditions and timing were deemed suitable based on the survey protocols being implemented (Table 4). Fieldwork consisted of Ecological Land Classification (ELC) of vegetation communities, a wetland evaluation, botanical surveys, aquatic surveys, breeding bird surveys, and amphibian breeding surveys. Any incidental wildlife observations made during the surveys were also documented. The following sub-sections outline the survey methodologies used in the EIS.

Table 4: Dates and Times of Field Surveys

DATE	TIME	WEATHER CONDITIONS	AIR TEMP (°C)	PURPOSE OF VISIT
October 15, 2016	1:00 pm	Partial cloud cover	17	Site recon., aquatic survey
April 21, 2017	11:26 pm	Cloudy, light breeze	6	Amphibian breeding survey #1
May 18, 2017	9:17 pm	Clear, slight breeze	17	Amphibian breeding survey #2
May 18, 2017	3:00 pm	Slight cloud cover, breezy	22	Spring vegetation survey
June 8, 2017	6:06 am	Clear	8	Breeding bird survey #1
June 20, 2017	5:42 pm	Sunny, slight cloud cover	26	Aquatic habitat assessment
June 21, 2017	4:40 am	Slight cloud cover, slight breeze	13	Breeding bird survey #2, ELC, OWES
June 29, 2017	9:41 pm	Slight cloud cover, no wind	22	Amphibian breeding survey #3
July 28, 2017	1:00 pm	Partial cloud cover, slight breeze	23	Summer vegetation survey

4.1 Aquatic Assessment

Tributaries within the Study Area have been labelled as Tributary A, B and C for ease of reference, as indicated on Figure 3. Tributary B is proposed to be realigned as part of this development. As a result several aquatic assessments and other studies have been completed by Dillon and other disciplines in support of the proposed realignment. The results of these studies were compiled into a Fisheries Act Request for Review for submission to DFO. Refer to Appendix E for a summary of the DFO submission package.

As part of the aquatic studies, a preliminary site visit was conducted on October 15, 2016 in which two Dillon biologists walked Tributary B to determine hydroperiod, potential groundwater inputs, habitat, channel modifiers, etc. A second aquatic survey was then completed in June of 2017 to determine if flows were present during baseflow periods (summer). During the site visit a standard OSAP stream assessment was completed in order to collect information on flow, potential for fish, and water temperature. This information was used in combination with data provided by Waters Edge from May of

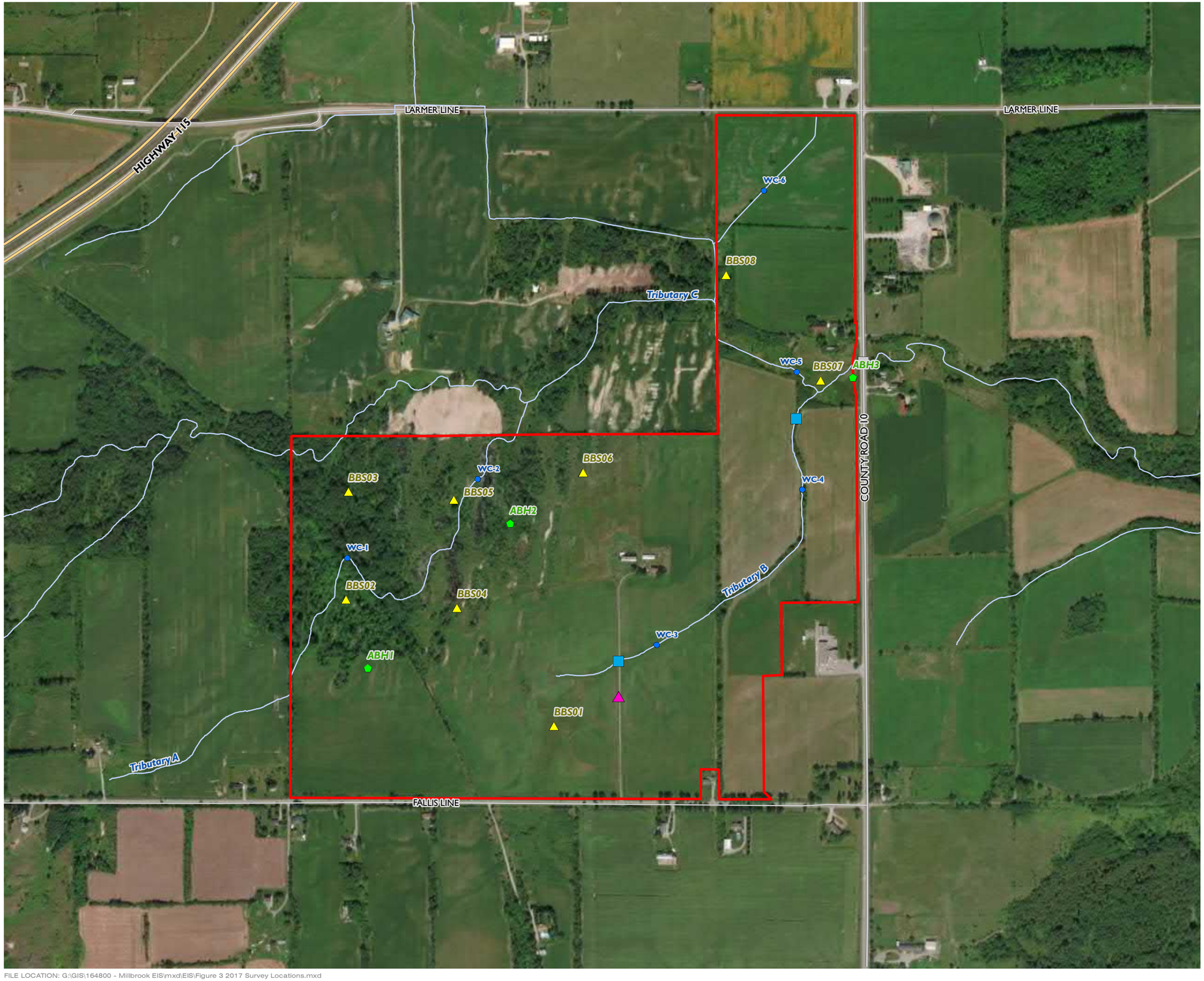

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FIGURE 3
2017 SURVEY LOCATIONS

- Study Area
- Bridge
- Culvert
- Driveway
- Aquatic Survey location
- Breeding Bird Survey Location
- Amphibian Breeding Habitat Survey Location

1:7,500

0 100 200 400 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, TOWNSHIP OF CAVAN MONAGHAN

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

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DATE: 10/3/2018

FILE LOCATION: G:\GIS\164800 - Millbrook EIS\mxd\EIS\Figure 3 2017 Survey Locations.mxd

2017 to determine the potential for impacts as a result of the proposed development.

Refer to Appendix E and Section 5.1 for details of the assessment.

4.2 Terrestrial Assessments

4.2.1 Ecological Land Classification

Vegetation communities were assessed using ELC in order to identify and assess potential natural heritage features within the Study Area. During the field investigations, vegetation was characterized using the ELC System for Southern Ontario (Lee et al., 1998; and Second Approximation, 2008) in order to classify and map ecological communities to the vegetation level. The ecological community boundaries were determined through the review of aerial photography and then further refined through on site vegetation and tree surveys. In addition to the vegetation survey, a basic soil assessment was conducted to identify the soil moisture class within the ecosystem.

The ELC protocol recommends that a vegetation community be a minimum of 0.5 ha in size before it is defined. Based on the composition of vegetation communities within the Study Area, patches of vegetation less than 0.5 ha or disturbed/planted vegetation were described, provided they clearly fit within an ELC vegetation type.

Results of the ELC survey are included in Section 5.2.1.

4.2.2 Vegetation Inventory

Spring and summer botanical surveys were conducted in 2017 in addition to the ELC and OWES survey in which vegetation species were also documented. During these surveys, vegetation was inventoried to determine the presence, richness and abundance of floral species within the Study Area. Species nomenclature is based on the Ontario Plant List (Newmaster *et al,.* 1998).

Results of the botanical surveys are discussed in Section 5.2.2.

4.2.3 Wetlands

Due to the presence of two evaluated wetland complexes located within the vicinity of the Study Area, wetlands within the Study Area were evaluated following the Ontario Wetland Evaluation System – Southern Manual, 3rd Edition, Version 3.3 (MNRF, 2014) (OWES) by an MNRF certified wetland evaluator. In accordance with the OWES, wetlands are assessed based on their perceived values in maintaining natural processes (ecosystem values). They are also assessed on the benefits provided to society (human utility values).

The wetland evaluation was conducted to confirm and/or revise the wetland boundaries based on field studies carried out over three seasons (spring/summer/fall) in 2017. Data collected by Dillon staff

throughout the 2017 field season was then applied to the OWES and used to calculate the evaluation score to determine if unevaluated wetland units meet the criteria for provincial significance.

The results of the wetland evaluation are discussed in Section 5.2.3.

4.2.4 Significant Wildlife Habitat

The potential for several SWH types was identified though background review in association with woodland and wetland areas to the north and west. As a result, both breeding bird and amphibian breeding surveys were conducted in 2017 to establish baseline conditions within the Study Area and confirm whether SWH is present for birds and amphibians. In addition, specific indicators of wildlife use and incidental wildlife observations were recorded during other field surveys to infer the potential for other SWH types. In addition, as the Hydrogeological Report (Geo-Logic 2015) had indicated that seeps were present within wetland communities to the west, the presence of seeps was considered during the OWES survey. Specific surveys for other species including bats were not conducted as tree removal will be limited to small trees and shrubs along the watercourse and central hedgerow. Areas identified with the potential to contain bat maternity colonies (woodland ecosites) will be protected from development activities.

Results of field surveys have been included in Section 5.2.5.

4.2.4.1 Breeding Bird Survey

Breeding bird surveys conducted within the Study Area followed the methods outlined in the Ontario Breeding Bird Atlas Guide for Participants (Cadman et al 2007), and were completed in early and late June of 2017 (two surveys) in an effort to capture both early and late season breeding birds. Specifically, surveys consisted of point counts generally conducted between dawn and five hours after sunrise that were used to establish quantitative estimates of bird abundance in suitable habitat types within the Study Area. During the surveys evidence of breeding behaviour was recorded which generally includes, but is not limited to, males singing, nest building, egg incubation, territorial defence, carrying food, and feeding their young.

To supplement the surveys, area searches of the habitat were completed using binoculars to observe species presence and breeding activity. Area searches involved noting all individual bird species and their corresponding breeding evidence within the Study Area. A total of eight point counts locations were established within the Study Area as shown on Figure 3.

Results of breeding bird studies within the Study Area are included in Section 5.2.5.1.

4.2.4.2 Amphibian Breeding Survey

Amphibian monitoring followed the Marsh Monitoring Program protocol (Bird Studies Canada, 2009). In accordance with the protocol, three different surveys were conducted between April 1 and June 30, with

at least two weeks between each survey. Surveys began at least one half hour after sunset during evenings with a minimum night temperature of 5ºC, 10ºC, and 17ºC for each of the three respective surveys.

The calling activity of individuals estimated to be within 100 m of the observation point were documented. All individuals beyond 100 m were recorded as outside the count circle and calling activity was not recorded. Calling activity was then ranked using one of the three abundance code categories:

Code 1: Calls not simultaneous, number of individual can be accurately counted;
Code 2: Some calls simultaneous, number of individuals can be reliably estimated;
Code 3: Calls continuous and overlapping, number of individuals cannot be estimated.

In areas were appropriate habitat exists vernal pools were also visually examined for egg masses and amphibian larvae in conjunction with other field surveys. These searches occurred between April and June when amphibians were concentrated around suitable breeding habitat. A total of three amphibian monitoring stations were surveyed within the Study Area, as shown on Figure 3.

Results of amphibian breeding studies within the Study Area are included in Section 5.2.5.2.

4.2.4.3 Incidental Wildlife

A general wildlife assessment was completed within the Study Area through incidental observations while on site. Any incidental observations of wildlife were noted, as well as other wildlife evidence such as dens, tracks, and scat. For each observation, notes, and when possible, photos were taken. These observations helped to determine potential ecological functions, linkages, etc. within the Study Area. Results relating to incidental wildlife within the Study Area have been included in Section 5.2.5.3.

5.0 Results of Detailed Field Work

A biophysical inventory of natural features within the Study Area was completed in accordance with the methods detailed in Section 4.0. The analysis of data collected from secondary source information and during field studies in 2017, was used to evaluate the significance of natural heritage features within the Study Area.

5.1 Aquatic Environment

During the first site visit in October of 2016, it was determined that Tributary B exists as a ditch originating within the agricultural field, conveying flows from spring freshet and rain events. Due to the location of the tributary, it may also receive input from tile drains throughout the agricultural fields, although no drains were specifically identified.

Tributary B originates within a meadow area within the agricultural field which appeared to be a low spot in the field with dense forbs and grasses and no defined channel was identified. This area was confirmed through ELC in the summer as Cattail Mineral Meadow Marsh (MAMM1-2) (Figure 4). As Tributary B passes under the driveway, it is constricted by a culvert that has almost completely collapsed and is surrounded by large cobble/boulders presenting a barrier to potential fish passage and effective flow (see Attachments A and B of Appendix E). As Tributary B continues northeast, it becomes more defined and channelized (straightened) through the agricultural field before entering a treed fencerow lined with boulders. The tributary continues northeast, then north where is crosses a laneway with a partially plugged culvert; another barrier to potential fish movement and flow within the tributary, before entering a wooded area and open meadow where it outlets into Tributary C. It was expected that water would have been observed during this visit if fed by groundwater (cold water) sources; however the entire length of Tributary B was dry. During the same site visit in October, Tributary C was also dry from the western property boundary, to downstream of its confluence with Tributary B. Downstream of the confluence with Tributary B, Tributary C contained substantial flow, likely fed by groundwater sources within the wetland area immediately adjacent to County Road 10, flowing east. Refer to Appendix E for further details and site photos.

The summer of 2017 was exceptionally wet, receiving large amounts of rainfall, with rainfall often occurring over several consecutive days throughout the season. During the June site visit, upstream Tributary B was mostly dry and described as channelized and having ephemeral or intermittent flow with agricultural inputs. It should be noted that 11.9 mm of rainfall was recoded at the Peterborough Airport on June 20; following sporadic rain events on several days leading up to the site visit, and this was evidenced by pooled water within the agricultural fields. Upstream riparian habitat consisted of cultivated lands with some grasses and patches of cattails (sampling point WC-3 in Figure 3). No bare substrate was observed within the upstream portion Tributary B and the water temperature was recorded as 25ºC within pooled areas but little to no flow was observed. At the second survey point

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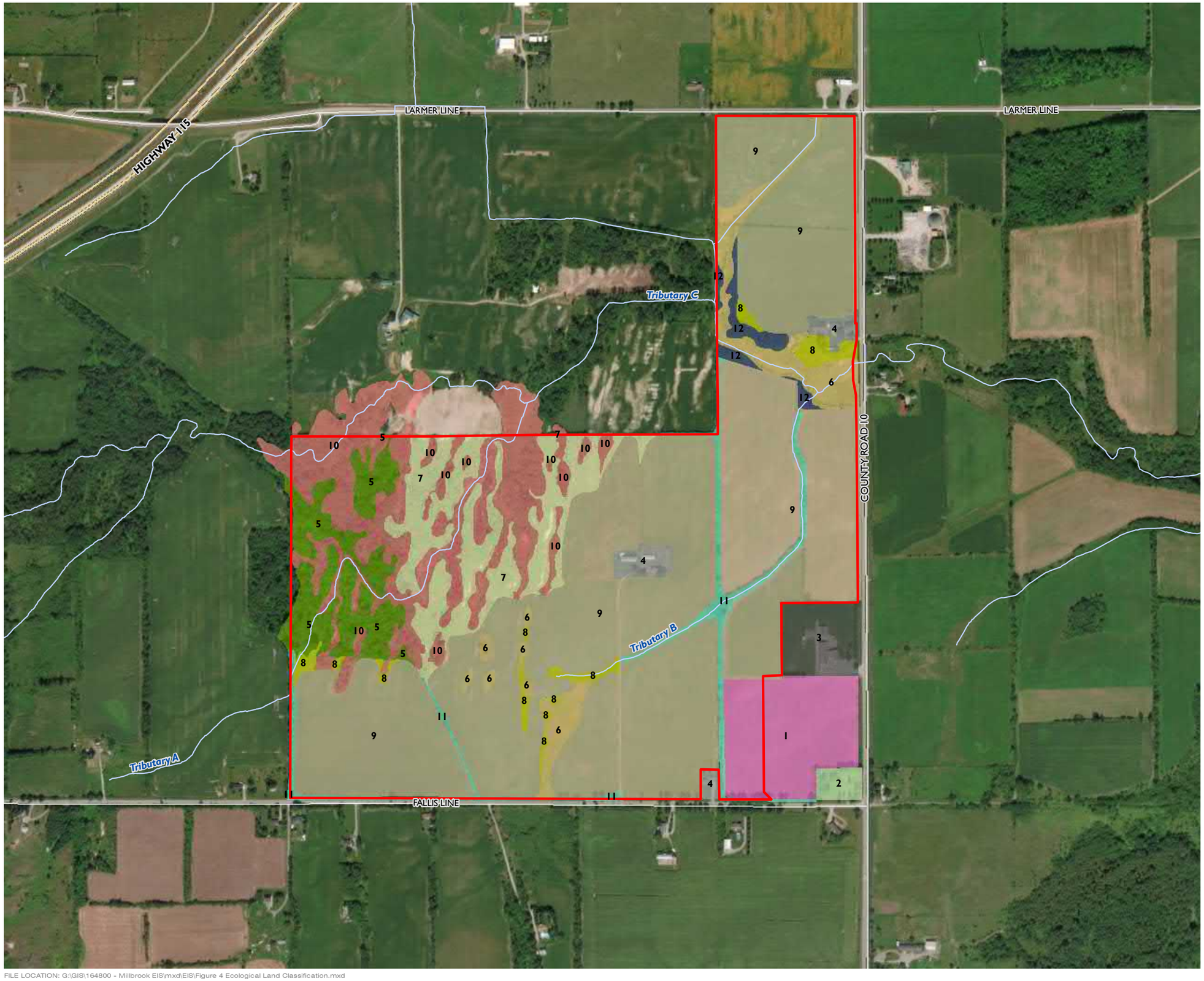
FIGURE 4
ECOLOGICAL LAND CLASSIFICATION



- Study Area
- Water Body

Ecological Land Classification

1. Cleared Land
2. CGL: Greenlands (Cemetery)
3. CVI_3: Transportation and Utilities
4. CVR_4: Rural Residential Property
5. FODM6-5: Dry-Fresh Sugar Maple-Hardwood Deciduous Forest
6. MAMM1-2: Cattail Mineral Meadow Marsh
7. MEMM3: Dry-Fresh Mixed Meadow
8. MEMM4: Fresh-Moist Mixed Meadow
9. OAGM1: Annual Row Crop
10. SWDM4: Mineral Deciduous Swamp
11. TAGM5: Fencerow/Riparian
12. THDM5: Fresh-Moist Deciduous Thicket Ecosite

1:7,500

0 100 200 400 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, TOWNSHIP OF CAVAN MONAGHAN

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

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FILE LOCATION: G:\GIS\164800 - Millbrook EIS\mxd\EIS\Figure 4 Ecological Land Classification.mxd

further downstream, WC-4 as noted on Figure 3, flow was observed and was determined to be ephemeral or intermittent flow. The temperature within this portion of the tributary was recorded as 18ºC.

The CWSS defines cold water habitat as <=22.7ºC. It should be noted that the standard widely used across southern Ontario for measuring thermal regime of streams is the Ontario Stream Assessment Protocol, Section 5, Module 1 (MNRF, 2013), which defines cold water fish habitat using an algorithm based on air temperature. Based on an air temperature of 26ºC recorded during the site visit in June, water temperatures of <= 16ºC would constitute cold water habitat. Although thermal regime cannot be accurately determined by one sampling event, based on the OSAP algorithm, 18ºC is indicative of cool water habitat. As mentioned, this tributary may be receiving inputs from tile drains evidenced by the water flows present during this site visit after a rain event, while the stream was dry in October of 2016.

As noted during the October 2016 site visit flows were present downstream of Tributary B at County Road 10 indicating cold water flows within the system. Sampling points along both Tributary A (WC-1 as indicated on Figure 3), and Tributary C (WC-5) were recorded at 17ºC, indicating cool water systems. It is important to note that ORCA's sampling of Baxter Creek in this area was done at the County Road 10 bridge crossing where flows were determined to permanent; cool/cold water flows as a result of several site visits. It is also of note that Tributary D, which is similar in structure and location to Tributary B was recorded at 21ºC (cool-warmwater based on OSAP Section 5, Module 1).

Information received from ORCA indicated that wetlands upstream to the north and west of the property contain fish habitat, and therefore Tributary C would function to convey flows from those upstream wetlands to downstream reaches and provide direct fish habitat for part of the year. It was noted that during site visits that the bank of Tributary C is quite steep at its confluence with Tributary B creating a barrier for fish to pass upstream into Tributary B through the dense grass during low flow. Based on this, Tributary B may contain seasonal fish habitat downstream during high water periods (i.e., spring freshet). However, barriers present throughout the tributary prevent effective passage of fish upstream, and therefore, the primary function of Tributary B is likely contribution of allochthonous flows to downstream reaches. Furthermore, consultation with DFO suggested that these barriers, specifically the steep drop down to Tributary 3, present a danger to fish of getting trapped within Tributary B during high water and having no way of escaping back into the downstream system.

Refer to the DFO Request for Review summary included in Appendix E. Potential impacts to surface water as a result of the proposed development have been included in Section 8.1.1.

5.3 Terrestrial Environment

5.3.1 Ecological Land Classification

A total of nine communities were observed within the Study Area during the ELC survey, seven of which are considered natural vegetation communities. The location, type, and boundaries of these communities are delineated in Figure 4. All vegetation communities surveyed within the Study Area are considered common in Ontario. Table 5 outlines the communities documented during ELC surveys and summarizes the dominant vegetation cover. Reference photos for each of the plant communities observed can be found in Appendix F.

Within the Study Area, the natural vegetation communities have been disturbed due to adjacent agricultural uses and contain invasive species (Common Buckthorn (*Rhamnus cathartica)*, Manitoba Maple (*Acer negundo)*, and Reed Canary Grass (*Phalaris arundinacea*)).

5.3.2 Vegetation

A total of 147 plant species were documented during 2017 field studies. Of the 147 species, approximately 73% are listed as native species considered to be common (S4) to very common (S5) in the province of Ontario; and approximately 27% are listed as introduced species, therefore a status ranking is not applicable as the species is not a suitable target for conservation activities (SE or SNA rank). Of the native species observed, one species, Butternut (*Juglans cinerea*), is listed as endangered under the ESA (Figure 5). In addition, two Species of Conservation Concern were noted in within the Significant Woodland, Scarlet Beebalm (*Monarda didyma*), and Striped Cream Violet (*Viola striata*). Due to the common use of Scarlet Beebalm in landscaping and the fact that it rarely occurs naturally within this area, it is expected that this individual is not likely natural. Based on the presence of the Striped Cream Violet, the FOD woodland community is considered SWH for Special Concern and Rare Wildlife Species (Figure 5).

The Co-efficient of Conservatism (CC) provides additional information on the nature of the vegetation communities within the Study Area. The CC values range from 0 to 10 and represent an estimated probability that a plant is likely to occur in a landscape that is relatively unaltered or is in a pre-settlement condition. For example, a CC of 0 is given to plants such as Manitoba Maple that demonstrate little fidelity to any remnant natural community, i.e. may be found almost anywhere. Similarly, a CC of 10 is applied to plants like Shrubby Cinquefoil (*Potentilla fructicosa*) that are almost always restricted to a pre-settlement remnant, i.e. a high quality natural area. Introduced plants were not part of the pre-settlement flora, so no CC values have been applied to these species.

Of the 147 species identified within the Study Area, several species had a CC value of 7 or greater indicating a generally un-altered landscape; typical of a naturally occurring environment, although

Table 5: Ecological Land Classification

ELC CODE	VEGETATION	PHOTO APP. F
FODM6-5: Fresh - Moist Sugar Maple Hardwood Forest	The canopy and sub-canopy consists of Sugar Maple (*Acer saccharum*), American Basswood (*Tilia americana*) and American Beech (*Fagus grandifolia*). Shrub species present include Common Buckthorn (*Rhamnus cathartica*), Choke Cherry (*Prunus virginiana*), Alternate-leaved Dogwood (*Cornus alternifolia*) and Purple-flowering Raspberry (*Rubus odoratus*). Herbaceous species include Blue Cohosh (*Caulophyllum thalictroides*), Virginia Creeper (*Parthenocissus quinquefolia*), Enchanter's Nightshade (*Circaea canadensis*) and Ostrich Fern (*Matteuccia struthiopteris*).	1
SWDM4: Mineral Deciduous Swamp	The canopy and sub-canopy consists predominantly of Freeman's Maple (*Acer × freemannii*) and Trembling Aspen (*Populus tremuloides*) with occasional American Elm (*Ulmus americana*), Green Ash (*Fraxinus pennsylvanica*) and Yellow Birch (*Betula alleghaniensis*). Willows (Salix spp.) and Red-osier Dogwood (*Cornus sericea ssp. sericea*) are the most common species in the shrub layer. Herbaceous species present consist of Spotted Jewelweed (*Impatiens capensis*), Sensitive Fern (*Onoclea sensibilis*), Rice Cutgrass (*Leersia oryzoides*), Bittersweet Nightshade (*Solanum dulcamara*) and Yellow Marsh Marigold (*Altha palustris*).	2-3
MAMM1-2: Cattail Mineral Meadow Marsh	The community contains a few Freeman's Maples and American Basswoods at the canopy level, and woody shrubs including Buckthorn, Pussy Willow (*Salix discolor*) and White Meadowsweet (*Spiraea alba*). The ground layer included terrestrial plants such as Swamp Milkweed (*Asclepias incarnate*) and Blue Vervain (*Verbena hastata*) as well as emergent aquatic plants including Broad-leaved Cattail (*Typha latifolia*), American Burreed (*Sparganium americanum*) and Northern Water-plantain (*Alisma triviale*) at the perimeter of open water ponds.	4-6
MEMM4: Fresh-Moist Mixed Meadow	Ground cover consisted primarily of Common Timothy grass (*Phleum pratensis*), Garden Bird's-foot Trefoil (*Lotus corniculatus*) and Cow Vetch (*Vicia cracca*) with Awnless Brome (*Bromus inermis*), Orchard Grass (*Dactylis glomerata*) and Reed Canary Grass (*Phalaris arundinacea*) associates. Woody vegetation is uncommon in this community, but includes young Black Walnut (*Juglans nigra*), Eastern Redcedar (*Juniperus occidentalis*), Common Buckthorn and Staghorn Sumac (*Rhus typhina*).	7
MEMM3: Dry-Fresh Mixed Meadow	Scattered Scott's Pine (*Pinus sylvestris*) as well as occasional Common Apple (*Malus pumila*) and Common Buckthorn occur in this mostly open/herbaceous ecosite. The predominant groundcover vegetation is Awnless Brome with Canada Goldenrod (*Solidago canadensis ssp. canadensis*) and Garden Bird's-foot Trefoil also common.	8
TAGM5: Hedgerow	These narrow strips of vegetation between agricultural field consisted mainly of Common Buckthorn, Staghorn Sumac and Manitoba Maple, with Riverbank Grape (*Vitis riparia*) and Virginia creeper (*Parthenocissus quinquefolia*) climbing underneath the canopy	9
OAGM1: Annual Row Crop	Cultivated fields	10-11
CVR_4: Rural Residential	N/A	12
THDM5: Fresh-Moist Deciduous Thicket	Common Buckthorn, Choke Cherry, Alternate-leaved Dogwood, Staghorn Sumac, Manitoba Maple, Riverbank Grape, and Virginia creeper.	N/A

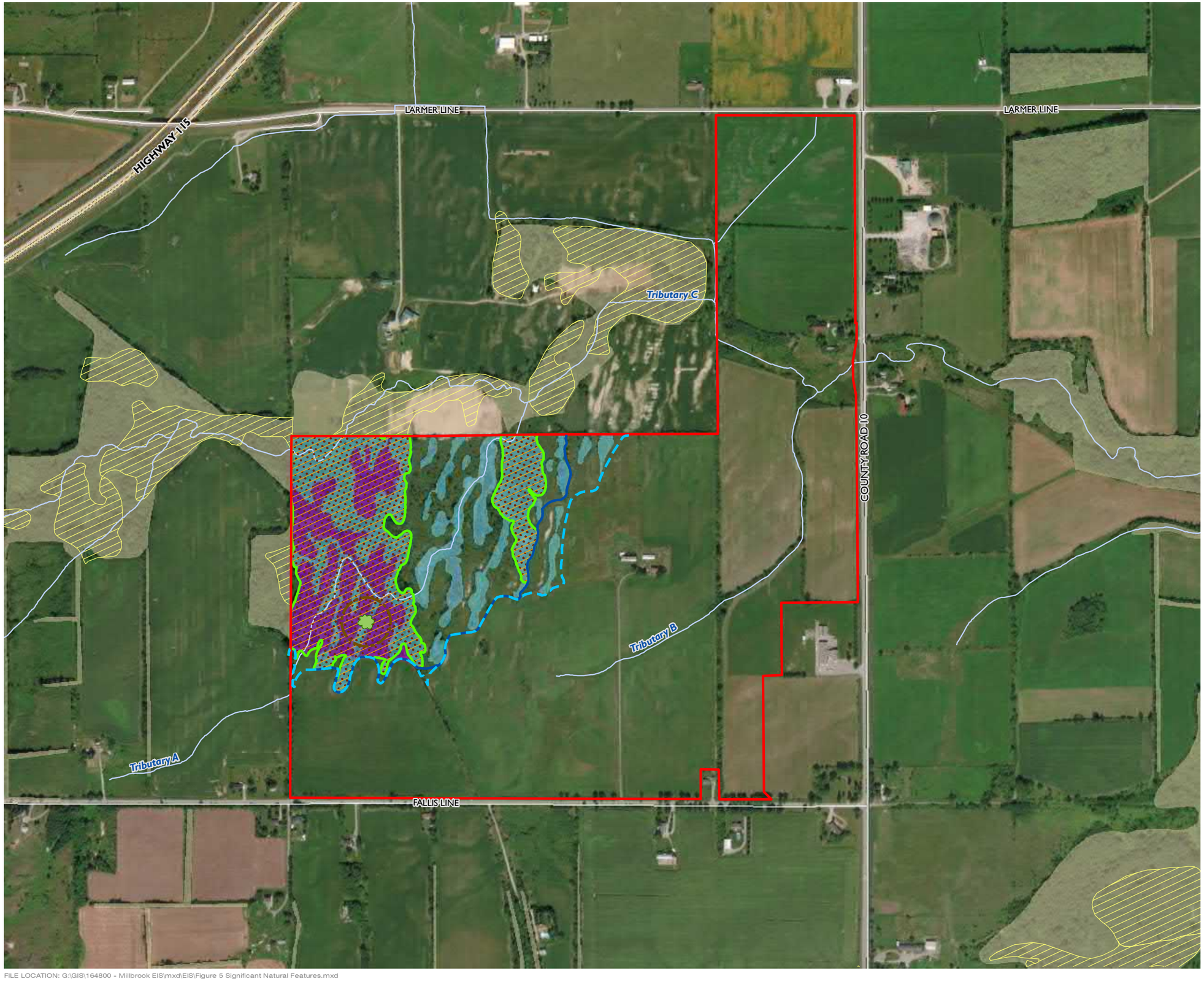

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FIGURE 5
SIGNIFICANT NATURAL FEATURES

- Study Area
- Butternut Observed
- 50 m Butternut Setback
- Core Wetland Boundary
- Water Body
- Wetland- Evaluated-Other
- Significant Woodland
- Unevaluated Wetland (MNRF)
- Woodlands (MNRF)

Significant Wildlife Habitat

- Seeps and Springs
- Special Concern and Rare Wildlife Species:
  - Eastern Wood-pewee
  - Wood Thrush
  - Striped Cream Violet

Candidate Significant Wildlife Habitat

- Bat Maternity Colony
- Waterfowl Nesting Areas

1:7,500

0 100 200 400 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, TOWNSHIP OF CAVAN MONAGHAN

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

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FILE LOCATION: G:\GIS\164800 - Millbrook EIS\mxd\EIS\Figure 5 Significant Natural Features.mxd

several non-native or invasive species were observed. A full list of the vegetation species observed within the Study Area has been included in Appendix G.

Potential impacts related to vegetation within the Study Area are included in Section 8.1.3.

5.3.3 Wetlands

The unevaluated wetlands located within and adjacent to the Study Area have been referred to as the Baxter Creek Headwaters Wetland Complex (BCH Wetland Complex) for the purposes of the OWES study and EIS. The proposed BCH Wetland Complex is comprised of two wetland units located northwest of the Town of Millbrook and roughly bound by Fallis Line to the south, County Road 10 to the east, Larmer Line to the north and Highway 115 to the west. The proposed wetland complex is also located between two other evaluated wetlands that include:

- The Tapley South Wetland Complex, evaluated as "other" which indicates a non-significant scoring for the complex but is potentially locally significant. This wetland is located northwest of the Baxter Creek Headwaters wetland complex at Tapley Quarter Line/Larmer Line and overlaps the same watershed/catchment area.
- The Millbrook Northeast Wetland Complex, evaluated as "other" which indicates a non-significant scoring for the complex but is potentially locally significant. This wetland is located to the south/southeast, with units located in the Town of Millbrook and along Baxter Creek.

The two units that make up the proposed BCH Wetland Complex and provide ecological support to the health of Baxter Creek and the downstream evaluated wetland, Millbrook Northeast. The units have been evaluated as a distinct complex instead of added to the neighbouring evaluated wetland complexes due to the following:

- Located further than 750 m from the Tarpley Wetland Complex; and,
- Located within 750 m of the Millbrook Northeast Wetland Complex but within a separate watershed/catchment area.

The two units that form the proposed BCH Wetland Complex are comprised of a number of smaller units that are generally less than 0.5 hectares in size and associated with glacial activity (ice-block ridges). Due the number of smaller units, it was decided to combine these into one larger unit as the units are generally all hydrologically connected.

The OWES scoring card and tables have been included in Appendix H.

5.3.4 Woodlands

Woodlands were investigated as part of ELC and botanical surveys in 2017. Significant Woodlands within the Study Area are comprised of Fresh - Moist Sugar Maple Hardwood Forest and Mineral Deciduous

Swamp communities as described in Table 5. One Butternut tree was identified within the Significant Woodland (Figure 5). As the proposed development is located more than 50 m from the Butternut tree, no impacts to the individual are anticipated. No other significant woodlands were identified within the Study Area.

Potential impacts related to Significant Woodlands and other vegetation communities within the Study Area are included in Section 8.1.3.

5.3.5 Significant Wildlife Habitat

As the Significant Woodland and core wetland communities will be protected as part of the proposed development, specific surveys for bat maternity colonies were not conducted as part of this EIS. As a result we have identified candidate SWH for Bat Maternity Colonies within the woodland and wetland communities (Figure 5). In addition, based on the observation of seeps within the wetland by Geo-logic Inc. in 2015, the wetlands are considered SWH for seeps and springs (Figure 5). The results of the breeding bird and amphibian surveys as they apply to SWH are detailed below.

5.3.5.1 Breeding Bird Survey

A total of 52 bird species were observed during breeding bird surveys in 2017 (Table 6). Although most species observed are considered common and secure (S4) to very common (S5) in the province of Ontario, several are considered Species of Conservation Concern, and one SAR, Barn Swallow (*Hirundo rustica*) was observed within the Study Area as a flyover.

Of the 52 species observed, two species; Scarlet Tanager (*Piranga olivacea*) and Canada Warbler (*Cardellina canadensis*); are considered area sensitive and considered under woodland area-sensitive breeding bird habitat in the Ecoregion 6E Criterion Schedule (MNRF 2015). In addition, Species of Conservation Concern were observed which fall under Special Concern and Rare Wildlife Species SWH including Wood Thrush (*Hylocichla mustelina*) and Eastern Wood-pewee (*Contopus virens*). Although the criteria for woodland area-sensitive species within the woodlands related to size is not met (i.e., must be ≥30 ha with interior habitat); because species such as Eastern Wood-pewee, and Wood Thrush were observed that do not fit into a specific SWH type, the deciduous forest community (FODM6-5) would be considered SWH for Special Concern and Rare Wildlife Species (Figure 5).

Table 6: Breeding Bird Survey Results

SCIENTIFIC NAME	COMMON NAME	SRANK[2]	SARA[3]	ESA[4]	BREEDING EVIDENCE[1]
Actitis macularius	Spotted Sandpiper	S5	---	---	O
Aix sponsa	Wood Duck	S5	---	---	H, S
Agelaius phoeniceus	Red-winged Blackbird	S4	---	---	S, O, F/O
Anas platyrhynchos	Mallard	S5	---	---	F/O
Bombycilla cedrorum	Cedar Waxwing	S4B	---	---	F/O

SCIENTIFIC NAME	COMMON NAME	SRANK[2]	SARA[3]	ESA[4]	BREEDING EVIDENCE[1]
Bonasa umbellus	Ruffed Grouse	S4	---	---	AREA
Cardellina canadensis	Canada Warbler	S4B	THR	SC	ASEAR
Cardellina pusilla	Wilsons Warbler	S4B	---	---	S
Cardinalis cardinalis	Northern Cardinal	S5	---	---	S
Carduelis tristis	American Goldfinch	S5B	---	---	F/O
Cathartes aura	Turkey Vulture	S5B	---	---	F/O
Charadrius vociferus	Killdeer	S5B,S5N	---	---	S
Colaptes auratus	Northern Flicker	S4B	---	---	ASEAR
Contopus virens	Eastern Wood-pewee	S4B	---	SC	S
Corvus brachyrhynchos	American Crow	S5B	---	---	F/O
Cyanocitta cristata	Blue Jay	S5	---	---	S
Dryocopus pileatus	Pileated Woodpecker	S5	---	---	S
Dumetella carolinensis	Gray Catbird	S4B	---	---	S/P
Empidonax alnorum	Alder Flycatcher	S5B	---	---	S
Empidonax minimus	Least Flycatcher	S4B	---	---	S
Empidonax traillii	Willow Flycatcher	S5B	---	---	S
Geothlypis philadelphia	Mourning Warbler	S4B	---	---	ASEAR
Geothlypis trichas	Common Yellowthroat	S5B	---	---	S
Hirundo rustica	Barn Swallow	S4B	---	THR	F/O
Hylocichla mustelina	Wood Thrush	S4B	---	SC	S
Icterus galbula	Baltimore Oriole	S4B	---	---	S/P,O
Larus delawarensis	Ring Billed Gull	S5B,S4N	---	---	F/O
Melospiza melodia	Song Sparrow	S5B	---	---	S
Mniotilta varia	Black-and-white Warbler	S5B	---	---	S
Molothrus ater	Brown- headed Cowbird	S4B	---	---	S
Myiarchus crinitus	Great Crested Flycatcher	S4B	---	---	S
Oreothlypis ruficapilla	Nashville Warbler	S5	---	---	S
Passerculus sandwichensis	Savannah Sparrow	S4B	---	---	S
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B	---	---	S
Picoides pubescens	Downy Woodpecker	S5	---	---	S
Picoides villosus	Hairy Woodpecker	S5	---	---	P
Piranga olivacea	Scarlet Tanager	S4B	---	---	S
Poecile atricapillus	Black-capped Chickadee	S5	---	---	O,S
Quiscalus quiscula	Common Grackle	S5B	---	---	F/O
Sayornis phoebe	Eastern Phoebe	S5B	---	---	O
Setophaga citrina	Hooded Warbler	S4B	THR	---	S

SCIENTIFIC NAME	COMMON NAME	SRANK[2]	SARA[3]	ESA[4]	BREEDING EVIDENCE[1]
Setophaga pensylvanica	Chestnut sided warbler	S5B	---	---	S
Setophaga petechia	Yellow Warbler	S5B	---	---	S
Setophaga ruticilla	American Redstart	S5B	---	---	S
Tachycineta bicolor	Tree Swallow	S4B	---	---	F/O
Toxostoma rufum	Brown Thrasher	S4B	---	---	S, P
Turdus migratorius	American Robin	S5B	---	---	F/O
Tyrannus tyrannus	Eastern Kingbird	S4B	---	---	H
Vermivora chrysoptera	Golden-winged Warbler	S4B	THR	SC	AREA,O
Vireo gilvus	Warbling Vireo	S5B	---	---	S
Vireo olivaceus	Red-eyed Vireo	S5B	---	---	S
Zenaida macroura	Mourning Dove	S5	---	---	F/O

Breeding Bird Codes from Breeding Bird Atlas of Ontario (Cadman *et al.* 2007)

Observed

X Species observed in its breeding season (no breeding evidence)

Possible

H Species observed in its breeding season in suitable nesting habitat

S Singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season

Probable

P Pair observed in suitable nesting habitat in nesting season

T Permanent territory presumed through registration of territorial song, or the occurrence of an adult bird, at the same place, in breeding habitat, on at least two days a week or more apart, during its breeding season.

D Courtship or display, including interaction between a male and a female or two males, including courtship feeding or copulation

V Visiting probable nest site

A Agitated behaviour or anxiety calls of an adult

B Brood Patch on adult female or cloacal protuberance on adult male

N Nest-building or excavation of nest hole, except by a wren or a woodpecker

Confirmed

NB Nest-building or excavation of nest hole by a species other than a wren or a woodpecker

DD Distraction display or injury feigning

NU Used nest or egg shells found (occupied or laid within the period of the survey)

FY Recently fledged young (nidicolous species) or downy young (nidifugous species), including incapable of sustained flight

AE Adult leaving or entering nest sites in circumstances indicating occupied nest

FS Adult carrying fecal sac

CF Adult carrying food for young

NE Nest containing eggs

NY Nest with young seen or heard

In addition, as Wood Ducks were observed within the breeding season it is possible that SWH for Waterfowl Nesting Areas exists in association with the open water pockets of the wetland. Since specific waterfowl nesting surveys were not conducted, for the purposes of this report we have identified candidate SWH for Waterfowl Nesting within the wetland (Figure 5). In accordance with the Ecoregion 6E Criterion Schedule (MNRF 2015), the extent of the SWH for Waterfowl Nesting Areas is 120 m upland from a wetland or cluster of wetlands where waterfowl nesting is known to occur. Upland areas should be at least 120 m wide in order to provide protection from predators locating nests. As a result, and based on the configuration of the wetland pockets within the Study Area, upland ELC communities adjacent (and connecting) the individual wetland pockets have been considered the limit of the candidate SWH. As agricultural fields would not provide movement areas or protection from predators, these communities have not been considered as part of the Candidate SWH for the purposes of this EIS.

5.3.5.2 Amphibian Survey

Potential amphibian breeding habitat was identified within the Significant Woodland/ wetland complex. In accordance with the Ecoregion 6E Criterion Schedule (MNRF 2015), the Study Area was considered under Amphibian Breeding Woodland Habitat based on the presence of vernal pools within the wetland polygons. In order for Amphibian Breeding Woodland Habitats to be significant, they must contain one or more of the listed newt/salamander species; at least two or more of the listed frog/toad species with at least 20 individuals (adults or egg masses) of each species; or at least two of the listed frog/toad species with Call Code 3.

Several amphibian species including Spring Peeper (*Pseudacris crucifer*), American Toad (*Anaxyrus americanus*), Gray Treefrog (*Hyla versicolor*), and Pickerel Frog (*Lithobates palustris*) were heard calling throughout the three amphibian breeding surveys conducted in 2017. In addition, tadpoles were noted in wetland communities during the ELC survey. The only two species considered under woodland habitat observed are Spring Peeper and Gray Treefrog; however Spring Peeper was the only species that was recorded with a Call Code of 3 on any of the three survey days. Therefore, according to the Ecoregion 6E Criterion Schedule (MNRF 2015) no SWH for breeding amphibians is present within the Study Area.

5.3.5.3 Incidental Wildlife

Incidental wildlife species observed within the Study Area are listed in Table 7 below. With the exception of Monarch (*Danaus plexippus)* (Special Concern), all of the species listed below are considered common and secure in Ontario (S5). Potential impacts related to wildlife within the Study Area are included in Section 8.1.5.

Table 7: Incidental Wildlife Observations

SCIENTIFIC NAME	COMMON NAME	SRANK[2]	SARA[3]	ESA[4]	EVIDENCE
BIRDS					
Agelaius phoeniceus	Red-winged Blackbird	---	---	S4	Observed during ELC
Vireo olivaceus	Red-eyed Vireo	---	---	S5B	Observed during ELC
Buteo jamaicensis	Red-tailed Hawk	---	---	S5	Observed during ELC
Aix sponsa	Wood Duck	---	---	S5	Observed during ELC
HERPETOFAUNA					
Chrysemys picta marginata	Midland Painted Turtle	---	---	S4	Observed during ELC
unknown	Tadpoles	---	---	---	Observed during ELC
MAMMALS					
Castor canadensis	Beaver	---	---	S5	Dam in wetland
Odocoileus virginianus	White-tailed Deer	---	---	S5	Tree stand in forest
LEPIDOPTERA					
Danaus plexippus	Monarch	SC	SC	S2N,S4B	Observed during ELC

1. Subnational (Provincial) Rank (Source: MNRF National Heritage Information Centre website, 2007)
2. Federal Species at Risk Act (Source: SARA Public Registry, 2007)
3. Provincial Endangered Species Act (Source: MNRF website, 2007

6.0 Ecological Function

Natural features within and adjacent to the Study Area were analyzed to determine their ecological function. At the larger landscape scale, the Study Area exists as part of the Peterborough Drumlin field and in the vicinity of two non-PSW wetland complexes. Wetlands within the Study Area provides ecological and hydrological function, providing habitat to SAR and Species of Conservation Concern in the form of several types of SWH; and acting as a Core Area and Linkage Area of the County's NHS; connecting to adjacent woodlands and habitats through a vegetated corridor and surface water conveyance along the Baxter Creek Tributary (Tributary A and C). General ecological functions of natural features within the Study Area include prevention of erosion and runoff, facilitating hydrological and nutrient cycling, and improving localized soil, water and air quality. Within the proposed development area, treed areas provide limited cover, foraging, refuge, and nesting habitat for urban terrestrial wildlife.

6.1 Hydrological Function

As indicated in the Hydrogeological Assessment Report (Geo-Logic Inc. 2015), a flow divide appears to exist where the shallow groundwater flow direction is toward the north and south at Fallis Line.

Seepage areas were observed in the wetland areas on the south of the slope of the rolling topography where groundwater appears to seep out of the slope; however, Geo-Logic Inc. goes on to say that there is not a shallow water table aquifer at the site within the till material where seepage was observed. Fine grained materials have high moisture content as they are able to retain more water but this does not indicate that they comprise a water table aquifer (Geo-Logic Inc. 2015). Though the moisture content of fine grained materials may be higher, the yield of water at significant quantities from these soils, in comparison with a water table aquifer that is comprised generally of sand and gravel is not expected. The water levels also reflect seasonal spring conditions with ponded surface water (Geo-Logic Inc. 2015).

At a few of the piezometer stations monitored by Geo-Logic Inc. in 2015, hydrostatic pressure from water encountered within sand seams appears to have created a potentiometric water level near the surface. However the potentiometric surface is not a water table surface but a potential water level from the water bearing sand seams encountered at depth; similar to what would occur in a well, where the water surface is above the top of the aquifer unit. Thus, significant quantities of groundwater within the shallow soils are not expected within the Study Area.

As indicated in the Hydrogeological Assessment Report (Geo-Logic Inc. 2015), surface waters flows in accordance with the local topography through Tributaries A, B and C, and eventually into Baxter Creek.

6.2 Aquatic and Terrestrial Habitat Function

According to ORCA's Watershed Panning & Regulations Policy Manual (2015), wetlands are important natural features on the landscape, performing many important ecological functions including moderating water flow by absorbing surface water runoff then slowly releasing it. This helps to reduce flooding and to sustain stream flows during dry spells. Many wetland areas recharge groundwater by moving surface water into the groundwater system. As a result, they play an important role in protecting and improving water quality, provide for fish and wildlife habitat and offer a number of associated recreational opportunities. The lands that surround wetland areas are also important; in sustaining the wetlands vital hydrologic and ecological functions (ORCA 2015).

Woodlands are also an integral component of the natural heritage system; providing environmental and economic benefits to both the private landowner and the general public, such as erosion prevention, hydrological and nutrient cycling, provision of clean air and the long-term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products (ORCA 2015).

The Baxter Creek Headwaters Wetland Complex, as a whole, provides important habitat for wildlife in the form of several types of SWH; including Seeps and Springs, Special Concern and Rare Wildlife Species (Eastern Wood-pewee, Wood Thrush, and Striped Cream Violet); and candidate Waterfowl Nesting Areas and Bat Maternity Colonies. The wetlands also provide general habitat and protection and cover to common plants and wildlife including amphibians. Some pockets of wetland are still present within the field but have been disconnected from the core wetland complex, separated by agricultural activities.

As for surface water features, while Tributaries A and C area surrounded by natural vegetation communities, Tributary B is located within an active agricultural field with little riparian vegetation for much of its length. In addition, barriers to fish movement and effective flow conveyance exist along Tributary B in the form of crushed and/ or plugged culverts beneath the driveway and farm laneway (refer to photos in Appendix E). In addition, the bank of Tributary C is quite steep at its confluence with Tributary B creating a barrier for fish to pass upstream into Tributary B through the dense grass during low flow. Based on this, Tributary B may contain seasonal fish habitat downstream during high water periods (i.e., spring freshet); however, barriers present throughout the tributary prevent effective passage of fish upstream, and therefore, the primary function of Tributary B is likely contribution of allochthonous flows to downstream reaches.

The remaining areas of the Study Area, and the majority of the proposed development area, provide minimal ecological function for plant and wildlife species as a result of the active agricultural use.

6.3 Connectivity and Linkage Function

Areas within the Study Area have been designated by both the County and the Township as Natural Core Areas and Natural Linkage Areas; and are associated with the wetland complex and Baxter's Creek corridor. As mentioned above, these areas connect adjacent woodlands and other habitats through a vegetated corridor and surface water conveyance along the Baxter Creek Tributary (Tributary A and C).

Natural Core Areas include areas with the highest concentration of sensitive and/or significant natural features and functions. These areas are to be managed as a connected and integrated natural heritage system recognizing the functional inter-relationships between them (Cavan-Monaghan 2015). This designation also applies to lands that form a natural 30 m buffer from significant natural heritage features. Natural Linkages Areas includes lands forming a 120 m vegetative buffer from Key Natural Heritage Features in the Natural Heritage System. This designation forms part of a central corridor system that supports or has the potential to support movement of plants and animals and provide linkages to natural heritage features (Cavan-Monaghan 2015).

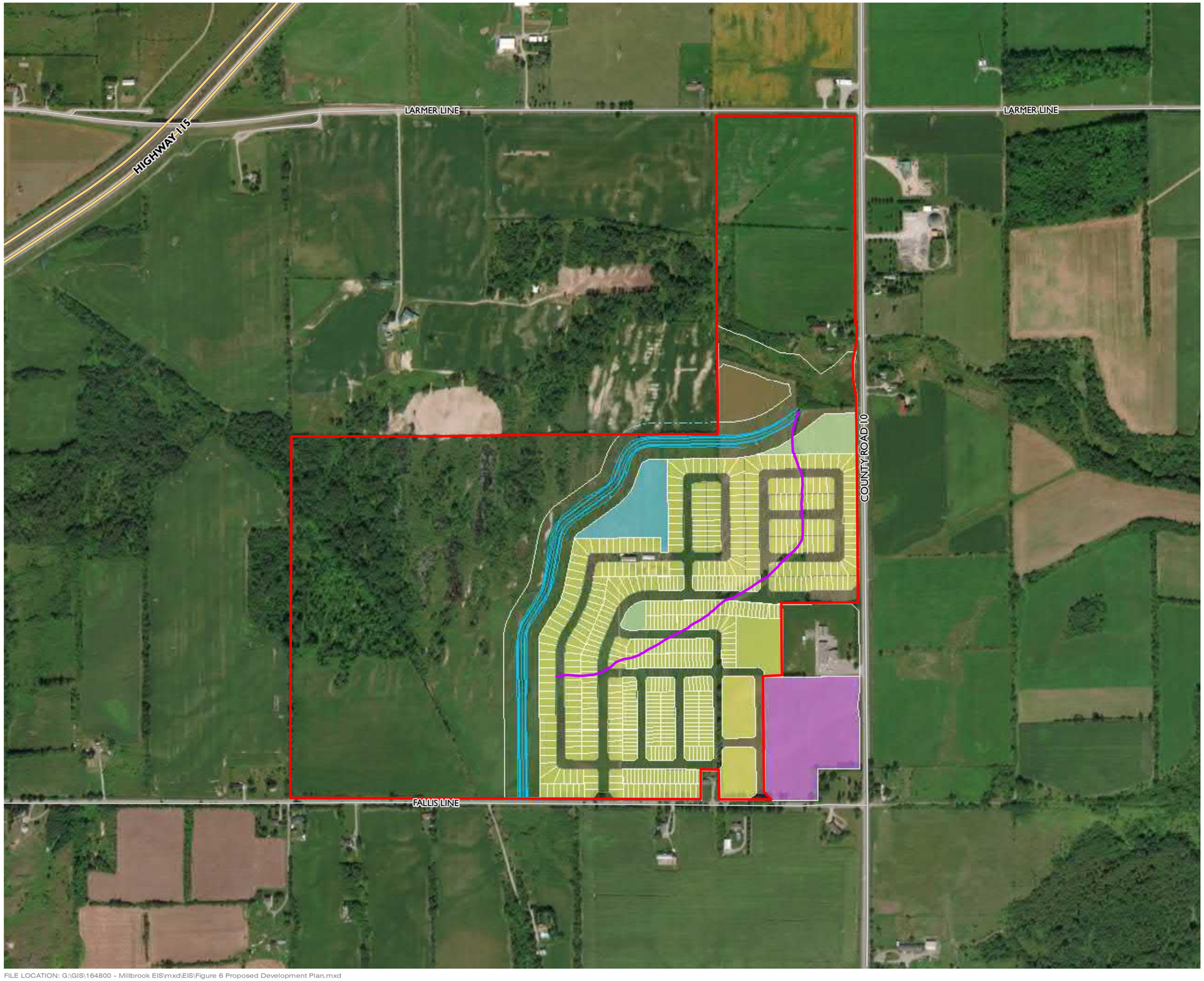
Within the Township of Cava-Monaghan and the jurisdiction of ORCA, the emphasis is on system integrity and the importance of a holistic or systems-based approach. Linkages are a key element of a natural heritage system that helps support the natural movement pattern of plants and animals that is necessary for biodiversity conservation and long term sustainability (ORCA 2015). A systems approach considers features as well as functions and is premised on a precautionary approach that considers the needs of more sensitive species from a landscape perspective (ORCA 2015).

Potential impacts to linkage functions as a result of the proposed development are discussed further in Section 8.1.1.1.

7.0 Description of Development

The proposed Millbrook development includes construction of a new residential development, containing typical 1 and 2-storey homes, with associated stormwater management (SWM) ponds, asphalt-paved roadways, and servicing. The development will front on both Fallis Line and County Road 10. Access for the subdivision will consist of a road network with two road connections off Fallis Line and one road connection to County Road 10. A park will be centrally located within the subdivision; and the remainder of the Study Area will be retained in environmental protection blocks. The proposed servicing will be installed at depths of up to approximately 10 m mbeg or shallower, and will be municipally serviced for water and sewer (Figure 6).

Construction of the proposed development would include the removal of select trees, shrubs and other vegetation from the development area. Landscaping would include, but is not limited to, the the insallation of patios, fencing, sod, and tree plantings. The associated impacts of the development and the mitigation measures will be discussed in Sections 8 and 9.



MILLBROOK
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FIGURE 6
PROPOSED DEVELOPMENT PLAN

- Study Area
- Watercourse to be Removed (863 m)
- Proposed Channel Realignment
- Proposed Channel Realignment 30 m Buffer
- Proposed Lot Line
- Proposed Road
- Agricultural
- Park/Open Space
- Recreation Centre
- Residential
- SWM Pond

1:7,500

0 100 200 400 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, TOWNSHIP OF CAVAN MONAGHAN

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 164800
STATUS: DRAFT
DATE: 10/3/2018

FILE LOCATION: G:\GIS\164800 - Millbrook EIS\mxd\EIS\Figure 6 Proposed Development Plan.mxd

8.0 Potential Impact Assessment

8.1 Potential Direct Impacts

Potential direct impacts are those that are immediately evident as a result of the development. Typically, the adverse effects of potential direct impacts are most evident during the site preparation and construction phase of a development. Potential direct impacts of the proposed residential development include the following:

- Diversion of surface water flows;
- Erosion and sedimentation of adjacent natural features (Significant Woodland and wetland);
- Reduction of hydrological function (groundwater);
- Reduction of hydrological function (infiltration);
- Tree and vegetation removal; and,
- Loss of/ disturbance to wildlife and wildlife habitat (including SAR).

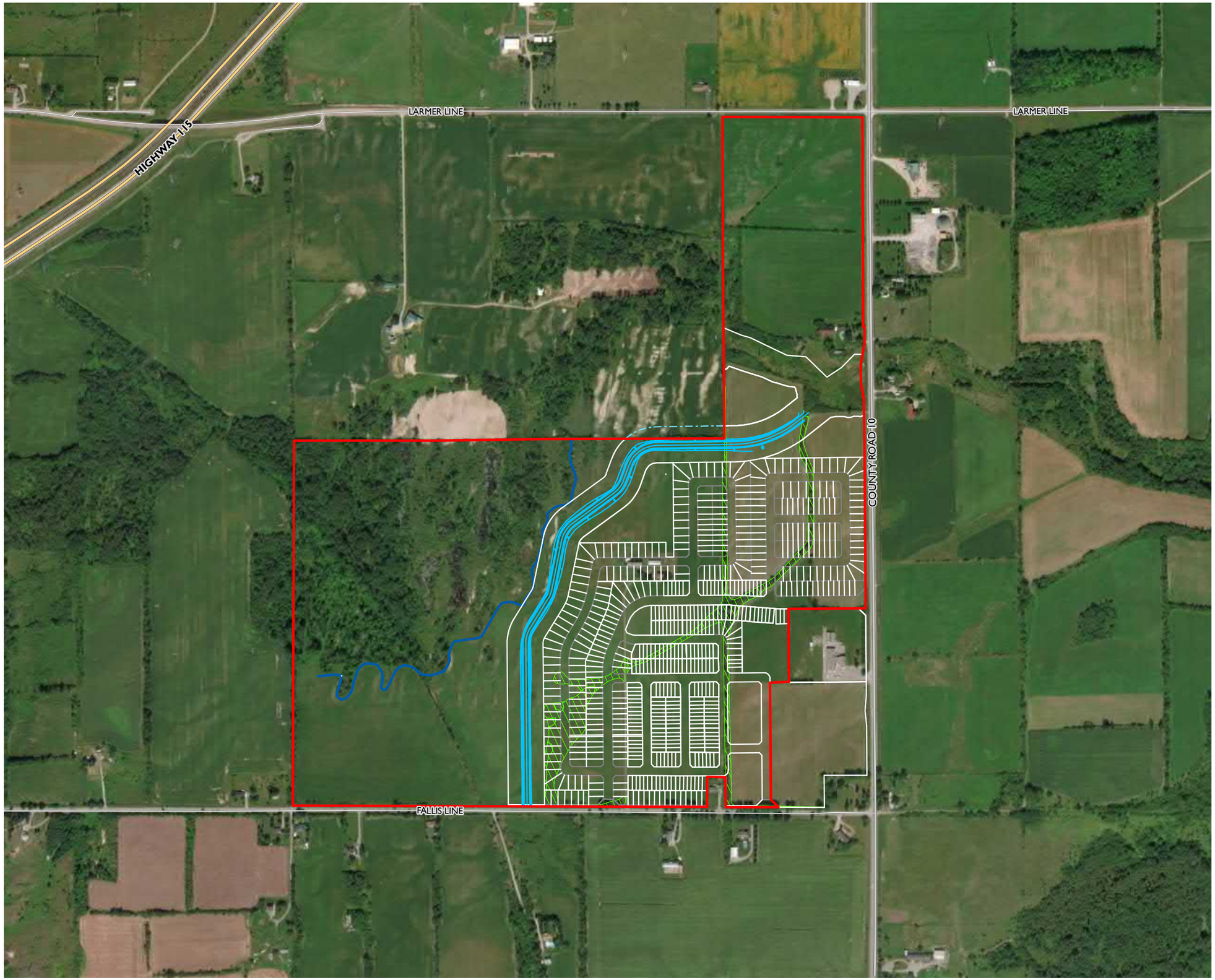
The proposed site plan and environmental impacts of development are shown in Figure 7.

8.1.1 Diversion of Surface Water Flows

The health of watercourses is integral to the health of a watershed as they provide key ecological functions and hydrologic functions such as fish habitat and habitat for wildlife, sediment and nutrient transport and deposition, transfer media for energy and organisms, source of water supply and important contributions to the hydrologic cycle (ORCA 2015).

The structure and function of watercourses are influenced by channel morphology, sediment characteristics and the nature of the riparian vegetation. Changes to channel morphology can reduce the ability of the watercourse to process sediment causing erosion and changing the amount or size of bed load being moved (ORCA 2015). Loss of riparian vegetation can result in more pollutants and run-off being transferred from the land to the water, impacting water quality and flooding downstream reaches. In addition, loss of riparian vegetation or changes to upstream or source of water supply can have impacts to the thermal regime of the watercourse. These changes affect riparian and aquatic habitat and can impair the watercourse for use by fish, wildlife, humans and other organisms (ORCA 2015).

The overall topography north of Fallis Line generally drains to Tributary B, which flows in a north-easterly direction. Tributary B drains into Tributary C, located along the southern boundary of the Study Area, before passing through a concrete box culvert at County Road 10. The total upstream drainage area of the Tributary C is 1,055.74 ha; and its associated floodplain will be entirely contained within open space blocks protecting proposed lots from flooding (Valdor, 2018).



MILLBROOK
EIS

FIGURE 7
POTENTIAL IMPACTS

- Study Area
- Proposed Channel Realignment
- Proposed Channel Realignment 30 m Buffer
- Proposed Lot Line
- Proposed Road
- Core Wetland Boundary
- Vegetation to be Removed (3.18 ha)

1:7,500

0 100 200 400 m

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF, TOWNSHIP OF CAVAN MONAGHAN

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 164800
STATUS: DRAFT
DATE: 10/3/2018

FILE LOCATION: G:\GIS\164800 - Millbrook EIS\mxd\EIS\Figure 7 Potential Impacts.mxd

As mentioned, the proposed development plan includes the realignment of Tributary B along the western boundary of the development. In its current state, Tributary B contains standing water for the majority of its length, contains two barriers to flow and fish movement (crushed in culverts) and contains little riparian vegetation. As a result, nutrient inputs from adjacent agricultural use and warming of pooled waters within the tributary pose in impact to downstream watercourses which are designated as cold water systems. Therefore, realignment of the tributary may be of ecological and hydrological benefit; providing effective conveyance of flow downstream with robust riparian buffers creating additional habitat and corridor linkage function.

In order to determine the Regulatory flow through the Study Area associated with Tributary B, the upstream drainage areas were delineated, and hydrologic modelling was completed. The total upstream drainage area is 32.02 ha. Based on this analysis, it was determined that the Regional Storm is the Regulatory Storm with a peak flow of 2.51 cm (Valdor, 2018). Surface flow from the development area contributing to Baxter Creek downstream of the Study Area will be maintained through the realigned channel as well as use of an integrated SWM system with use of Low Impact Development (LID) techniques.

Refer to Section 9.1-9.3 for mitigation measures related to surface flows.

8.1.1.1 Loss of Linkage Function

While areas designated as Natural Core Area will be preserved through the proposed development process, there are areas designated as Natural Linkage Area within the proposed development area. Natural Linkage Areas are defined by the County as areas forming part of a central corridor system that have the potential to support movement of plants and animals between the Natural Core Areas, Natural Linkage Areas, river valleys and stream corridors. Where development is proposed in the Natural Linkage Areas the Township requires that the Linkage function will be preserved and enhanced as the result of the proposed development.

While Tributaries A and C are surrounded by natural vegetation communities, Tributary B is located within an active agricultural field with little riparian vegetation for much of its length, and therefore likely provides marginal terrestrial habitat function in its current state. In addition, potential barriers to fish movement and effective flow conveyance exist along Tributary B in the form of crushed and/ or plugged culverts beneath the driveway and farm laneway (refer to photos in Appendix E). As a result, nutrient inputs from adjacent agricultural use and warming of pooled waters within the tributary pose in impact to downstream watercourses which are designated as cold water systems.

Furthermore, it was noted that during site visits that the bank of Tributary C is quite steep at its confluence with Tributary B and the grade difference is creating a barrier for fish to passage upstream into Tributary B through the dense grass during low flow. Based on this, Tributary B may contain seasonal fish habitat downstream during high water periods (i.e., spring freshet). However, barriers

present throughout the tributary prevent effective passage of fish upstream, and therefore, the primary function of Tributary B is likely contribution of allochthonous flows to downstream reaches. Furthermore, consultation with DFO suggested that these barriers, specifically the grade difference to Tributary 3, present a danger to fish of getting trapped within Tributary B during high water and having no way of escaping back into the downstream system.
As a result, Tributary B is providing marginal function as a Linkage Area. Mitigation measures related to maintaining linkage functions within the Study Area have been included in Section 9.1.

8.1.2 Erosion and Sedimentation of Natural Features

Construction activity, especially operations involving the handling of earthen material, dramatically increases the availability of particulate matter for erosion and transport by surface drainage. In order to mitigate the adverse environmental impacts caused by the release of silt-laden stormwater runoff into receiving watercourses, measures for erosion and sediment control are required for construction sites. This is an extremely important component of land development that plays a large role in the protection of downstream watercourses and aquatic habitat.

Due to the potential for reduction in infiltration rate post-development, there is the potential for swamps, forests, and watercourses to be impacted as a result of development if construction best management practices are not implemented.

Potential impacts to these features may include, but are not limited to:

- Reduced water quality and degradation of downstream aquatic habitat (e.g. surface water flow into the wetland to the west and Baxter Creek downstream of the Study Area); and,
- Disturbance to or loss of additional vegetation due to the deposition of dust and/or overland mobilization of soil.

As a result, control measures must be selected that are appropriate for the erosion potential of the site and it is important that they be implemented and modified on a staged basis to reflect the site activities. Furthermore, their effectiveness decreases with sediment loading and therefore inspection and maintenance is required.

Refer to Section 9.3 for mitigation measures related to erosion and sedimentation within the Study Area.

8.1.3 Reduction of Hydrological Function (Groundwater)

As apparent on Figure 4, a few small wetland pockets are isolated within the agricultural fields and been disconnected from the periphery of the wetland and core wetland complex that are proposed for removal. In addition, there is one area of cattail marsh to the south within a low lying area that is proposed for removal.

As mentioned in Section 6.1, Geo-Logic Inc. has indicated that there is not a shallow water table aquifer at the site within the till material where seepage was observed. The water levels during their assessments reflected seasonal spring conditions with ponded surface water, and a water table aquifer that is comprised generally of sand and gravel is not expected. Furthermore, at a few of the piezometer stations hydrostatic pressure from water encountered within sand seams appears to have created a potentiometric water level near the surface; similar to what you would see in a well. As a result, significant quantities of groundwater within the shallow soils are not expected within the Study Area, and as a result, impacts to groundwater are not anticipated.

Measures to prevent impacts to groundwater will be included in the integrated SWM system for the proposed development, which may include LID techniques related to groundwater. Refer to Section 9.2.

8.1.4 Reduction of Hydrological Function (Infiltration)

The pre-development baseline site infiltration condition was calculated as 0.510. The calculations indicate that the existing annual surplus is 143,480 m^3 and the annual infiltration capacity is 73,175 m^3 (Valdor, 2018).

Under post-development conditions and without implementing any infiltration mitigation measures, it is estimated that approximately 45,328 m^3 of water will infiltrate the ground. This represents 61.9% of the existing infiltration volume. The notable reduction in infiltration volume is the result of an increase in the impervious area associated with the proposed development. Therefore, mitigation measures are necessary to achieve the site infiltration water balance (Valdor, 2018).

Refer to Section 9.4 for mitigation measures related to infiltration.

8.1.5 Tree and Vegetation Removal

The proposed development plan indicates tree and ground vegetation removal limited to the development area as shown on Figure 7 to facilitate grading and construction of the development.

Tree removal would result in a reduction of tree cover, marginal wildlife habitat loss, and alteration of soil conditions. On a site level, the impacts of tree and vegetation removal may include:

- Direct loss of trees;
- Decreased floral species richness and abundance;
- Altered soil conditions and water availability;
- Alteration of microclimate;
- Loss of native seed banks; and,
- Physical injury, root damage, and compaction of trees not intended for removal that may result from construction operations.

As previously stated in this report, with the exception of Tributary B, which in its current states is not providing valuable hydrologic or fish habitat function; the Study Area is largely agricultural and provides minimal ecological function and thus, the removal will result in minimal habitat loss, minimal reduction of natural cover in the area, and minimal reduction in ecological function. Refer to Section 9.5-9.6 for mitigation and enhancement opportunities.

8.1.6 Loss of and/or Disturbance to Wildlife and Wildlife Habitat

Both SWH and Candidate SWH types were identified in association with woodland and wetland communities within the Study Area. In accordance with the PPS (2014), ORCA recommends that development and/or site alteration not be permitted in SWH or the applicable buffers unless it has been demonstrated that there will be no negative impact on the wildlife habitat or its ecological functions (ORCA 2015). Since development activities are proposed wholly outside of the Significant Woodland and core wetland areas, the potential for impacts to SAR or Species of Conservation Concern utilizing the woodland/ wetland complex is limited. Although the proposed realigned tributary is to encroach into the delineated candidate Waterfowl Nesting Area SWH, establishment of the realigned channel and its corridor to the east of the core wetland boundary is expected to provide added protection to the woodland and wetland communities as well as additional aquatic habitat and surface flow area, benefitting SWH for Waterfowl Nesting Areas and other SWH functions of the wetland/ woodlands. As a result, negative impacts to wildlife within adjacent natural features are not anticipated.

There is, however, potential for flora and fauna to be impacted by vegetation clearing and other activities within the proposed development area. Habitat for flora and fauna may be impacted by construction in the following ways:

- Displacement, injury, or death resulting from contact with heavy equipment during clearing and grading activities;
- Disturbance to wildlife as a result of noise associated with construction activities, particularly during breeding periods; and,
- Loss of general wildlife habitat.

Furthermore, there is potential for Barn Swallow to be present within barns and other buildings within the proposed development area. As a result, a nest survey should be conducted prior to removal of the buildings to confirm whether Barn Swallows are using the structures. If nests are observed the activity will be registered through submission of a Notice of Activity Form to the MNRF Registry.

Wildlife impact mitigation measures have been recommended for the development area and are included in Section 9.7.

8.2 Potential Indirect Impacts

Potential indirect impacts are those that do not always manifest in the core development area, but in the lands adjacent to the development. Potential indirect impacts can begin in the construction phase; however, they can continue post-construction. Potential indirect impacts of the proposed development include anthropogenic disturbance and colonization of non-native and/or invasive species.

8.2.1 Anthropogenic disturbance

Disturbance to local wildlife communities due to indirect impacts on the lands adjacent to the proposed development could result if left unmitigated. Noise, light, vibration and human presence are indirect impacts that can adversely influence the population size and breeding success of local wildlife. These effects are more pronounced when new development is introduced in non-urban areas. Lands within the development area are already disturbed with agricultural activities and therefore, with the establishment of appropriate buffers from natural areas, the proposed development is not anticipated to cause a negative impact to natural areas.

Refer to Section 9.5 for mitigation recommendations related to buffers.

8.2.2 Colonization of Non-native and/or Invasive Species

Physical site disturbance can increase the likelihood that non-native and/or invasive flora species will be introduced to the surrounding vegetation communities. Invasive flora can establish in disturbed sites more efficiently than native flora and can then encroach into adjacent undisturbed areas. This is already occurring in some areas where species such as Common Buckthorn and Reed Canary Grass were observed. In order to maximize ecological function within the development area, removal of invasive species paired with planting of native tree and shrub species is recommended.

Refer to Section 9.6 for mitigation recommendations related to invasive species.

9.0 Mitigation and Opportunities for Enhancement

Mitigation involves the avoidance or minimization of developmental impacts through good design, construction practices and/or restoration and enhancement activities. The feasibility of mitigation options has been evaluated based on the existing conditions within and adjacent to the Study Area. The impact assessment highlighted six potential direct impacts, which include diversion of surface water flows, erosion and sedimentation of natural features, reduction of hydrological function (groundwater and infiltration), tree and vegetation removal, and potential loss of or disturbance to wildlife.

A variety of mitigation techniques can be used to minimize or eliminate the potential impacts noted above. These measures may include a landscaping and plating plan, a wildlife impact mitigation plan, a SWM plan, erosion and sediment control plan and an environmental monitoring plan. Each mitigation measure is introduced below. Detailed mitigation measures will be finalized in consultation with the ORCA and the Township as part of the preliminary and Detailed Design of the development.

9.1 Realignment of Tributary B

As mentioned, the proposed development plan includes the realignment of Tributary B along the western boundary of the development. In its current state, Tributary B contains standing water for the majority of its length, contains two barriers to flow and fish movement (collapsed/plugged culverts) and contains little riparian vegetation. As a result, nutrient inputs from adjacent agricultural use and warming of pooled waters within the tributary pose an impact to downstream watercourses which are designated as cold water systems.

Tributary B is designated as a Natural Linkage Area in the Township OP. Where development is proposed in the Natural Linkage Areas the Township requires that the Linkage function will be preserved and enhanced as the result of the proposed development. In its current state, Tributary B is located within an active agricultural field with little riparian vegetation for much of its length, and therefore likely provides marginal terrestrial habitat function in its current state. In addition, potential barriers to fish movement and effective flow conveyance exist along Tributary B in the form of collapsed and/ or plugged culverts beneath the driveway and farm laneway (refer to photos in Appendix E).

ORCA generally recommends that all watercourses and adjacent areas remain in their natural state and that base flow and velocity be maintained. However, proposals to realign natural watercourses or previously realigned watercourses may be supported if the alterations are proven to establish flood relief, erosion control, or fisheries and/or environmental enhancement to ORCA's satisfaction (ORCA 2015).

Realignment of Tributary B will involve creation of approximately 1172.37 m of new, naturalized channel, flowing northeast outside of the western development boundary; resulting in an additional ~264 m of channel length when compare the existing condition within Tributary B. Furthermore, the total amount of area to be created below the high water mark for the realignment is 12,896 m^2, which equates to an increase of approximately 10,426.25 m^2 of habitat below the high water mark, and approximately 434.7 m^2 of potential fish habitat. Refer to Attachments A and B of Appendix E.
The upstream limit of the channel will originate at Fallis Line along the southern property boundary; incorporating a few disconnected wetland pockets along the periphery of the Significant Woodland/ wetland complex; and conveying flows from south of Fallis Line as well as surface water inputs within the property north and east toward Tributary C, and ultimately Baxter Creek. This will create a connected linkage corridor that does not currently exist in Tributary B. The existing confluence with Tributary C will be maintained at the downstream end of the realigned tributary to prevent potential downstream impacts.

Measures used to protect fish and fish habitat from development proposals in or around water include timing windows, which restrict work around water to times outside of the critical life stages of fish based on the water feature's thermal condition; and, buffer widths (ORCA 2015). Within the MNRF Peterborough District, the timing restrictions are as follows:

- Coldwater: October 1st - May 31 (note there is a typo in the ORCA 2015 document)
- Warmwater: April 1st - June 30th
- Both: October 1st – June 30th.

As a result, no in-water work should occur between April 1st – June 30th of a given year, unless no water is present (work in the dry). Refer to Appendix E for further mitigation measures related to in-water works.

The thermal regime of the water feature not only affects the timing for which works in and around water may be restricted to protect the local fish population, but it also has bearing on determining an appropriate buffer width for development and/or site alteration proposals adjacent to a water feature (see following subsection). Maintaining an appropriate shoreline buffer is another measure used to protect fish and fish habitat from development impacts (ORCA 2015). The minimum recommended natural vegetated cover adjacent to fish habitat is 30 m for both coldwater and warmwater fisheries.

The new realigned channel will flow between the development and a wetland complex to the west with a buffer of approximately 30 m on either side, effectively providing protection to both the created fish habitat within the realigned channel; as well as the wetland and SWH within the wetland. Application of natural channel design principles will be paired with native tree and shrub plantings to enhance water quality and the quality of habitat to be supported within the realigned channel and channel corridor. Enhancement activities within the corridor and buffer areas, will also increase the amount of terrestrial

available habitat and overall wildlife corridor and linkage, and provide protection to the wetland and associated tributaries through filtration of overland flows, and protection from edge effects. Furthermore, on the development side of the realigned channel will be the back lots of houses, rather than roadways, providing further protection to the corridor.

As a result, realignment of this tributary as proposed will not only maintain the current linkage function, but provide a greater, enhanced function as it will connect to upstream flows at Fallis Line, form part of a larger corridor incorporated into the wetland/ Significant Woodland; provide additional terrestrial and aquatic habitat. Furthermore, the realigned tributary will provide protection to existing SWH habitat within the wetland complex including Waterfowl Nesting Areas, as well as a protected movement corridor along the periphery of the wetland. Refer to Appendix E for details on the channel realignment.

As described in the following section, the uncontrolled Regional flow from the SWM pond (discharged via the emergency spillway) is 3.808 cms. The realigned channel must therefore convey a total flow of 6.319 cms (2.511 cms from upstream, plus 3.808 cms from the proposed development) (Valdor, 2018).

The proposed channel will be 1.10 m deep, with an 11.00 m wide bottom, 3:1 side slopes and a minimum slope of 0.5%. Based on modelling of the proposed channel, the Regional flow can be conveyed at a flow depth of 0.74 m (at a minimum 0.5% slope), resulting in a minimum freeboard depth of 0.36 m to the top of the channel. It is to be noted that the proposed channel will be constructed entirely in cut, and that the channel will typically be deeper than the minimum 1.10 m depth required. The bottom of the channel will consist of a low-flow channel designed in accordance with geomorphic and natural channel design principles (Valdor, 2018).

It should also be noted that the floodplain associated with the exiting Tributary B will be entirely contained within the realigned channel which will be located within an open space block. As a result, the proposed lots will be protected from flooding (Valdor, 2018).

9.2 Stormwater Management Plan and Low Impact Design

As per the Township engineering design criteria, the proposed development is to be serviced with a minor storm sewer system that is designed to convey runoff from the 5-year storm event. In addition, as per the ORCA and the Township's standards, the SWM facility shall be designed to control the post-development peak flow to pre-development levels for the 2-year through 100-year design storms and to safely convey the greater of the uncontrolled 100-year or Regional flow. The proposed SWM facility shall be designed to provide levels of control as per the requirements of the Ministry of the Environment (MOE), ORC) and Township, which include quality control, erosion control, and flood control (Valdor, 2018).

Various source controls, conveyance and end-of-pipe SWM facilities were considered to provide the appropriate level of stormwater quality control. Reduced lot grades, rear and side yard swales, and discharge of roof leaders to pervious surfaces will augment the control provided by the SWM facility and promote infiltration where possible. Based on a preliminary review of available controls, it appears that the primary and most effective option to provide water quality control for runoff from the contributing drainage areas is a SWM facility (Valdor, 2018).

As a result, a SWM facility was designed to serve the proposed development. The total service area for the SWM facility is approximately 37.76 ha. Based on a total average assumed imperviousness of 67.5%, the required permanent pool volume is 6,463 m^3. The proposed SWM pond will be located at the north-west corner of the proposed development. Per the Township standards, MOE SWM pond criteria and recommendations in the geotechnical report, the SWM pond design includes 5H:1V side slopes, a 4.0 m wide maintenance access road to the headwalls and control structure, and access to the bottom of the forebay with a maximum 10% slope (Valdor, 2018).

The normal water level of the permanent pool for the pond is set at an elevation of 241.50 m. The bottom of the pond is set at an elevation of 239.50 m, providing a permanent pool depth of 2.00 m in the forebay and main cell. The actual permanent pool storage volume provided is approximately 6,981 m^3 which is greater than the minimum required volume (6,463 m^3) (Valdor, 2018).

Drainage will be conveyed to the SWM pond via the storm sewer system, or overland via the road network to the low point adjacent to the SWM pond maintenance access road. Discharge from the SWM pond will be released to the proposed realigned channel, which will in turn discharge to Tributary C immediately upstream of County Road 10 (Valdor, 2018).

Erosion and sedimentation were also considered as part of the functional servicing study for the proposed development. In accordance with the ORCA guidelines, erosion control shall be provided using an extended detention active storage zone sized to capture the runoff resulting from a 25 mm rainfall event and to release the runoff over a period of at least 24 hours (Valdor, 2018).

Based on the modelling of this storm condition, the estimated runoff volume is 13.57 mm distributed over the 37.76 ha catchment area draining to the SWM pond (including the SWM block) for a required erosion control volume of 5,124 m^3. Based on the design for the SWM pond, the erosion control volume provided is 5,443 m^3 at an elevation of 242.30 m. This exceeds the required erosion control volume of 5,124 m^3 for the pond. The proposed extended detention depth is 0.80 m, which is less than the maximum recommended extended detention depth of 1.00 m (Valdor, 2018).

The extended detention function of the pond will be controlled with a 170 mm diameter orifice plate to achieve the minimum required drawdown time of 24 hours (48 hours is considered preferable) (Valdor, 2018).

In accordance with the ORCA requirements for development within the Baxter Creek watershed, Enhanced (Level 1) water quality protection shall, therefore, be provided by the proposed SWM facility (Valdor, 2018).

Additional mitigation measures will also be incorporated into the SWM pond design to minimize thermal impacts to the receiving watercourse. These measures include use of a bottom draw pipe to discharge water from the deepest section of the pond where the water temperature is lowest, providing benefit to the thermal regime of the receiving watercourse; and a planting strategy to promote shading along the pond perimeter, provide a natural appearance, and to minimize solar heating of the permanent pool during summer months (Valdor, 2018).

It should also be noted that the lots fronting Fallis Line will drain to the Fallis Line storm sewer and be conveyed to the Millbrook Subdivision, Phase 1 SWM pond, south of Fallis Line. This area has been accounted for as part of the Phase 1 SWM pond design (Stormwater Management Report, Millbrook Subdivision, Phase 1, Valdor Engineering Inc., October 2016).

Refer to the Functional Servicing Report by Valdor, 2018 for further details on SWM.

9.3 Erosion and Sediment Control Plan

The proposed development area is to be graded in accordance with the Township grading criterion which dictates that road grades are to range from 0.5% to 5.0% and that sodded yard areas are to range from 2.0% to 5.0%. For large grade differentials, a maximum slope 3H:1V can be used for sodded embankments. In areas where space is limited, retaining walls can be utilized to accommodate grade differentials, however, their use should be minimized (Valdor, 2018).
Based on the topographic survey, the proposed subdivision configuration and the Township's criteria, a preliminary grading design has been prepared. The preliminary grading design, considered the following factors:

- Achieve the Township's lot grading criteria.
- Meet the Township's vertical road design parameters.
- Minimize the requirement for retaining walls.
- Match existing grades along the adjacent properties and road allowances.
- Grading along existing road allowances is to have consideration for their future urbanization and grades are to be established to accommodate future boulevard slopes in the range of 2 to 4%.
- Provide an overland flow route to direct drainage to a safe outlet.
- Provide sufficient cover over the sanitary sewer (Valdor, 2018).

An analysis of the earthworks will be conducted using modelling software at the detailed design stage to optimize the cut and fill volumes in an effort to achieve a balance. Based on the preliminary design, no

significant difficulties are anticipated in achieving the municipal grading design standards. It is anticipated that the lots will generally be split draining and the lots along the north, east and west limits of the site will be basement walk-out type lots. Due to grading constraints associated with the required minimum cover over the sanitary sewer at the north east corner of the site, a retaining wall will be required along County Road 10 (Valdor, 2018).

As previously stated, control measures must be selected that are appropriate for the erosion potential for the site. On relatively large sites, measures for erosion and sediment control typically include the use of sediment control basins, silt fencing, a mud mat and sediment traps. The following is a description of the sediment controls to be implemented for the proposed development:

- Temporary Sediment Control Basins are commonly used to clarify silt-laden stormwater runoff by promoting sedimentation of the suspended particles in the runoff through long detention times. The proposed SWM pond will be utilized as temporary sediment control basins during construction.
- Silt Fences are to be installed adjacent to all property limits subject to drainage from the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles.
- Mud Mat is to be installed at the construction entrance prior to commencing earthworks to minimize the tracking of mud onto municipal roads.
- Sediment Traps are to be installed at all catchbasin locations once the storm sewer system has been constructed to prevent silt laden runoff from entering.
- Rock Check Dams are to be constructed in swales and ditches to reduce velocities and trap sediment (Valdor, 2018).

Furthermore, as the proposed development area falls within the ORCA Regulated Area, a grading permit is required under Ontario Regulation 166/06 prior to commencing topsoil stripping and earthworks. The permit application should be submitted in conjunction with the detailed design at the subdivision engineering stage.

Refer to the Functional Servicing Report (Valdor, 2018) for further details on erosion and sediment control.

9.4 Water Balance

In accordance with the requirements of the ORCA, a site water balance assessment was completed for the proposed development to determine the overall infiltration deficit under proposed conditions and to design infiltration facilities as part of an overall mitigation strategy to maintain pre-development infiltration volumes. Data for the assessment was obtained from soil mapping obtained from the Ontario Soil Survey mapping for Durham County, satellite imagery, the Stormwater Management Planning and

Design Manual (Ministry of the Environment, March 2003) and the Geotechnical Investigation Report for the proposed development.

With regards to land use, the analysis reflects existing conditions which is described as predominantly agricultural, with pockets of pasture and shrub areas. The proposed land use is primarily residential with the pervious component being limited to the lawn areas. The proposed bypass channel and open space blocks will also consist of lawn areas, and a portion of the existing pasture and shrub areas will remain undeveloped.

As mentioned previously, under post-development conditions and without implementing any infiltration mitigation measures, it is estimated that infiltration would be approximately 61.9% of the existing infiltration volume. In order to minimize the impact of development on the future water balance for the site, infiltration mitigation measures will be promoted and incorporated within the proposed development. These measures include basic and enhanced best management practices (BMPs) as follows:

Basic Best Management Practices

- Roof down spouts of the dwellings will be directed to pervious lawn areas and grassed swales where feasible to promote infiltration;
- Where applicable, grassed swales will be constructed alongside and rear lot lines;
- Where possible, the fine grading of lots will be completed with an extra depth of topsoil to encourage infiltration and absorption.

Under proposed conditions with the implementation of the above basic infiltration BMPs, approximately 53,328 m^3 of water will infiltrate the ground which equates to approximately 72.9% of the pre-development infiltration volume (Valdor, 2018).

Enhanced Best Management Practices

In an effort to better match the existing infiltration volumes, enhanced infiltration BMPs in the form of infiltration trenches are required. Through the implementation of the proposed infiltration trenches, the annual infiltration capacity can increase by 20,651 m^3. As a result, the post-development infiltration volumes for the site will be 73,979 m^3, which is 101.1% of the pre-development volume. Based on the water balance calculations completed, a minimum drainage area of 7.44 ha, including rear yard and roof areas, will need to be directed to the proposed infiltration trenches to achieve the required annual infiltration volume. The proposed infiltration trench design, consisting of both rear lot catch basin (RLCB) infiltration trenches and rear-of-lot infiltration trenches (built along the back of lots backing onto the open space blocks) will capture runoff from a total drainage area of 8.40 ha, meeting the minimum drainage area requirement (Valdor, 2018).

The proposed infiltration trenches will be designed to overflow into the storm sewer, or sheet flow to the open space blocks, once the storage capacity of the trench is exceeded (Valdor, 2018).

Refer to the Functional Servicing Report by Valdor (2018) for further information.

9.5 Natural Heritage Buffers

The development area will be limited to the boundaries shown on Figure 6, with an approximately 30 m buffer applied to the wetland complex. In order to off-set the minimal encroachment proposed within a few of the isolated wetland pockets along the periphery of the core wetland area, enhancement activities are recommended, which include planting of native tree and shrub species along the realigned channel corridor to increase the quality of habitat within the buffer, and to provide better protection to wildlife and adjacent natural features within the wetland and Significant Woodland area. Furthermore, activities where encroachment into isolated periphery wetland pockets is proposed are associated with the stream realignment, and therefore, those disconnected pockets will be incorporated into the realigned stream.

In its current state, the buffer areas consist primarily of agricultural lands. Enhancement activities within the buffer areas, including plantings associated with the realigned channel corridor will increase the amount of available habitat and overall wildlife corridor. In addition, this naturalized, vegetated buffer will provide protection to adjacent natural features within the wetland and associated tributaries, through filtration of overland flows, and protection from edge effects to the wetland. As the proposed buffer enhancements will not only increase the overall quality of available habitat within the buffer, but also the quality and protection of both aquatic and terrestrial habitat within the adjacent natural features.

Buffer enhancement plantings should be detailed in a Landscaping and Planting Plan, described below.

9.6 Landscaping and Planting Plan

The proposed development plan will require the removal of select trees and shrubs, and other vegetation within the Study Area. It is recommended that a Landscaping and Planting Plan be prepared for the proposed development to off-set vegetation removal and incorporate natural plantings within the development, where possible. Compensation plantings of trees are generally based on the number of removals required to facilitate construction of the development. The exact number of compensation plantings and locations is to be determined through Detailed Design of the development. The planting plan may include, but is not limited to:

- A mix of native deciduous and coniferous trees and shrubs throughout the development and buffer area;
- Sodding within the residential portions of the development; and

- A native seed mix recommended by suppliers for enhancement within buffer areas.

A landscaping plan has already been completed as part of the channel realignment works and is included in Appendix E. The channel plantings plan includes native tree and shrub species to be planted within the wetland buffer area as well as native seed mixes. Refer to Appendix E for further details.

The following monitoring and maintenance measures may also be recommended for both the buffer and channel enhancement areas:

- Removal of invasive tree and shrubs (i.e., buckthorn), where applicable;
- Watering and weeding of newly planted areas as required for proper establishment of plantings; and
- Replacement of dead material from previous year's planting.

9.7 Wildlife Impact Mitigation Plan

Strategies to mitigate impacts to general wildlife prior to and during construction are proposed. These may include (but are not limited to):

- Clearing vegetation outside the breeding bird season (April 1 to August 31);
- Should any clearing be required during the breeding bird season (April 1 to August 31), nest searches conducted by a qualified person must be completed 48 hours prior to clearing activities. If nests are found, work within 10 m of the tree should cease until the young of year have fledged or until the nest is determined to be inactive. If no nests are present, clearing may occur. This is in accordance with the federal *Migratory Birds Convention Act*;
- Schedule vegetation clearing and grading activities to avoid disturbance to breeding amphibians and other sensitive wildlife species, where possible;
- Where possible, maximize the distance of construction equipment used from the woodland/wetland edge to avoid disturbing wildlife;
- Limit the use of lighting, where possible. Avoid light effects entering the woodland/wetland (eliminate light trespass), where possible;
- Installation of wildlife exclusion fencing and escape routes, which direct wildlife away from the construction area and to more suitable habitat;
- Visual monitoring for wildlife species and avoidance where encountered, if possible;
- If necessary, have a qualified biologist monitor construction in the areas of potential wildlife habitat. If wildlife are found within the construction area they will be re-located to an area outside of the development into an area of appropriate habitat, as necessary;
- Construction crews working on site should be educated on local wildlife and take appropriate measures for avoiding wildlife; and
- Should an animal be injured or found injured during construction they should be transported to an appropriate wildlife rehabilitation center.

In addition, as Barn Swallow was observed within the Study Area; although as a flyover and specific habitat use was not noted; there is potential for Barn Swallow to be nesting within structures located within the Study Area (i.e., barns). As a result it is recommended that structures proposed for removal are assessed for presence of Barn Swallow nests. In the event Barn Swallow nest(s) are observed and their removal is required in support of the development, the removal of the nest(s) can be registered through the MNRF registry process. Timing windows do, however, apply with respect to when a Barn Swallow nest can be removed and, subsequently when compensation habitat is required to be in place.

9.8 Environmental Monitoring Plan

The Environmental Monitoring Plan (EMP), if necessary, would be carried out through the duration of construction activities on-site to ensure that the erosion and sediment control measures operate effectively. The duration of construction is defined as the period of time from the beginning of earthworks until the site is stabilized. Site stabilization is defined as the point in time when the roads have been paved, buildings have been built, lawns have been sodded and restoration plantings have been completed.

Erosion and sediment control measures should be regularly monitored and are likely to require periodic cleaning (e.g. removal of accumulated silt), maintenance and/or re-construction. Inspections of the erosion and sediment controls on the construction site should be undertaken by a certified sediment and erosion control monitor. If damaged control measures are observed they should be repaired and/or replaced promptly. Site inspection staff and construction managers should refer to the *Erosion and Sediment Control Inspection Guide* (2008) prepared by the Greater Golden Horseshoe Area Conservation Authorities. This guide provides information related to the inspection reporting, problem response and proper installation techniques.

The EMP should be implemented during active construction periods in the development area with the following frequency:

- On a bi-weekly basis;
- After every 10 mm or greater rainfall event;
- After significant snow melt events; and/ or
- Prior to forecasted rainfall events.

If damaged control measures are found they should be repaired and/or replaced within 48 hours. Site inspection staff and construction managers should refer to the Erosion and Sediment Control Inspection Guide (2008) prepared by the Greater Golden Horseshoe Area Conservation Authorities. This Inspection Guide provides information related to the inspection reporting, problem response and proper installation techniques.

Protected vegetation areas may also require periodic monitoring to ensure that they are not being impacted by the proposed development. Should impacts be observed, necessary steps will be taken to ensure that the impacted vegetation is either restored or replaced.

The details of the EMP would be confirmed through consultation with ORCA and/or the Township at the Detailed Design stage.

10.0 Summary

This EIS was prepared for in support of an application for Draft Plan of Subdivision for a property known as Towerhill Development North, located at Fallis Line and County Road 10, in the Township of Cavan-Monaghan, Peterborough County. An EIS was required due to the presence of natural heritage features including woodlands and wetlands, which have the potential to be impacted by development activities. The findings of the biophysical inventory, which consisted of secondary source reviews supported by a full field program, are summarized below.

The presence of a Significant Woodland, non-Provincially Significant Wetland, and associated SWH and candidate SWH was confirmed through field surveys in 2017. The majority of lands within the proposed development area consist of agricultural fields and therefore, do not contain significant natural features. The Significant Woodland, wetland complex, and core SWH within the Study Area will be protected from development. In addition, establishment of buffers, along with enhancement through planting of native species within the buffer area are proposed to provide further protection to Significant Woodland/ wetland and wildlife habitat.

A number of policies and guidance documents are outlined in section relating to the natural environment. Specifically, natural heritage policies under Section 2.1 of the PPS; Section 6 of the Cavan-Monaghan Official Plan; and Section 2.3 of the ORCA Watershed Planning & Regulations Policy Manual (2015). Policies related to protection of natural features have been addressed as part of this EIS; summarized in the following paragraphs.

An OWES wetland evaluation has been conducted for wetlands within the Study Area and considering wetlands beyond the Study Area; the results of which will be submitted to the MNRF Peterborough District for incorporation into the provincial mapping layers. The OWES evaluation conclude that no significant wetlands are present within the Study Area. Furthermore, all development activities including creation of the realigned channel will be 30 m from the core wetland boundary and the Significant Woodland. Therefore, no development is proposed within 30 m of the Significant Woodland or a Provincially Significant Wetland.

As confirmed through correspondence with DFO, no fish habitat is present within the Study Area, and therefore, no development is proposed within fish habitat. Furthermore, creation of the realigned channel will provide more potential habitat for fish than is currently available within the Study Area.

In general, natural heritage features within the Study Area have been protected and in some cases enhanced with the creation of a natural meandering channel bordering the wetland, Significant Woodland, and SWH; and creating a permanent protected movement corridor that currently exists as agricultural fields, effectively separating the natural areas from the proposed development.

Development of the project with the realigned channel is therefore expected to enhance linkage function within the natural heritage system, provide a layer of protection to the core natural areas, and increase the amount of available habitat within the Study Area.

A portion of fringe wetland and candidate SWH for Waterfowl Nesting Areas will be incorporated to the realigned channel. Due to the existing agricultural nature of the proposed development area, the addition of the realigned tributary will contribute to the candidate Waterfowl Nesting Areas by providing more habitat, as well as a protected corridor for movement along the edge of the wetlands and protection from predators. Protection from predators in the form of natural vegetated cover within 120 m of a wetland is a key function of the SWH buffer for Waterfowl Nesting Areas that does not currently exist within the Study Area. Therefore, as mentioned, establishment of this channel will increase the amount of available habitat within the NHS and the Study Area, and also create a protected movement between the core areas and the proposed development.

The proposed realigned channel will provide a greater amount (and higher quality) fish habitat, and will also benefit the core natural features within the Study Area. Vegetated buffers consisting of native tree, shrub, and grass species will be established within the riparian areas within approximately 30 m of the realigned channel rom the edge of the meanderbelt; or high water mark. The SWM pond proposed for the development will tie into the realigned channel (outlet), but will be sited outside of the 30 m watercourse buffer and floodplain. Vegetated buffers and other SWM mitigation measures have been proposed to avoid potential negative impacts to downstream reaches of the tributary.

Lastly, appropriate steps will be taken in consultation with the MNRF Peterborough District to avoid contravention of the ESA, 2007.

Potential ecological impacts of development may include diversion of surface water flows, erosion and sedimentation, tree and vegetation removal, and general impacts to wildlife. These impacts can be avoided or minimized by implementing the mitigation, restoration, and management measures described in this report.

Appendix A

Terms of Reference

MEMO

TO: Erin McGauley, Otonabee Region Conservation Authority

FROM: Whitney Moore, Dillon Consulting Limited

cc: Andrew McLeod, Towerhill Developments Inc.
Luka Kot, Towerhill Developments Inc.

DATE: June 19, 2017

SUBJECT: Environmental Impact Study Terms of Reference for the Towerhill Developments Inc. property located at Fallis Line and County Road 10 in Millbrook, Ontario.

OUR FILE: 16-4800

Introduction

Dillon Consulting Limited (Dillon) has been retained by Towerhill Developments Inc. to undertake environmental studies for a proposed residential development at County Road 10 and Fallis Line in the community of Millbrook, Ontario. As such, Towerhill Developments Inc. and Dillon are taking a pro-active approach to environmental-first planning and undertaking the appropriate environmental studies that are required to complete an Environmental Impact Study (EIS) and utilizing the results in the planning of this property. A figure outlining the location of the subject property is attached.

In keeping with the general policies of the Otonabee Region Conservation Authority (ORCA) Environmental Impact Study Terms of Reference & Submission Standards (2015), we have prepared the following Terms of Reference (TOR). Below, we present the TOR in a check-list format to ensure that the required work and/or studies are known and agreed to prior to the commencement of work, to facilitate a stream-lined and timely review process.

Terms of Reference

General Policies

☒ The EIS must be undertaken by a qualified professional in environmental or related sciences to provincial standards and/or the satisfaction of the ORCA.

☒ A visit to the site may be required by the Authority prior to, during, or upon receipt of the EIS.

☒ The staking of significant natural features (i.e., woodlands, wetlands, etc.) by the Authority may be required. Staking will generally occur between the end of May and the end of October. Any staking that occurs outside of this time may require a confirmatory visit between May and October.

Existing Conditions

☒ The existing conditions of the subject site must be clearly described and clearly mapped on aerial photographs.

☒ The description must include the zoning and all designations of all Official Plan(s) (OP) on the subject site. This includes any land use designations from other municipal planning documents, such as Secondary Plans.

☒ Land use designations from any other applicable planning documents (e.g., Oak Ridges Moraine Conservation Plan) must be clearly described and the limits identified in the mapping.

☒ The EIS shall identify the components of the natural heritage system (should it be located on the subject lands). The boundaries of the natural heritage system shall be confirmed in the field by the proponent, mapped on a figure in the report and approved by the Authority and the planning authority.

☒ All natural heritage features (woodlands, wetlands, Areas of Natural and Scientific Interest (ANSIs), valleylands, significant wildlife habitat, etc.) and watercourses must be identified in the mapping and described in the report.

☒ A description of the soils, landforms and surficial geology based on a review of available mapping and literature must be described in the report. Any staking done to date as well as the calculated hazard limits will be provided on constraints mapping. If available, topographical information will be provided on constraints mapping.

☒ Hydrological and hydrogeological resources and issues, including surface water features, recharge/discharge zones, groundwater quality and quantity, groundwater elevations and flow directions, and connections between groundwater and surface water features will be identified based on the information available from the consulting team.

☒ A wetland evaluation is required following the Ontario Wetland Evaluation System (OWES) for Southern Ontario (MNRF, 2013). The evaluation will be completed by an MNRF-certified OWES evaluator within the Study Area only, where land access is permissible. The results of the OWES evaluation will be incorporated into the EIS report, and provided to ORCA and the MNRF.

Note: Areas of unevaluated wetland have been identified within the western portions of the Study Area. These wetlands form part of the Natural Heritage System.

☒ The vegetation communities must be identified using the Ecological Land Classification (ELC) system to vegetation type, where possible. The communities must be identified in the mapping, using the appropriate ELC codes, as well as described in the text. As a component of the ELC, a plant list must be included as an appendix. The list must include an analysis for the presence of federal, provincial, regional and/or watershed rare, threatened or endangered species. This should include information from the MNRF district office and NHIC.

☒ Two-season (spring and summer) plant survey is required to identify rare or uncommon species. The list must include an analysis for the presence of federal, provincial, regional and/or watershed rare, threatened or endangered species. This should include information from the MNRF district office and NHIC.

☒ The EIS requires a breeding bird survey. The survey must be conducted during the breeding bird season at an appropriate time of day in appropriate weather conditions and by a qualified professional. A minimum of two surveys are required and they must follow generally accepted scientific protocols, not necessarily atlasing methods. A list of the breeding birds is required as an appendix. The list must include an analysis for the presence of federal or provincial rare, threatened or endangered species. Watershed rarity status shall be determined in conjunction with the Conservation Authority.

☒ The EIS requires a breeding amphibian survey. The survey must be conducted during the breeding amphibian season and by a qualified professional. For calling amphibians a minimum of three surveys are required. These surveys must span the full amphibian breeding season to ensure that the peak periods of activity for early and late breeding species are accounted for. For non-calling amphibians, appropriate methodology must be used. A list of the breeding amphibians is required as an appendix. The list must include an analysis for the presence of federal, provincial, threatened or endangered species. Watershed rarity status shall be determined in conjunction with the Conservation Authority.

☒ A fisheries assessment shall be provided due to the presence of potential suitable fish habitat and confirmed on-site by the ORCA and MNRF. Existing data regarding fish species shall be obtained from ORCA and/or the MNRF and used for the fisheries assessment. The assessment shall include a description of watercourses or other fish habitat on and/or adjacent to the property (where site access is permitted).

Note: A watercourse has been identified within subject lands. A Fisheries Act Request for Review is currently underway to identify potential for impacts of development and mitigation measures to ensure no serious harm to fish or fish habitat, as requested by the client.

☐ The fisheries assessment will include community sampling through electrofishing and/or netting during the appropriate season, under a collection permit issued by the MNRF.

Note: Fish community sampling is not proposed. An information request was submitted to ORCA on November 4, 2016 requesting fisheries sampling information, and data was received on November 9, 2016; with additional data received on February 24, 2017.

☒ All incidental wildlife observed shall be reported on and listed in an appendix. The list must include an analysis for the presence of federal or provincial rare, threatened or endangered species. Watershed rarity status shall be determined in conjunction with the Conservation Authority.

☒ A functional assessment of the subject site describing the ecology of the natural heritage features and functions (including components of the natural heritage system) within and

adjacent to the subject site should be provided. The functional assessment may include ecological function, wetland functions, natural heritage features and landscapes, benefits of importance to humans, and corridors and linkages, as required.

Evaluation of the Ecological Impacts

☒ Mapping (at a minimum) shall consist of the following:

a) All mapping must have a title, figure number, north arrow, legend and scale or scale bar.
b) A site location map that provides the regional or watershed context of the subject site.
c) The extent of natural heritage features identified must be clearly demarcated on an air photo base, if applicable.
d) The locations of all watercourses and waterbodies and an indication of their flow and thermal regimes.
e) Vegetation communities must be delineated and identified using ELC.
f) The location of any rare, threatened or endangered species and/or populations shall be identified, if appropriate.
g) The location of any important wildlife features (i.e., hibernacula, den, stick nest, etc.) shall be identified.

☒ The potential impacts to the features and functions of natural areas shall be identified and discussed.

☒ An assessment of the potential impact on wildlife at a local, watershed and provincial (if applicable) level shall be provided.

☒ In the case of significant natural features (as confirmed through field studies), the EIS must demonstrate that there is no development or site alteration within the feature with the exception of uses as specified in the OP and/or prior approvals. The EIS must determine appropriate buffers from significant natural features.

☒ If applicable, where natural features or natural vegetation communities are proposed for removal, the quantity of removal shall also be included.

☒ An assessment of the potential impact on the natural heritage system, including any linkage areas that have been identified shall also be included.

Recommendations and Mitigation Measures

☒ Avoidance of any natural heritage system feature is the preferred approach to mitigation unless otherwise specified in the OP and/or prior approvals.

☒ Determine adequate buffers through the identification of the critical function and protection zones of any identified natural areas.

☒ Where avoidance of a feature is not feasible or possible, mitigation approaches/techniques must be provided. These may include edge management plans, buffer plantings, fencing, low impact designs (LID), etc.

☒ In cases where a linkage area has been identified on a property, the EIS must demonstrate how it will be integrated into the proposed development plan.

☒ Recommendations for Best Management Practices during construction should be provided. This may include silt fencing, tree protection, fencing, identification of timing or seasonal constraints to construction or restoration, etc.

☒ Mitigation for negative impacts on the natural features or their ecological functions (or to achieve no net negative impact) may include, at the discretion of the planning authority in conjunction with the Conservation Authority, approaches to replace lost areas or functions. If acceptable, replacement shall, to the extent possible, occur within the same subwatershed as the proposed development or site alteration. The appropriate amount of replacement will be determined through discussions with the Conservation Authority and the planning authority and will be agreed to by all parties in writing.

☒ If monitoring is required, the details of a monitoring program must be agreed to in writing by the Authority, planning authority and other parties.

Conclusions

The EIS will address conformity with the following:

☒ Policies and requirements of the Township of Cavan Monaghan and the County of Peterborough Official Plans.

☒ Policies and requirements of other applicable planning documents (i.e., Oak Ridges Conservation Plan, etc.)

☒ Requirements of the ORCA.

Species at Risk

Should any Species at Risk or their habitat be identified during the EIS process and confirmed in the field, the MNRF will be notified and we will address any species at risk requirements as outlined in the *Endangered Species Act, 2007* under separate cover with MNRF. The ORCA will be informed of MNRF approvals that are acquired.

MILLBROOK
INFORMATION REQUEST

PROJECT LOCATION

Project Location
Road

0 50 100 200 Metres

SCALE 1:9,585

N
W E
S

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

MAP CREATED BY: LK
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT:
STATUS: DRAFT
DATE: 2016-11-04

Appendix B

Official Plan Schedules

Township of Cavan Monaghan
Official Plan - Schedule 'A-1'

Land Use and Transportation

MILLBROOK

Settlement Area

Legend

- Millbrook Urban Settlement Area
- Built Boundary
- Oak Ridges Moraine Boundary

Land Use

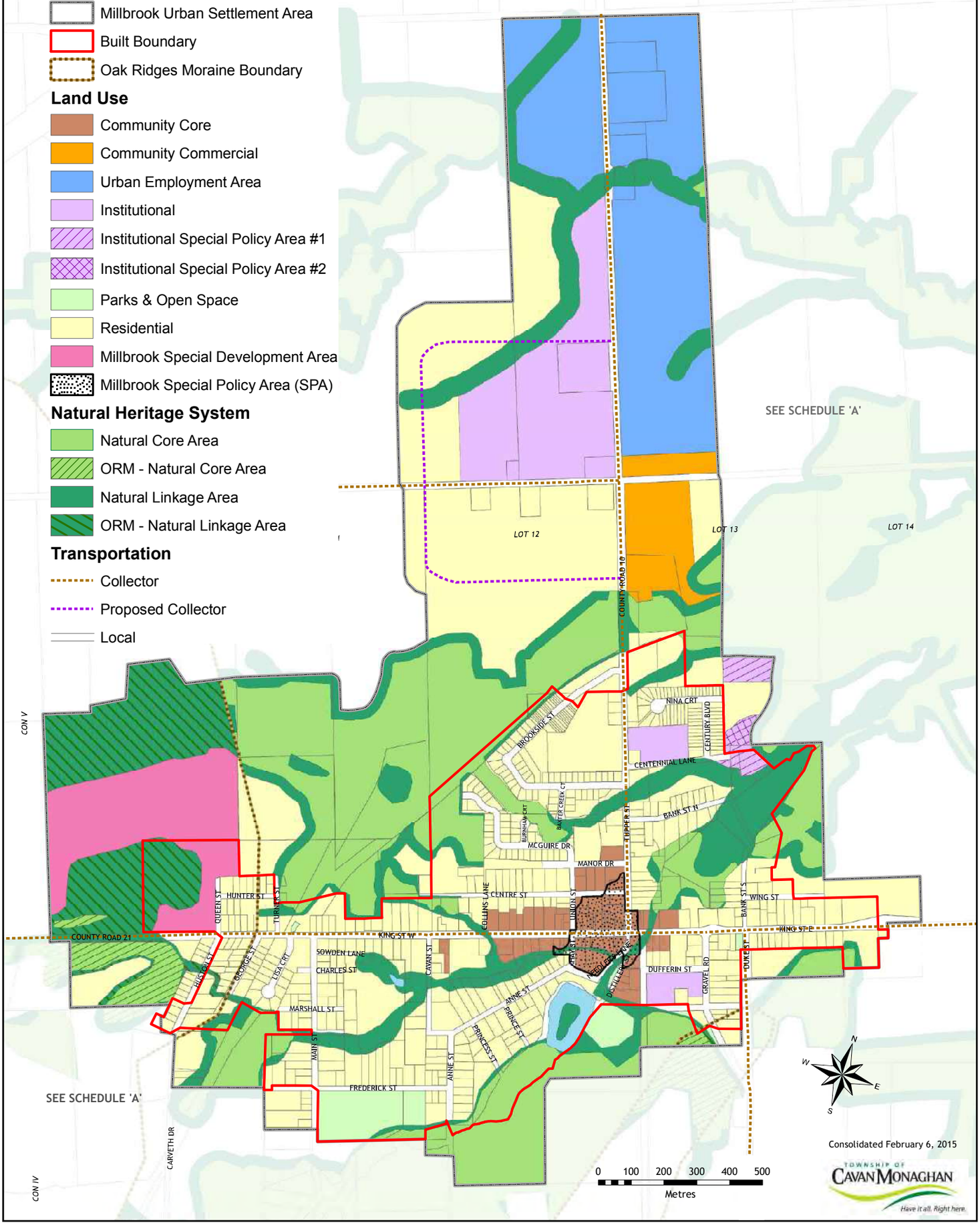
- Community Core
- Community Commercial
- Urban Employment Area
- Institutional
- Institutional Special Policy Area #1
- Institutional Special Policy Area #2
- Parks & Open Space
- Residential
- Millbrook Special Development Area
- Millbrook Special Policy Area (SPA)

Natural Heritage System

- Natural Core Area
- ORM - Natural Core Area
- Natural Linkage Area
- ORM - Natural Linkage Area

Transportation

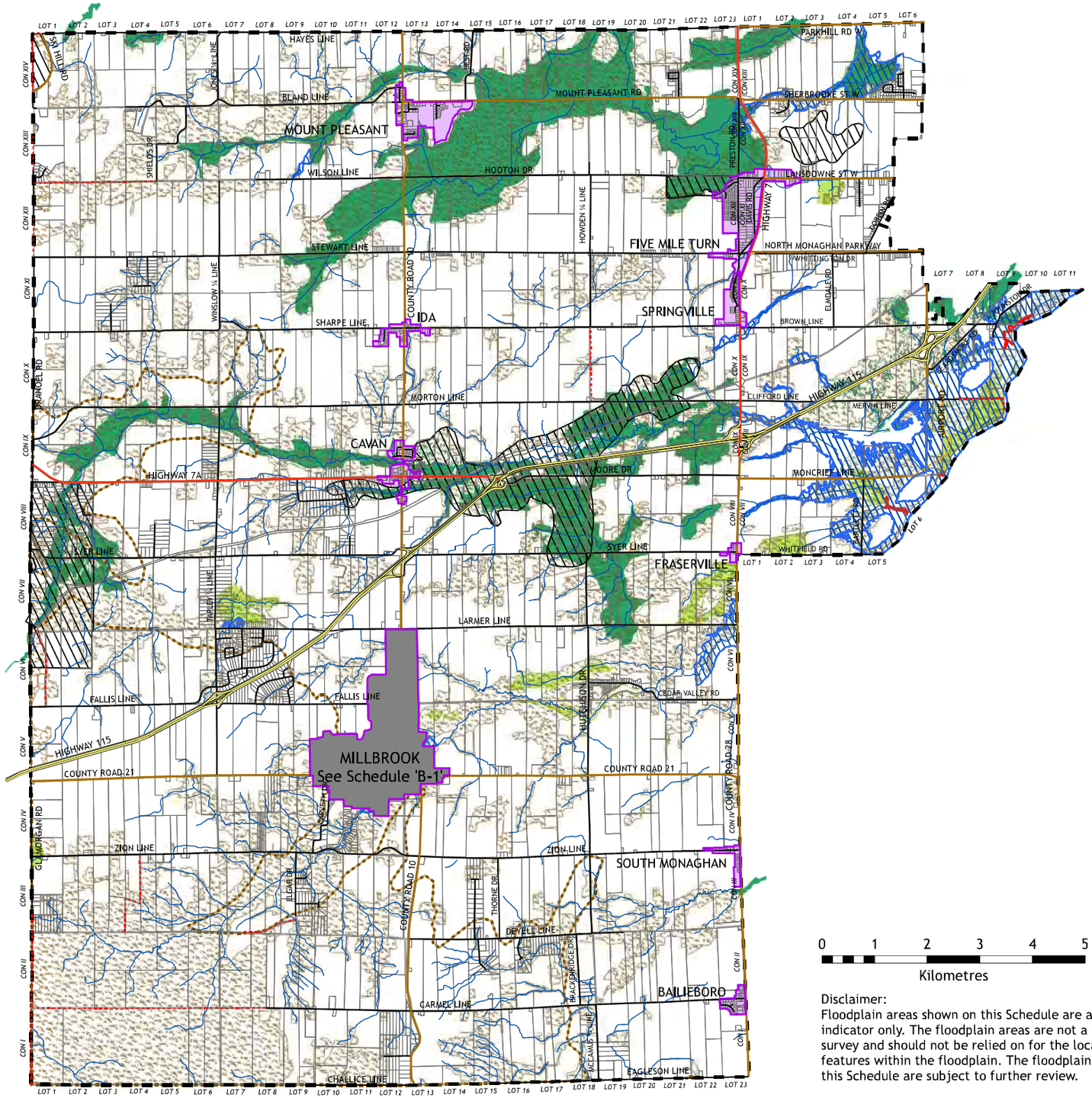
- Collector
- Proposed Collector
- Local



Consolidated February 6, 2015

TOWNSHIP OF CAVAN MONAGHAN
Have it all. Right here.

Township of Cavan Monaghan Official Plan - Schedule 'B' Natural Heritage System and Environmental Constraints



Legend

- Settlement Areas
- Hamlet
- Millbrook Urban Settlement Area

Natural Features

- Watercourse
- Oak Ridges Moraine Boundary
- ANSI
- Fish Spawning Area
- Floodplain Area
- Significant Woodland
- Other Wetland
- Provincially Significant Wetland

Transportation

- Freeway
- King's Highway
- County Road
- Proposed Arterial Road
- Township Road
- Private Road

0 1 2 3 4 5
Kilometres

Disclaimer:
Floodplain areas shown on this Schedule are a general indicator only. The floodplain areas are not a legal plan of survey and should not be relied on for the location of features within the floodplain. The floodplain areas on this Schedule are subject to further review.

Consolidated February 6, 2015

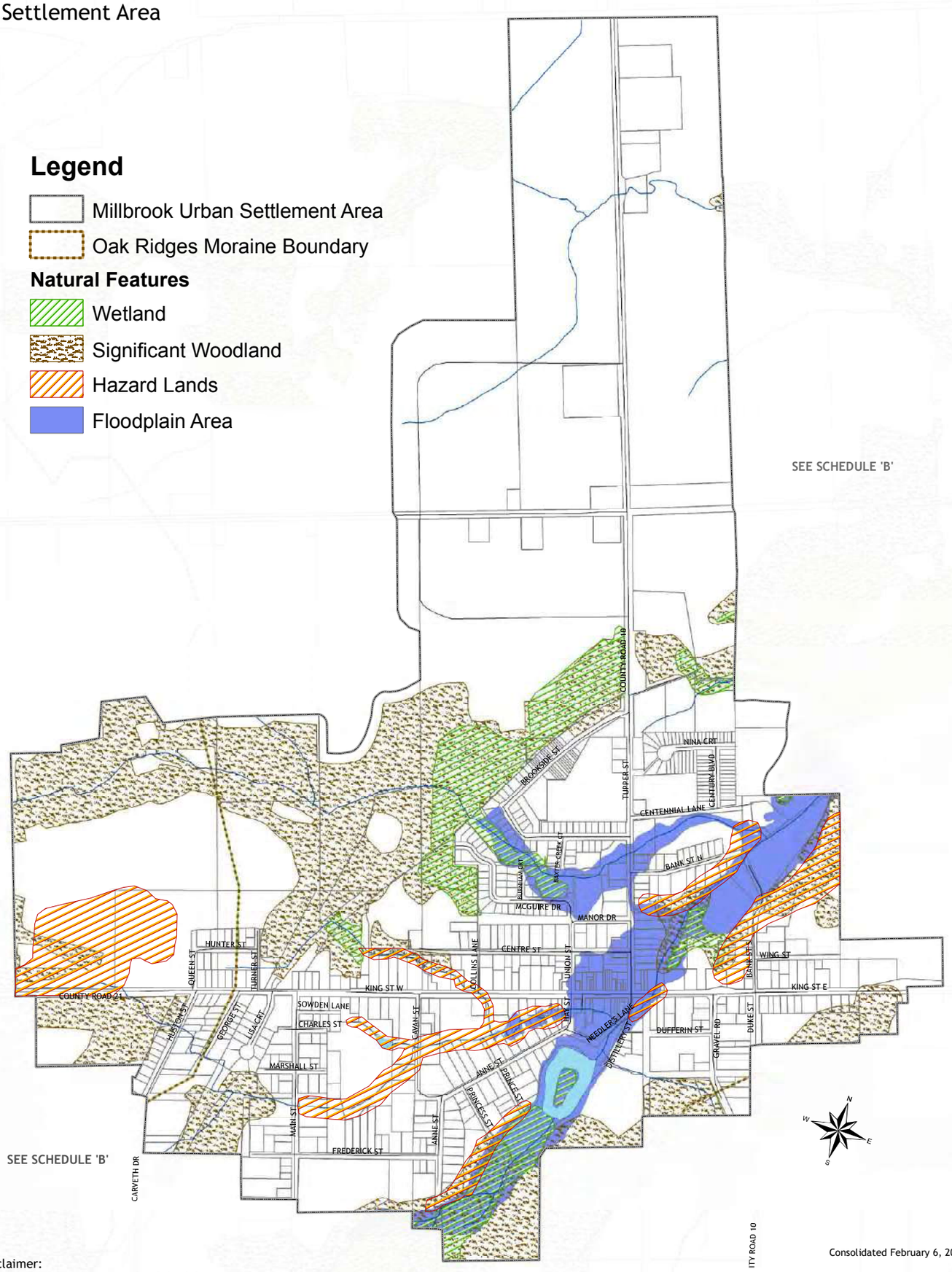
TOWNSHIP OF CAVAN MONAGHAN
Have it all. Right here.

Township of Cavan Monaghan
Official Plan - Schedule 'B-1'

Natural Heritage System and Environmental Constraints

MILLBROOK

Settlement Area



Disclaimer:
Floodplain areas shown on this Schedule are a general indicator only. The floodplain areas are not a legal plan of survey and should not be relied on for the location of features within the floodplain. The floodplain areas on this Schedule are subject to further review.

Consolidated February 6, 2015

TOWNSHIP OF CAVAN MONAGHAN
Have it all. Right here.

Appendix C

Historic Photo


ABANDONED
HIGHWAY
CANADIAN
Millbrook

Appendix D

MNRF Correspondence

DILLON CONSULTING

Moore, Whitney <wmoore@dillon.ca>

RE: Information Request- County Road 10 and Fallis Line, Millbrook

1 message

Hernould, Cara (MNRF) <Cara.Hernould@ontario.ca> Wed, Aug 2, 2017 at 11:15 AM
To: "wmoore@dillon.ca" <wmoore@dillon.ca>

Hi Whitney,

MNRF Peterborough District has received your information request regarding the wetland and Species at Risk Screening with respect to the project area located on the Northeast corner of County Road 10 and Fallis Line in part of Lot 11 and 12, Concession 6 and part of Lot 12, Concession 5, at the Township of Cavan. We provide the following general information for your consideration:

Wetlands

The subject property is near (not adjacent) to the Millbrook Northeast evaluated wetland and contains an unevaluated wetland. We recommend contacting the local Conservation Authority for more information on approvals that may be required.

Species at Risk

A review of our best available information indicates that there are occurrences of Snapping Turtle (Special Concern) in the immediate area of the site. Also, there are occurrences of Wood Thrush (Special Concern), Red-headed woodpecker (Special Concern), Eastern Wood-Peewee (Threatened), Eastern Meadowlark (Threatened), Butternut (Endangered), Bobolink (Threatened), and Barn Swallow (Threatened) in the general area (5 km) of the proposed activities. Although no other threatened or endangered species or their habitat have been documented in the area of the proposed projects, these features may be present and this list should not be considered complete.

Species listed as endangered or threatened on the Species at Risk in Ontario (SARO) list are protected under the Endangered Species Act, 2007 (ESA). Section 9(1) of the ESA prohibits a person from killing, harming, harassing, capturing or taking a member of a species listed as endangered, threatened or extirpated on the SARO list. Section 10(1) of the ESA prohibits the damage or destruction of habitat of a species listed as endangered or threatened on the SARO list.

Since comprehensive mapping for most Species at Risk is not available, a site assessment is recommended to identify the presence of any Species at Risk and/or their habitat on the subject lands, as a decision should not be made in the absence of such information. The focus of the site assessment can include a review of the information about known occurrences provided by MNRF above along with other information sources such as species distributions and habitat requirements as well as field visits using MNRF approved protocols during the appropriate seasons by a qualified professional. Due to the species that are potentially present at this site, the following recommendations should help prevent adverse impacts:

Birds

Workers must be vigilant and check work areas for the presence of breeding birds and nests containing eggs and/or young. If breeding birds and/or nests are encountered, works should not continue in the location of the nest until after August 1 (or as soon as it has been determined that that the young have left the nest). Please note that the breeding bird season in the subject area extends from April 15 to July 31.

Specific Barn Swallow Information: Barn Swallow nests may be present under bridges and/or culverts. Therefore, the underside of these structures should be assessed for Barn Swallow nests before proceeding. If no nests are present, a contravention of the ESA is unlikely. However, if nests are present, construction should not begin until after August 15 of any year. If nests will be impacted during the nesting season or if the structure will no longer be suitable for nesting post-construction, ESA requirements will apply to the activity. A regulatory provision is available that allows eligible activities that impact to Barn Swallow to register and follow all the rules in regulation in place of applying for a permit under the ESA. See our website for more information on regulatory requirements for Barn Swallow.

Turtles and Snakes

Workers must be vigilant and check work areas for the presence of turtles. If turtles or snakes are encountered, whenever possible, work should be temporarily suspended until the animal is out of harm's way. Workers should report any turtle observations (including photographs and coordinates) to the Peterborough District Office immediately at (705) 755-2001. Please note that the turtle nesting season in the subject area extends from May 15th to September 30th. Therefore, activities which may cause adverse impacts to a species or habitat (e.g. use of heavy equipment) should commence after September 30th.

Butternut:

If a Butternut tree(s) is identified and is to be removed, trimmed or is in close proximity to the application of herbicides, a Butternut Health Assessment should be conducted by an individual trained and certified by MNRF as a Butternut Health Assessor (BHA) under the Butternut Health Assessment in Ontario protocol. All Butternut Health Assessments must be submitted to the MNRF District office for a 30 day review period before proceeding. Depending on the results of the assessment, you may have different options for how to proceed - Please see the online factsheet for more information. Please note that the ideal time of year to properly identify Butternut (and to distinguish between Butternut and Butternut Hybrids) is between the leaf on and leaf off period (approximately June to August). Workers should report any Butternut observations (including photographs and coordinates) to the Peterborough District office immediately upon discovery. For those Butternut that are not proposed for removal, a minimum protective buffer of a 25 metre radius from the stem of each Butternut is required to prevent root disturbance. A larger area up to 50 m may also be considered protected habitat for the tree. Within the 25 metre buffer area, activities that would remove or significantly compact the roots and soil, and cause direct harm to the Butternut are not permitted. Within the 25-50 metre buffer area, activities that would significantly damage or destroy habitat e.g. by impacting the tree's ability to disperse seeds are also not permitted. Removal of other vegetation and careful logging practices within this radius are permitted.

As of July 1, 2013, there are new regulatory provisions provided under the ESA. This regulatory provision allows eligible activities, such as work undertaken to repair, modify, demolish, replace or general maintenance of a structure or the removal of buildings and/or excavation of land, vegetation removal, etc. that is considered to be species at risk habitat to proceed without a permit, provided the proponent register with the Ministry of Natural Resources and Forestry and then follow the specific rules in regulation under the ESA. These rules include, but are not limited to, preparing a mitigation plan and implementing steps to minimize the adverse effects of the activity on the species identified.

- Information on the new ESA regulatory provision that come into effect on July 1, 2013
- The amended ESA regulation (O.Reg 242/08)

If an impact to a Species at Risk or its habitat cannot be avoided, a person(s) should contact MNRF to discuss options, including applying for an authorization under the ESA. In situations where an activity is not registered with or authorized by the MNRF, a person(s) must comply with the ESA by modifying proposed activities to avoid impacts to Species at Risk and habitat protected under the ESA.

It is highly recommended that landowners and on-site workers familiarize themselves with information found on MNRF's Species at Risk website.

During on-site activities, should any species at risk or their habitat be potentially impacted, MNRF should be contacted immediately and operations should be modified to avoid any negative impacts to species at risk or their habitat until further discussions with MNRF can occur regarding opportunities for mitigation. If any species at risk are found, the Peterborough District MNRF office should be contacted at 705-755-2001. If possible, pictures of the species at risk and coordinates for the location where it was observed should be provided to MNRF.

Significant W ildlife Habitat

The site is near (not adjacent) to a deer wintering area which typically must be identified during site-specific investigations. Significant wildlife habitat may include features such as: seasonal concentration areas for wildlife species (e.g. snake hibernaculum), rare vegetation communities (e.g. tallgrass prairie), specialized habitats of wildlife (e.g. turtle nesting and over-wintering areas), habitats of species of conservation concern (e.g. Special Concern species as identified on the Species at Risk in Ontario list) and animal movement corridors (e.g. amphibian movement corridors). We recommend that you contact the local planning authority for potential study requirements for the identification of Significant Wildlife Habitat. In addition, when no information is available, we refer you to the Significant Wildlife Habitat Technical Guide and the recently approved Ecoregion Criterion Schedules for the identification of Significant Wildlife Habitat (January 2015). The Ecoregion Criterion Schedules and newly approved Significant Wildlife Habitat Mitigation Support Tool (MiST) can be downloaded here: https://www.ontario.ca/search/natural-heritage-planning-resources-municipal-planning. MNRF considers these documents to be the best available information to identify significant wildlife habitat.

Other Approvals

It is the responsibility of the proponent to acquire all other information and necessary approvals from any other municipal, provincial or federal authority under other legislation. We recommend that you contact your local Conservation Authority, Department of Fisheries and Oceans, Ministry of the Environment and Climate Change, Ministry of Tourism, Culture and Sport, etc.

If you have any questions regarding the above comments, don't hesitate to contact me. Please reference the file number in the subject line for any future correspondence.

Sincerely,

Cara Hernould

A| District Planner

Peterborough District | Ministry of Natural Resources and Forestry

300 Water St. Peterborough ON

705.755.3360

Cara.Hernould@ontario.ca

From: Moore, Whitney [mailto:wmoore@dillon.ca]
Sent: March-29-17 1:40 PM
To: Spang, Elizabeth (MNRF)
Cc: 164800; Luka Kot; Andrew Mcleod; Allen Benson
Subject: Information Request- County Road 10 and Fallis Line, Millbrook

Hi Liz,

Thanks very much for providing the info for the Lily Lake project. I have another information request for you, this one in Millbrook.

The location is Part Lot 11 & 12, Concession 6 and Part Lot 12, Concession 5, Geographic Township of Cavan; located at the northwest corner of Fallis Line and County Road 10.

I have attached a map of the site for your reference.

Please let me know if you have any questions or would like to discuss.

Thanks again!

Whitney

Whitney Moore B.Sc. (Hons.)
Dillo n Consulting Limited
177 Colonnade Rd South, Suite 101
Ottawa, Ontario, K2E 7J4
T - 613.745.2213 ext. 3040
F - 613.745.3491
M - 613.797.1235
WMoore@dillon.ca
www.dillon.ca

3 attachments

MillbrookInfoRequest.pdf
1947K

Millbrook NorthEast W etland Summary .pdf

Appendix E

DFO Correspondence

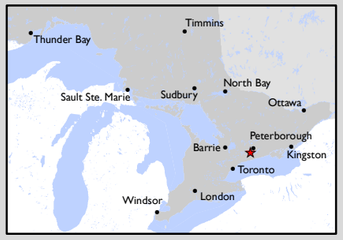
Attachment A:

Figures

MILLBROOK
FISHERIES REQUEST FOR REVIEW

FIGURE 1
PROPERTY LOCATION

Property Boundary



1:50,000

0 250 500 1,000 m

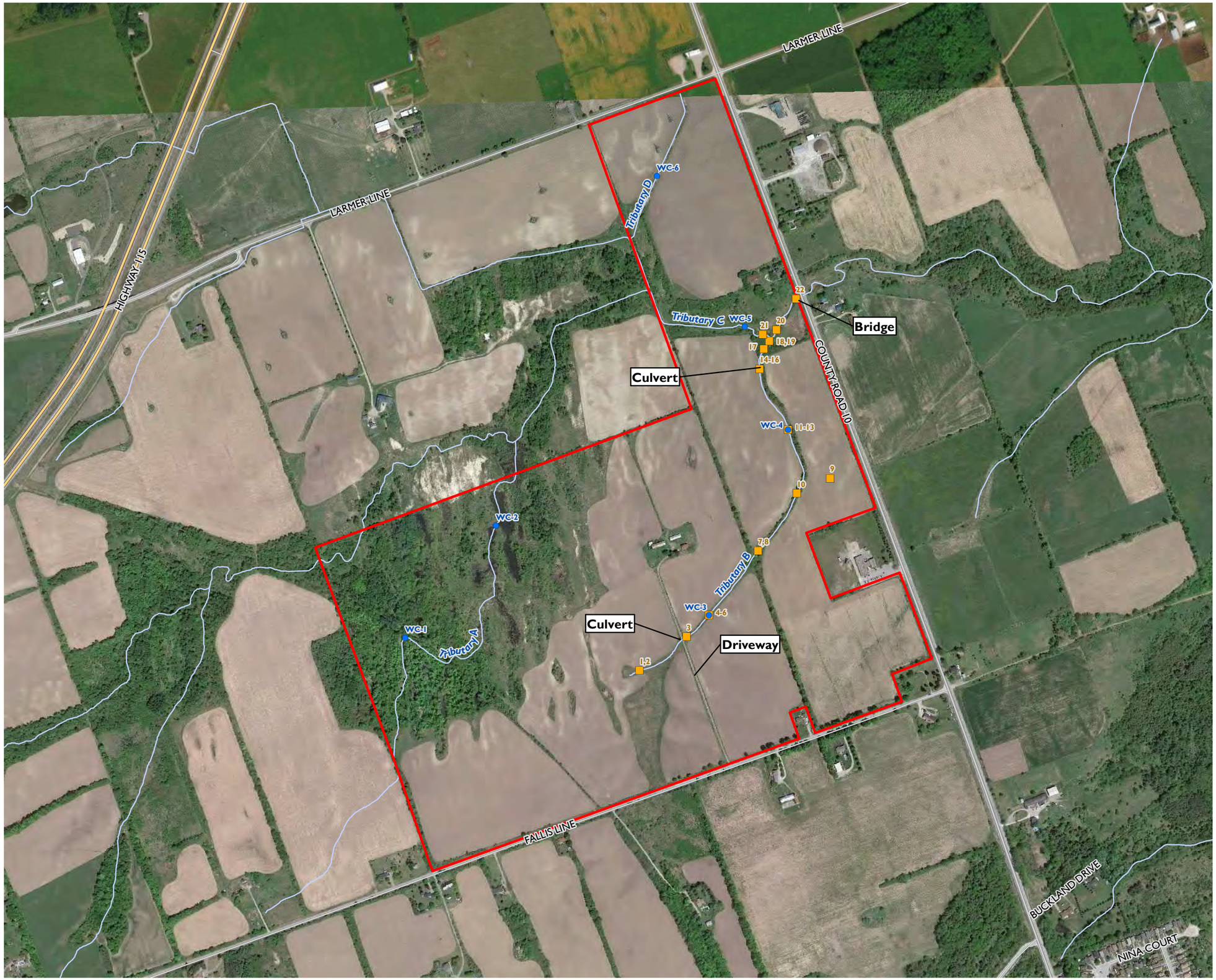
MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 164800
STATUS: DRAFT
DATE: 2017-09-28

FILE LOCATION: I:\GIS\164800 - Millbrook EIS\mxd\Figure 1 Property Location.mxd



MILLBROOK
FISHERIES REQUEST FOR REVIEW

FIGURE 2
SAMPLING AND PHOTO LOCATIONS

- Property Boundary
- Sampling Location
- Photo Location
- Water Body

1:8,000

0 50 100 200 m

N
W E
S

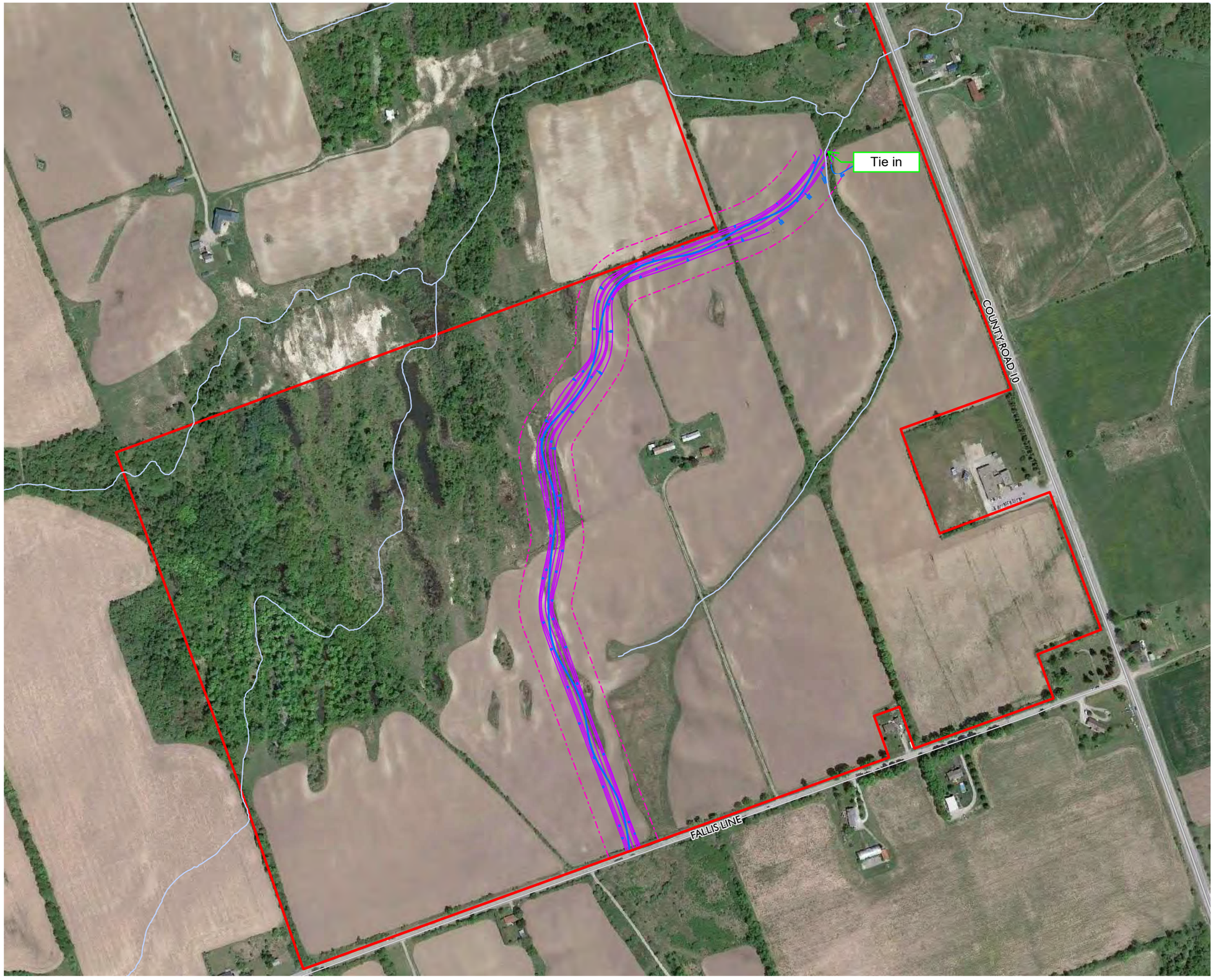
MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

DILLON CONSULTING

PROJECT: 164800
STATUS: DRAFT
DATE: 2017-09-28

FILE LOCATION: I:\GIS\164800 - Millbrook EIS\mxd\Figure 2 Sampling and Photo Locations.mxd



MILLBROOK
FISHERIES REQUEST FOR REVIEW

FIGURE 3
PROPOSED CHANNEL REALIGNMENT

- Property Boundary
- Water Body
- Revised Channel
- Meanderbelt/Low-flow Channel
- 30 m Buffer

1:5,000

0 50 100 200 m

N W E S

MAP DRAWING INFORMATION:
DATA PROVIDED BY MNRF

MAP CREATED BY: GM
MAP CHECKED BY: WM
MAP PROJECTION: NAD 1983 UTM Zone 17N

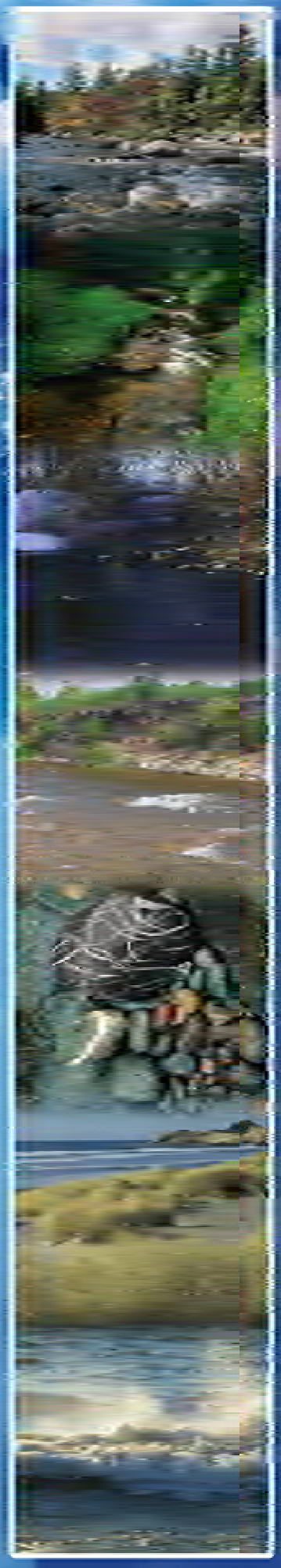
DILLON CONSULTING

PROJECT: 164800
STATUS: DRAFT
DATE: 2017-09-28

FILE LOCATION: I:\GIS\164800 - Millbrook EIS\mxd\Figure 3 Proposed Channel Design.mxd

Attachment B:

Channel Realignment Design Brief



water's edge
ENVIRONMENTAL SOLUTIONS TEAM

Millbrook Subdivision, Fallis Line and Country Road 10, Millbrook, Ontario, Towerhill Development Inc.

Natural Channel Design: Channel Realignment Design Brief

July 26, 2017

July 26, 2017
WE 17007

Towerhill Development Inc.
c/o Mr. Oliver Beaudin, B.Eng.
Project Manager, Water Resources
Valdor Engineering Inc.
741 Rowntree Dairy Road, Suite 2,
Woodbridge, Ontario
L4L 5T9

Dear Mr. Beaudin:

RE: Millbrook Subdivision, Fallis Line and County Road 10 – Millbrook, Ontario
Natural Channel Design of Realigned Channel – Design DRAFT Brief

Water's Edge was authorized by Towerhill Development Inc. (c/o Valdor Engineering Inc.) to complete a realignment of the existing watercourse that runs through the Millbrook Subdivision located at the north-west corner of Fallis Line and County Road 10 in Millbrook, Ontario. This work will be part of the Phase 2 construction of the Millbrook Subdivision. This report outlines the existing geomorphic stream conditions and outlines a proposed design for channel realignment. We request the approval of these proposed designs by Valdor Engineering Inc. The following information was provided to Water's Edge by Valdor Engineering Inc. in order to conduct this work:

(1) Finalized CAD base plan with final alignment;

(2) Soils, geotechnical and hydrogeologic reports (GEO-LOGIC INC., 2014a and GEO-LOGIC INC., 2014b); and

(3) Existing benchmarks from surveys.

It was reported to Water's Edge that the preliminary realigned channel design will be approximately 1400 m long with an average grade of 0.5%. The approximate area that will be draining to this feature is 35 ha. To ensure that this preliminary design is appropriate, as was proposed, a desktop geomorphic assessment of the stream system is required prior to geomorphic and topographic field investigations. This report will discuss the findings of these assessments and provide a design brief.

1.0 BA CKGROUND REVIEW

Millbrook, Ontario is part of the Township of Cavan Monaghan within the Peterborough County located approximately 20 km southwest of Peterborough, Ontario. Millbrook, Ontario boasts historic relevance to the rural surrounding area such as Needler's Mill and the Robert Deyell House. Generally, the surrounding area is a mix of industrial, agricultural and commercial activities.

The study area for this report is part of Phase 2 of the construction of the Millbrook Subdivision. The study area is located at the intersection of Fallis Line and County Road 10 (north of Fallis Line and west of County Road 10). The study reach currently flows through the center of the proposed subdivision development. The study area and reach can be seen in **Figure 1.1.**

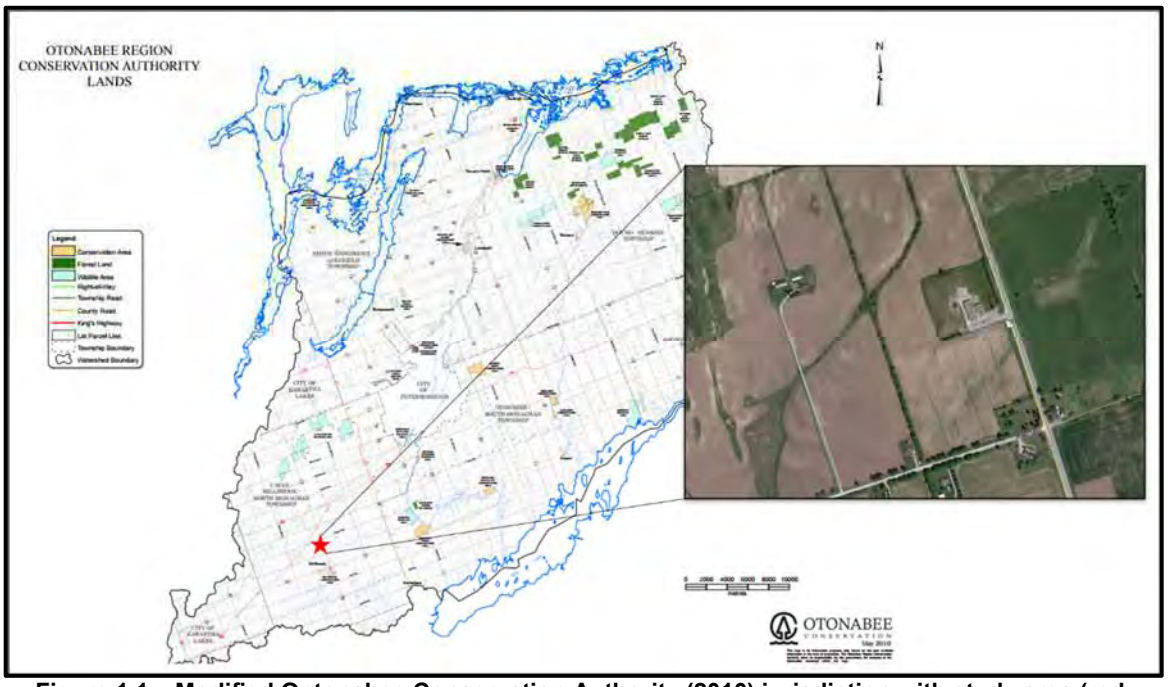


Figure 1.1 – Modified Optonabee Conservation Authority (2010) jurisdiction with study area (red start) indicated and inset map showing the study reach.

2.0 WATERSHED DESKTOP ASSESSMENT

A review of pertinent background information regarding the site was conducted. Within the following sub-sections a brief description of the relevant watershed and physiographic geology characteristics are given for the study area. General watershed characteristics and physiographic geology are important to understand river reach form, process and adjustment over time.

2.1 Wa tershed characteristics

The study reach proposed to be moved during Phase 2 of the Millbrook Subdivision development is appears to be a headwater stream in the middle of agricultural farmlands with some rural residential area surrounding it. The study reach confluences just north of the Phase 2 subdivision with another tributary that flows in the easterly direction (**Figure 2.1**). Both tributaries flow eastwards towards Baxter Creek. Based on a preliminary desktop analysis, the study reach is a first order stream.

Land use of the watershed was collected using the Ontario Flow Assessment Tool from the Ministry of Natural Resources and Forestry. As previously mentioned, the study area and surrounding area is predominantly agricultural and undifferentiated rural land use. There are also intermittent locations of mixed (i.e., deciduous and coniferous) trees. Northwest of the subdivision there is a swap area with coniferous tress in place. Directly south of the study area is the Phase 1 subdivision and further south is the urban development of Millbrook, Ontario.

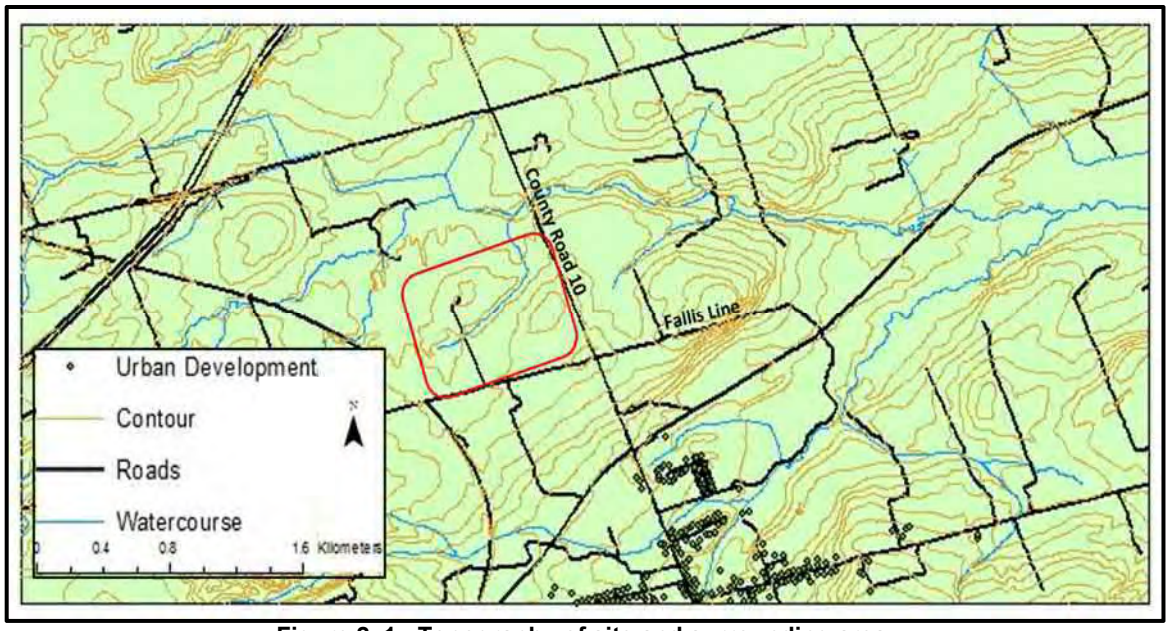


Figure 2. 1 - Topography of site and surrounding area.

2.2 Geology and Physiography

The topography of the surrounding area has some gentle hills. Chapman and Putman (1982) reported the study area to be predominately a sand plain, kame moraine. The quaternary geology was obtained using the Ministry of Northern Development and Mines (MNDM) CLAIMaps tool. It was determined that the majority the study area was formed from varying glacial deposits. The glacial deposits are 1-50 m thick and mainly sandy silt to sandy till with some stone content. The west end of the study area and headwaters of the study reach is formed with silt and clay (massive to laminated) glacial lake deposits. As previously mentioned there is a downstream confluence. The tributary that confluences with the study reach is composed of the same glacial lake deposits of the study reach (i.e. composed of silt and clay). The channel that the two tributaries confluence into is a geologic area of sand and gravel river deposits.

3.0 DESKTOP ASSESSMENT

A preliminary evaluation of the study reach was conducted. Generally, this assessment was conducted to provide initial planform characteristics, reach limits, and study reach delineation. This desktop assessment will aid in efficient preparation and execution of geomorphic field surveying and data collection. The following section will include a brief background review discussion and assessment of the study area and reach using publicly available aerial photography.

3.1 Background Review & Historical Assessment

Aerial images of the study area were obtained from readily available sources (Google Earth and University of Toronto Spatial Maps Library). Generally, these images were used to determine historical alternations such as land use changes or road re-alignment in addition to pertinent adjustments in channel planform. A range of images from 1954 to 2017 were obtained. All aerial images were examined and some were eliminated due to poor quality or obstruction of view due to cloud cover. These satellite images were georeferenced using projected shapefiles in ArcMAP 10.3.

An analysis of the channel planform was completed to determine channel adjustment over the years and the pre-development or pre-alignment length and width of the channel. The geometry and the planform of the channel will help classify the study reach into a channel type. The existing channels geomorphic form and processes will aid and serve as a base level prototype for the re-aligned channel.

Generally, based on the aerial images available for analysis, no significant changes in land use or in road re-alignment were present. South of the study area, the downtown core of Millbrook, Ontario was present at the earliest aerial image that was analyzed. **Figure 3.1-A** shows the 1954 aerial image with the georeferenced channel planform outlined in blue. The area is predominantly for used agricultural activity such as row crops. A municipal office is present on the east side of the proposed development area (on County Road 10). A small marsh or wetland is present, in the northwest area. On each georectified image, the left and right banks of the channel was delineated using ArcMAP Software. For the time range investigated, the planform of the channel did not change enough for it a migration rate of the respective banks to be calculated. The georeferenced banks of the channel (blue) was overlaid on the 2015 aerial image (**Figure 3.1-B**). The existing channel length was measured along the thalweg of the channel using present day aerial imagery. The channel length from the headwaters to the downstream confluence was calculated to be 908m.

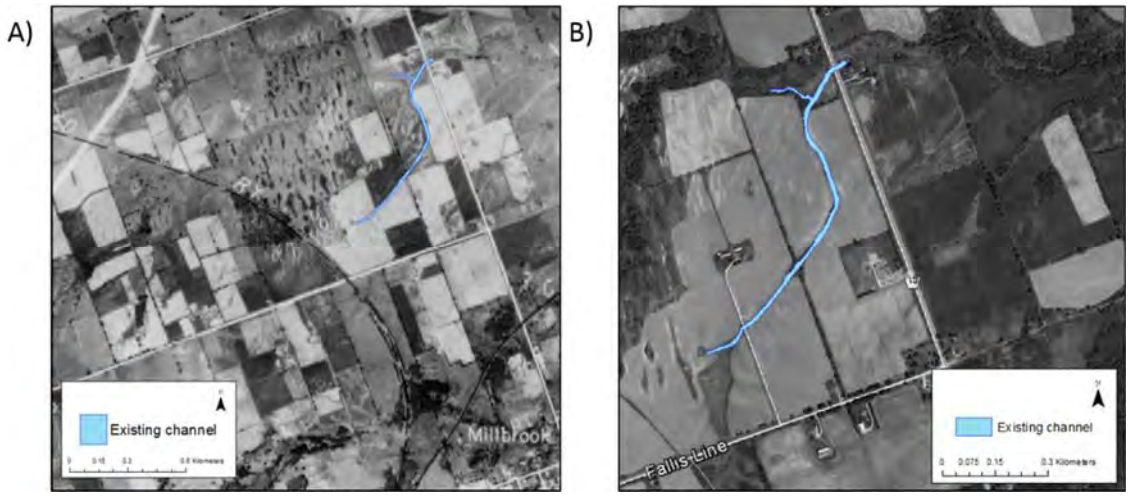


Figure 3. 1 - A) 1954 and B) 2015 georeferenced aerial image with outline of channel.

3.2 Meander Belt Width Assessment

A desktop meander belt width assessment was completed for the study reach. The purpose of this assessment is to determine trends in the watercourse alignment within the valley of the channel with the use of a series of air photos over time. Defining the meander belt width of the channel will allow for erosion limits for the study reach to be determined. It is well known that there is a dynamic energy balance within fluvial systems that are governed by sediment load and discharge. In part, this balance can be seen adjusting during three processes: erosion, slope alteration and flooding. Determination of the meander belt width or the erosional hazards limits can guide design to ensure that there is an appropriate maximum lateral extent for the channel to adjust within. This can infer a lateral width that is recommended to remain undeveloped to ensure long term integrity of the channel and surrounding infrastructure.

The Ontario Ministry of Natural Resources document entitled, “Technical Guide – River and Stream Systems: Erosion Limit” Policy 3.1.1 was also considered when defining the meander belt width of

the study reach. Generally, this document simplifies the variety of combinations of physical landforms into two basic types:

(1) Confined system

(2) Unconfined system

The study area is in an unconfined river system. This means that there is no discernable valley break in slope within the study rea. This classification is typical for the study area, as the surrounding area is flat with some gently rolling hills. A preliminary meander belt allowance was determined to be approximately twenty times the channel bankfull width. This yielded a preliminary meander belt allowance of 54m which is an overestimation of the channel properties and additional protocols were considered to appropriately quantify the meander belt width of the study reach.

Assessment of the meander belt width was undertaken in accordance to the Toronto and Region Conservation Authority document entitled, "TRCA Meander Belt Width Delineation Procedures". Generally, there are two procedures within this document:

(1) Following the meander pattern of the system as it proceeds downstream around a meander belt axis; or

(2) Following the down valley meandering trend of the river along a linear axis.

The planform from the 2015 georectified aerial image was used in the meander belt width delineation. The channel limits from the historical aerial images were overlaid but since there was no evidence of channel migration, the meander belt width delineation was based on the 2015 aerial image. Aerial images considered had a time interval range of 63-years to ensure no significant channel adjustment was left out of the detailed analysis. This time interval range allowed for a conservative approach to be taken, above the recommended 20- to 30- year time interval of aerial images. The TRCA (2005) protocol assumes that there is no change in the hydrology regime of the study area, which, based on the proposed use of appropriate stormwater management techniques to mitigate the increased runoff from the Phase 2 subdivision will also be assumed in this analysis.

The meander belt width assessment can be seen in **Map 1** and **Table 3.1.** A meander belt axis was defined along the study reach (purple dashed line). The meander belt axis is a conceptual line that is drawn through the centerline of the channel that represents the general down-valley orientation of the channel. The preliminary meander belt width (yellow dashed line) and existing meander belt width (peach dashed line) were measured to 3m and 5.7m, respectively. The final belt width (red dashed line) using this protocol was found to be 6.3m.

Table 3. 1 - Summary of meander belt width assessment.

Preliminary MBW [m] (A)	Mean Channel Width [m] (B)	Existing MBW [m] (A + B = C)	Final MBW [m] (C*1.10)
3	2.7	5.7	6.3

To ensure an accurate and reliable meander belt width that can be used to recommend a post-development low-flow channel that is able to meet the proposed requirements, a final approach was considered to quantify the existing meander belt width of the existing channel conditions. A suite of empirical regime equations developed by Ward and Mecklenburg (2011) in conjunction with

Williams (1986) equations were used to compare against the three aforementioned approaches. Average values of cross-sectional area, width and mean bankfull depth were (see **Section 4.0**) inputted as 0.41m^2, 2.7m and 0.16m, respectively. Three different equations were used to compute meander belt widths using cross-sectional area, width and depth. Meander belt width minimum, maximum and mean values can be seen in **Table 3.2**. The overall, average meander belt width was found to be 11m.

Table 3. 2 - Summary of Williams (1986) and Ward and Mecklenburg (2011) meander belt width assessment for study reach.

Input parameter	Value	Equation	Meander belt width (min) [m]	Meander belt width (mean) [m]	Meander belt width (max) [m]
XS area [m^2]	0.41	$L_m = 30A^{0.65}$	6	10	16
Bankfull width [m]	2.70	$L_m = 7.5W^{1.12}$	8	13	23
Bankfull depth [m]	0.16	$L_m = 240D^{1.33}$	4	9	20
average =				11	

A meander belt width assessment was also conducted on a reference reach within the study area (see **Map 2**). This representative reach has similar sub-watershed characteristics to the study reach (geology, physiography) and is of similar geometric size. The representative reach was dissimilar from the study reach due to the sinuosity of the channel. This sinuous, representative reach was conducted in order to ensure a conservative meander belt width was selected. The same procedure was adopted for this representative reach, as was mentioned above. The results from the TRCA method can be seen in **Table 3.3** . The Ward and Mecklenburg (2011) and Williams (1986) approach was also conducted for the representative reach. The bankfull conditions were assumed to be the same as the representative reach. The results for this analysis can be seen in **Table 3.4**.

Table 3. 1 - Summary of meander belt width assessment for representative reach.

Preliminary MBW [m] (A)	Mean Channel Width [m] (B)	Existing MBW [m] (A + B = C)	Final MBW [m] (C*1.10)
31	2.3	33.3	36.6

Table 3. 2 - Summary of Williams (1986) and Ward and Mecklenburg (2011) meander belt width assessment for representative reach.

Input parameter	Value	Equation	Meander belt width (min) [m]	Meander belt width (mean) [m]	Meander belt width (max) [m]
XS area [m^2]	0.41	$L_m = 30A^{0.65}$	6	10	16
Bankfull width [m]	2.30	$L_m = 7.5W^{1.12}$	6	11	19
Bankfull depth [m]	0.16	$L_m = 240D^{1.33}$	4	9	20
average =				11	

A summary of all meander belt width assessments can be seen in **Table 3.5** for comparison. A meander belt width of 11m is recommended for design purposes of the realigned low-flow channel.

Table 3. 3 - Summary of meander belt width assessments.

Method	Site	MBW [m]
TRCA	Study reach	6
Williams	Study reach	11
TRCA	Representative reach	37
Williams	Representative reach	11
average =		**16**

4.0 FIELD RECONNAISSANCE

On May 24, 2017, a geomorphic survey was completed for the entire reach as well as downstream of the confluence. In the following sub-sections a general description of the reach will be discussed. The long profile and multiple cross-sectional surveys were completed alongside additional geomorphic data that was collected using the Rapid Geomorphic Assessment (RGA) and Rapid Stream Assessment Technique (RSAT).

4.1 General Reach Descriptions

In the aforementioned subsection, the total study reach length is 908m. For the purposes of analysis this reach will be segmented into numerous study reaches. At the end of each study reach, the Typically, channel reach is defined by channel length (ranging from 200m to 2km in length) that have similar channel characteristics. Channel reaches are generally 200m in length and include two meander bends. However, the sinuosity of the study reach is very limited so similar geomorphic

units will be identified for the existing channel. Channel characteristics that can aid in reach delineation include, but are not limited to, the following: valley or channel slope, channel form and/or function, morphology, substrate composition, riparian buffer composition and hydrology.

Field photographs from May 24, 2017 can be seen in **Appendix B**. The direction, position that the photograph was taken and a detailed comment of the photograph are included for each photograph. An upstream and downstream view of each of 21 cross-sectional profiles is included. The Appendix is organized starting at the headwaters (Cross-Section 1) and continues working the way downstream to the confluence of the tributary that flows to Baxter Creek (Cross-Section 21). Additional cross-sectional surveys were included at the confluence and downstream of the confluence. Knowledge of geomorphic processes and cross-sectional geometry downstream of the proposed segment of channel realignment will be useful to the design of channel tie-ins. It will become evident throughout the general discussion of the reach that reaches of geomorphic similarity are present.

The overall characteristics of the channel are that typical of a headwaters channel (**Appendix B – Photograph No. 1**). The low-lying topography, gentle, tranquil flow and grassy bed and banks are that of a traditional headwaters channel. However, the study tributary is straight with very little sinuosity which deviated from the traditional headwater planform shape and primarily serves as a drainage ditch for the surrounding agricultural fields. The study reach flows from the headwaters through three agricultural fields and converges with a tributary that flows into Baxter Creek. Generally, the bed of the channel is flat and covered with vegetation such as long grasses (see example at **Appendix B – Photograph No. 2**). In the upstream part of the reach, changes in bed

roughness was due to the presence of vegetation with sturdier or more woody trunks (see example at **Appendix B – Photograph No. 16**). Downstream of these vegetative patches on the bed it was observed that a slight pool (deeper water depth) had formed and the cross-sectional width was slightly larger (see example at **Appendix B – Photograph No. 6**).

It was evident that the downstream portion of the river (that flows parallel to Country Road 10) had some pre-existing bank stabilization measures. Bank stabilization measures included earthen river stone berms that disconnected the main channel from the floodplain (see example at **Appendix B – Photograph No. 30**). This section of the channel had a bed that, based on a qualitative inspection, appeared to be composed of sandy-silts. Some large cobbles and boulders were periodically placed on the stream bed (see example at **Appendix B – Photograph No. 32**). Some degradation of the bed was observed in these downstream sections (see example at **Appendix B – Photograph No. 34**). A compressed culvert (**Appendix B – Photograph No. 37**) with an approximate diameter of 0.4m served as a drainage feature to allow the flow to pass beneath two agricultural fields. Downstream of this culvert, the morphology of the channel was significantly different. Generally, the bed composition and sinuosity changes and a riffle-pool morphology was observed. There were some significant meanders in the channel and exposed, depositional point bar features were observed (**Appendix B – Photograph No. 39**). Downstream of this, the study reach confluences and eventually flows into Baxter Creek. Downstream of the confluence, the channel is significantly wider with a substantially greater flow depth and bed is composed of a mix of grasses and larger river stones (**Appendix B – Photograph No. 41 and 43**) at riffle sections and exposed, depositional point-bars are observed in the meander bends (**Appendix B – Photograph No. 42**). Larger cobbles and boulders in the channel bed have diverted the flow in some areas (**Appendix B – Photograph No. 44**). These features have increased the localized channel bed roughness and encouraged further sediment to accumulate surrounding them which has resulted in the growth of small depositional features covered in grassy vegetation. The farthest downstream section surveyed was the concrete, rectangular culvert that underpasses County Road 10 (**Appendix B – Photograph No. 45**). The right floodplain and bank was quite saturated and some flow diversion channels resulted in a multitude of grassy islands.

4.2 Rapid Field Assessments

Two rapid field assessments methods were conducted: Rapid Geomorphic Assessment (RGA) and Rapid Stream Assessment Technique (RSAT). These rapid field assessments indicate the existing channel conditions. The RGA is a checklist document that records the following parameters:

(1) Aggradation;

(2) Degradation;

(3) Widening; and

(4) Planform adjustment.

Results indicate channel stability by classifying data into the following three categories: (1) in regime/stable; (2) transitional/stress; and (3) in adjustment/unstable. The data sheet for the RGA can be seen in **Appendix C** . Overall, the study reach was given the classification of being transitional (**Table 4.1**). Evidence of aggradation within the study reach was observed due to the presence of some siltation within the pools, medial bars and poor longitudinal sorting of bed materials. Generally, there processes were seen in the mid- and downstream portions of the reach (Cross-Sections 25 to 31) where channel modification techniques had been implemented. The vegetated upstream reach segments were vegetated and had very little sediment transport occurring. The second classification system used in the RGA form pertains to evidence of degradation. The RGA form is tailored to urban degradation issues (i.e., stormwater management)

that are not applicable to the present state of the study area. However, there was evidence of some degradation in a circular culvert (located between Cross-Sections 18 and 19) that had been compressed and the flow was cutting underneath it. There was minimal evidence of widening beyond the typical width adjustments seen between the riffle and pool areas. There was some evidence of falling trees and gates. Finally, there was also minimal evidence of planimetric form adjustment. Some examples of the evidence documented to infer planimetric form changes are some cut formations, and grassy islands forming as previously discussed.

RSAT is takes a semi-quantitative approach to characterize stream conditions with the following indicators of abiotic and biotic quality:

(1) Channel stability

(2) Channel scouring and sediment deposition;

(3) Physical in-stream habitat;

(4) Water quality

(5) Riparian habitat conditions; and

(6) Biological conditions.

The data from an RSAT form is then summed and a final index of overall stream quality is binned in categories ranging from Excellent to Degraded. Overall, the study reach was given the classification of being in Fair (**Table 4.2**). Channel stability was quantified using the criteria of bank stability, stream bed stability, and cross-sectional shape. The channel stability for the study reach was deemed excellent. Finally, channel scour and sediment deposition was quantified as being fair.

Table 4. 1 - Summary table of Rapid Geomorphic Assessment results.

Stability Index (SI) Value	Classification Interpr	etation
SI ≤ 0.20	In Regime	The channel morphology is within a range of variance for rivers of similar hydrographic characteristics and evidence of instability is isolated or associated with normal river meander processes.
0.21 ≤ SI ≤0.40	Transitional/Stressed	Channel morphology is within a range of variance for rivers of similar hydrographic characteristics but the evidence of instability is frequent.
SI ≥ 0.40	In Adjustment	Channel morphology is not within the range of variance and evidence of instability is wide spread.

Table 4. 2 - Summary table of Rapid Stream Assessment Technique results.

RSAT Score	Ranking
41-50	Excellent
31-40	Good
21-30	Fair
11-20	Poor
0-10	Degraded

4.3 Detailed field survey

A detailed geomorphic survey was conducted and data was analyzed and processed using computational software. The location of the 21 geomorphic cross-sectional surveys can be seen in **Map 3**. Results from this analysis can be seen in **Appendix C**. A long profile for the study reach was generated and can be seen in **Figure C.1** with each of the Cross-sectional (XS) locations identified. The average slope of the study reach was found to be 0.24%. On the long profile Cross-sections, water surface and bankfull elevations were labelled were applicable to infer energy gradient. Plots of Cross-sections 1 to 21 can be seen **Figure C. 2** to **C.22**. Summary tables of relevant geomorphic parameters can be seen in **Tables 3.3 and 3.4**. An average of all 21 cross-sections geomorphic parameters can be seen in **Table 3.5**. These tables report the following parameters: bankfull width, depth and area; wetted perimeter; hydraulic radius, entrenchment ratio (value and classification); width to depth ratio (value and classification); and Rosgen classification. Geometric parameters related to discharges (i.e., bankfull width, depth and area, wetted perimeter; hydraulic radius) guide decision making during bankfull channel discharge calculations and representative dimensions for channel design. Entrenchment ratios is a quantification of floodplain and main channel connectivity. Width-to-depth ratio quantifies channel flow to be one- or two-dimensional and can therefore infer whether discharges effect the banks. Overall, the planform shape of the channel was observed to be fairly straight with some adjustment in channel widths and a meander The Rosgen system uses the aforementioned parameters to classify the general geomorphic processes of the channel. This allows ease of replication during design protocols.

Table 4. 3 - Summary table of study area geomorphic parameters from Cross-Section (XS) 1 to 11.

	XS1	XS2	XS3	XS4	XS5	XS6	XS7	XS8	XS9	XS10	XS11
Bankfull width [m]	1.71	1.96	2.38	5.61	2.32	3.28	2.24	2.67	3.29	1.86	2.42
Bankfull depth [m]	0.16	0.17	0.17	0.14	0.16	0.12	0.14	0.22	0.13	0.11	0.18
Bankfull area [m^2]	0.28	0.33	0.40	0.76	0.37	0.39	0.32	0.58	0.42	0.21	0.44
Wetted perimeter [m]	1.83	2.17	2.52	5.68	2.47	3.41	2.31	2.85	3.33	1.95	2.53
Hydraulic radius [m]	0.15	0.15	0.16	0.13	0.15	0.11	0.14	0.20	0.13	0.11	0.17
Entrenchment ratio [m]	7.08	4.97	5.03	3.27	5.67	5.57	4.84	4.02	1.35	2.64	7.69
Width-Depth ratio [m]	10.69	11.53	14.00	40.07	14.50	27.33	16.00	12.14	25.31	16.91	13.44
Rosgen classification	E	E	C	C to D	C	C	C	C	F	C	C
Entrenchment classification*	SE	SE	SE	SE	SE	SE	SE	SE	E	SE	SE
W:D classification**	L	L	M to H	Very H	M to H	M to H	M to H	M to H	M to H	M to H	M to H

*SE = slightly entrenched; M E = moderately entrenched; E = entrenched

**L = low; M = moderate; H = high

Table 4.4 - Summary table of study area geomorphic parameters from Cross-Section (XS) 12 to 21.

	XS12	XS13	XS14	XS15	XS16	XS17	XS18	XS19	XS20	XS21
Bankfull width [m]	3.28	5.88	n/a	3.28	3.68	1.67	1.83	1.15	1.20	n/a
Bankfull depth [m]	0.20	0.06	n/a	0.19	0.13	0.26	0.28	0.18	0.16	n/a
Bankfull area [m^2]	0.66	0.33	n/a	0.61	0.47	0.43	0.51	0.21	0.20	n/a
Wetted perimeter [m]	3.39	5.92	n/a	3.38	3.75	2.15	2.43	1.38	1.48	n/a
Hydraulic radius [m]	0.19	0.06	n/a	0.18	0.12	0.20	0.21	0.15	0.13	n/a
Entrenchment ratio [m]	5.39	2.55	n/a	2.50	1.50	12.08	8.16	4.03	2.32	n/a
Width-Depth ratio [m]	16.40	98.00	n/a	17.26	28.31	6.42	6.54	6.39	7.50	n/a
Rosgen classification	C	C to D	n/a	C	B	E	E	E	E	n/a
Entrenchment classification*	SE	SE	n/a	SE	ME	SE	SE	SE	SE	n/a
W:D classification**	M to H	Very H	n/a	M to H	M to H	L	L	L	L	n/a

*SE = slightly entrenched; M E = moderately entrenched; E = entrenched

**L = low; M = moderate; H = high

Table 4.5 - Average of geomorphic parameters for all Cross-Sections.

	Average
Bankfull width [m]	2.72
Bankfull depth [m]	0.17
Bankfull area [m^2]	0.42
Wetted perimeter [m]	2.89
Hydraulic radius [m]	0.15
Entrenchment ratio [m]	4.77
Width-Depth ratio [m]	20

Channel stability can be inferred from parameters such as the entrenchment ratio. Generally, an entrenchment ratio threshold of < 1.4 persists. The upstream Cross-Sections were determined to be slightly entrenched (SE) from Cross-Sections 1 through 8 and the same classification was seen at the downstream end. Cross-Section 9 was found to be entrenched. In future design protocols, non-entrenched or slightly entrenched cross-sectional profiles will be used as representative Cross-sections that function well geomorphically. Entrenched channels typically infer degradation of the channel bed which can lead to toeing or even slumping of the banks. Channels that are not entrenched have connectivity to floodplains during greater than bankfull flow events. Overall, within the study reach the banks were observed to be stable based on both qualitative and quantitative analysis due to properties such as vegetated bed and banks that offer channel stability.

Cross-Sectional geometry of the existing channel also offer stability of the channel to resist the typical flow conditions of the drainage feature. Generally, the upstream study reach with the vegetated bed and banks had a V shaped cross-section (see **Figure C.2**). Near the large meander in the study reach where bank stabilization techniques such as riprap had been implemented, the channel had a more rectangular cross-sectional shape. The farthest downstream section of the channel composed of a sandy-silt bed had a more U-shaped cross-section prior to the confluence with the tributary that flows into Baxter Creek (see **Figure C.22**). A sediment sample was taken downstream of Cross-Section 20 where the bed was no longer vegetated and a d_{50} of 0.46mm was determined. Conditions such as bankfull conditions were identified in the field and reported at each Cross-Section (green dots) where there was a break in the bank slope. Geomorphic principles infer

that bankfull conditions should occur where there is a break in the slope of the bank and the main channel connects to the floodplain. Deviation from this during design practices results in an over- or under-sized channel for the hydrology of the channel. A cross-section that exhibits proper connection of the main channel to the floodplain was identified in Cross-Section 4 (**Figure C.5**). Overall, based on this analysis, channel stability and appropriate cross-sectional shapes were seen in the upstream cross sections and will be used to guide design of the relocated channel.

4.4 Chan nel flows

The bankfull discharge is typically considered to be a channel forming or dominant discharge. This estimation was conducted using field collected bankfull indicators such as a break in bank slope, distinct changes in vegetation, soil, etc.. When re-naturalizing the channel, natural channel design concepts include the creation of a bankfull flow channel to accommodate the dominant discharge. Using data from the geomorphic field work, and using a friction factor and relative roughness methodology, bankfull flows in the existing system were estimated to be 0.39 m^3/s.

5.0 RECOMMENDED DESIGN OPTIONS

The overall objective of natural channel designs is to rehabilitate and restore the channels form and function. The same principles pertaining to natural channel design can be applied to channel re-alignment projects. Based on the desktop analysis and field surveys discussed above, recommended design options are discussed. The design concepts presented herein are drafted at a high-level to be compared against the “do nothing” approach. The range of solutions are limited to the available space, proposed subdivision lot-lines and roadway constraints. Sufficient detail is included to allow selection of an appropriate design option, at which time, details and plans will be developed in support of permitting and construction. As per the request of the client, channel corridor alignment and the modification plans will be discussed and confirmation of these preliminary design stages are required prior to the determination of more detailed design components.

The following preliminary design options were developed based on natural channel design principles. Generally, existing geomorphic conditions and knowledge of similar systems were used as the foundation of the designs. If approval is given, the detailed design will be tested and adjusted against our database of completed projects across southern Ontario. The proposed increase in channel length and alteration to grade of the channel will be adjusted accordingly and considered in each of the following design concepts. All design concepts are for the main channel and floodplain area and more detailed features such as upstream and downstream tie-ins will be addressed at subsequent design stages. The existing and proposed channel alignment can be seen on **Map 4**.

Option 1– Do Nothing

This option would allow the channel to maintain its existing shape, behavior and future rate of adjustment. However, the channel would pass through the proposed subdivision development of the Millbrook Phase 2 site.

Option 2 – Meandering Channel Realignment:

This channel design option includes a sinuous, meandering channel. The channel is proposed to have a low sinuosity, with a riffle-pool morphology. Generally, this design would mimic existing channel geometry and characteristics. This option will allow the main channel to have connectivity to both sides of the stream. In keeping with this assessment of the channel and by taking into account the existing geometric planform parameters such as radius of curvature, sinuosity, and meander amplitude, a sinuous channel pattern has

been proposed. The radii of curvatures used range between 2 and 7m (based on regime equations). Similarly, a meander belt width of approximately 11m will be used. To appease geomorphic processes, the channel cross-sectional geometry will be reduced from its present conditions to accommodate for the two-fold increase in channel length (i.e., increase in length to border the Phase 2 site and length required for meandering) while maintaining sufficient geometry to drain the required 32 hectares. This will also dictate a decrease in channel slope. To counteract the reduction in natural channel processes that are required for proper form and function such as sediment transport and continuity throughout the natural channel reach the channel geometry will be reduced. Working with geomorphic principles and pre-existing conditions will result in a meandering natural channel design with optimal geomorphic function. Bed and bank composition will aim to mimic the natural morphology of the grassy river stone exhibited at the upstream and downstream confines of the study reach.

Option 3 – Channel Realignment:

This channel realignment design proposes to follow the proposed alignment in a straight planform shape. The main channel would have floodplain connectivity. The cross-sectional, geometric shape would match existing conditions of the channel. The channel length will be required to increase and the slope will be decreased. As a result, the dimensions of the cross-sectional geometry will also likely need to be size down from the present conditions to maintain sediment continuity throughout the reach. Small riffle-like features of stone are proposed to be implemented at equally spaced intervals within the channel as a precautionary grade control feature and the rest of the bed will be composed of grass to replicate existing channel conditions.

5.1 Preliminary Design Dimensions for Meandering Channel Realignment

Preliminary design dimensions for "***Option 2 – Meandering Channel Realignment***" are discussed in the following section. The design dimensions are determined from the desktop and field based assessments. Based on the 32 hectare drainage area of the proposed subdivision, the Water's Edge database was utilized to determine the preliminary channel dimensions. The channel width was determined to be 0.82m and depth to be 0.18m. A summary of the Water's Edge database results can be seen in **Table 5.1**.

Table 5. 1 - Summary of channel dimensions derived from Water's Edge Database

Water's Edge Database Results	
Watershed area [km^2]	0.32
Width [m]	0.82
Depth [m]	0.18
Area [m^2]	0.15

The Williams (1986) relationships were considered for preliminary design dimensions. Designs aimed to achieve a maximum radius of the lateral width constraints of the proposed development. Julien (2002) and Newbury (2008) were also considered when optimizing the radius of curvature of the channel in relation to the bankfull channel width. The Rosgen (1994) classification system was subsequently considered to further guide design dimensions. Based on the existing and proposed conditions the Rosgen C4 Type channel was determined to be a suitable choice to guide designs. The design constraints for a Rosgen C4 Type channel can be seen in **Table 5.3**.

Table 5. 2 - Rosgen C-4 type channel properties

	Rosgen constraints for C4 type channel:	
Slightly entrenched	ratio > 2.2	can vary by +/- 0.2 units
Moderate to high width/depth	> 12	can vary by +/- 2.0 units
Moderate to high sinuosity	> 1.2	can vary by +/- 0.2 units
Slope Range	0.001-0.02	

Post-development valley slope was determined using the upstream (246.25m) and downstream (236.60m) tie-in elevations provide plan drawings provided by Valdor Engineering Inc. The total valley distance was obtained to be 1166.41m. This gives a channel slope of **0.008**. The representative reach (see **Map 2**) sinuosity was determined to be 1.3. The low flow channel has a maximum radius of curvature at the apex of each meander bend and the sinuosity was relaxed so that the resulting channel was not extremely tortuous. The final channel length was determined to be **1172.37m**.

In-stream channel features were selected to be riffles and pools. Riffle design was based on estimating critical flow depths and specific energy relationships at the upstream crest of the riffles during bankfull events while assuming a rectangular cross-section. Final average riffle and pool design dimensions can be seen in **Table 5.4**. On either side of the low-flow channel, a relief zone of 0.27m in width will be placed on either size to relieve stresses during higher flow events. This will reduce the potential for detrimental channel adjustment. Banks will be stabilized with geotextile. **Drawing 1** shows the planform and cross section of the pool and riffle.

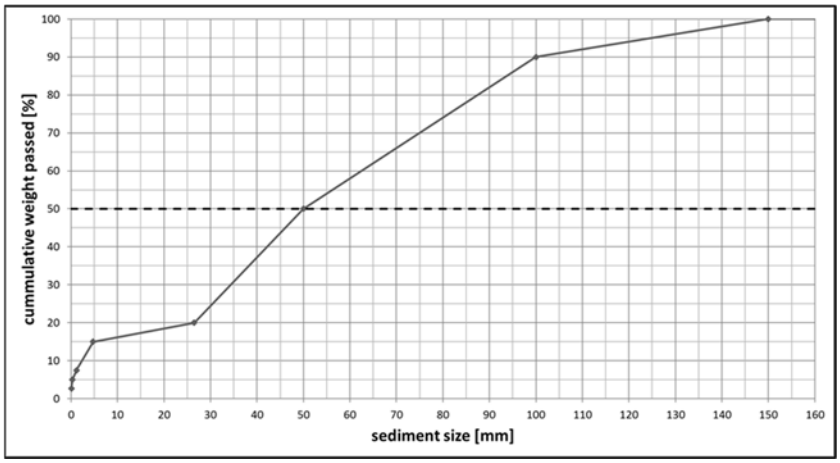
Table 5. 3 - In-stream feature design dimensions

	Dimensions				
Feature	**Height [m]**	**Length [m]**	**Gradient [m]**	**Spacing [m]**	**Depth [m]**
Riffle	0.08	1.025	0.01	6.15	--
Pool	--	--	--	--	0.34

Substrate sizing of the riffle features was also determined based on entrainment thresholds for a range of sediment sizes using a safety factor of 1.2. The final distribution of sediment sizes can be seen in **Figure 5.1** which gives a d_{50} of **50mm**. Sediment sizes including and smaller than 26.5mm were determined to be entrained during bankfull flow events and sizes larger would not be entrained. This balance allows for sediment continuity to occur while maintaining channel stability.

Figure 5. 1 - Riffle sediment sizing and distribution curve

	Sediment Size [mm]
	0.075
WEEST Granular "B" Type II	0.3
	1.18
	4.75
	26.5
25-50	50
50-100	100
100-150	150
150-200	200
200-250	250
250-300	300
300-500	500
500-750	750
750-1000	1000



6.0 SUMMA RY AND CONCLUSIONS

Based on the desktop analysis and field reconnaissance, the following can be concluded:

(1) ***Historical assessment:***
A preliminary desktop assessment was conducted on the study reach using historical aerial photographs. Generally, the study area was found to be a predominately agricultural area situated north of the urban center of Millbrook, Ontario.

(2) ***Channel migration:***
Aerial imagery was georeferenced over a range of time steps in order to investigate channel migration and no significant migration using a desktop approach was determined.

(3) ***Meander belt width assessment:***
A meander belt width assessment was conducted on the study reach. The TRCA Meander Belt Width Delineation Procedure and Ward and Mecklenburg (2011) was used to determine the active belt width of the channel. This meander belt width indicates the lateral extent required for the re-aligned channel. The meander belt width for the study reach was found to be 11m.

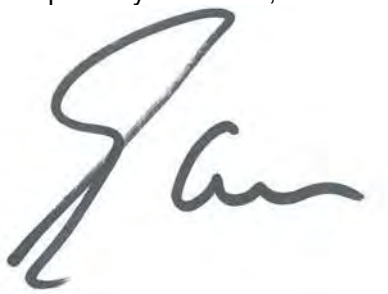
(4) ***Field investigation of study reach:***
General reach descriptions and a geomorphic analysis of the reach was conducted. Generally, the upstream reach was a grassy swale with reeds and low flows. At the mid-length cross-sections, near the location where the channel meanders and begins to flow northwards toward the confluence, there were berms built. The downstream section before the confluence was composed of sandy silts. The overall study reach was given a Rapid Geomorphic Assessment classification of being in transition and a Rapid Stream Assessment Technique score of fair.

(5) ***Geomorphic analysis of study reach:***
Twenty-one geomorphic and topographic surveys were conducted along the length of the study reach. Analysis of this data provided quantitative geomorphic parameters such as bankfull geometry and entrenchment values. Generally, bankfull geometries were consist throughout the reach apart from locations where the channel had been modified. The channel was overall slightly entrenched, which provides a multitude of representative cross-sections that can be used to guide channel design.

(6) ***Recommended design options:***
Based on the aforementioned desktop and field analysis of the study reach three design options were recommended using a natural and adaptive channel design approach. Recommended planform and in-channel feature design dimensions for the meandering channel option were also presented.

Should you have any comments or require clarification on any matter pertaining to the information contained in this report, please do not hesitate to contact Water's Edge.

Respectfully submitted,



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Attachments:

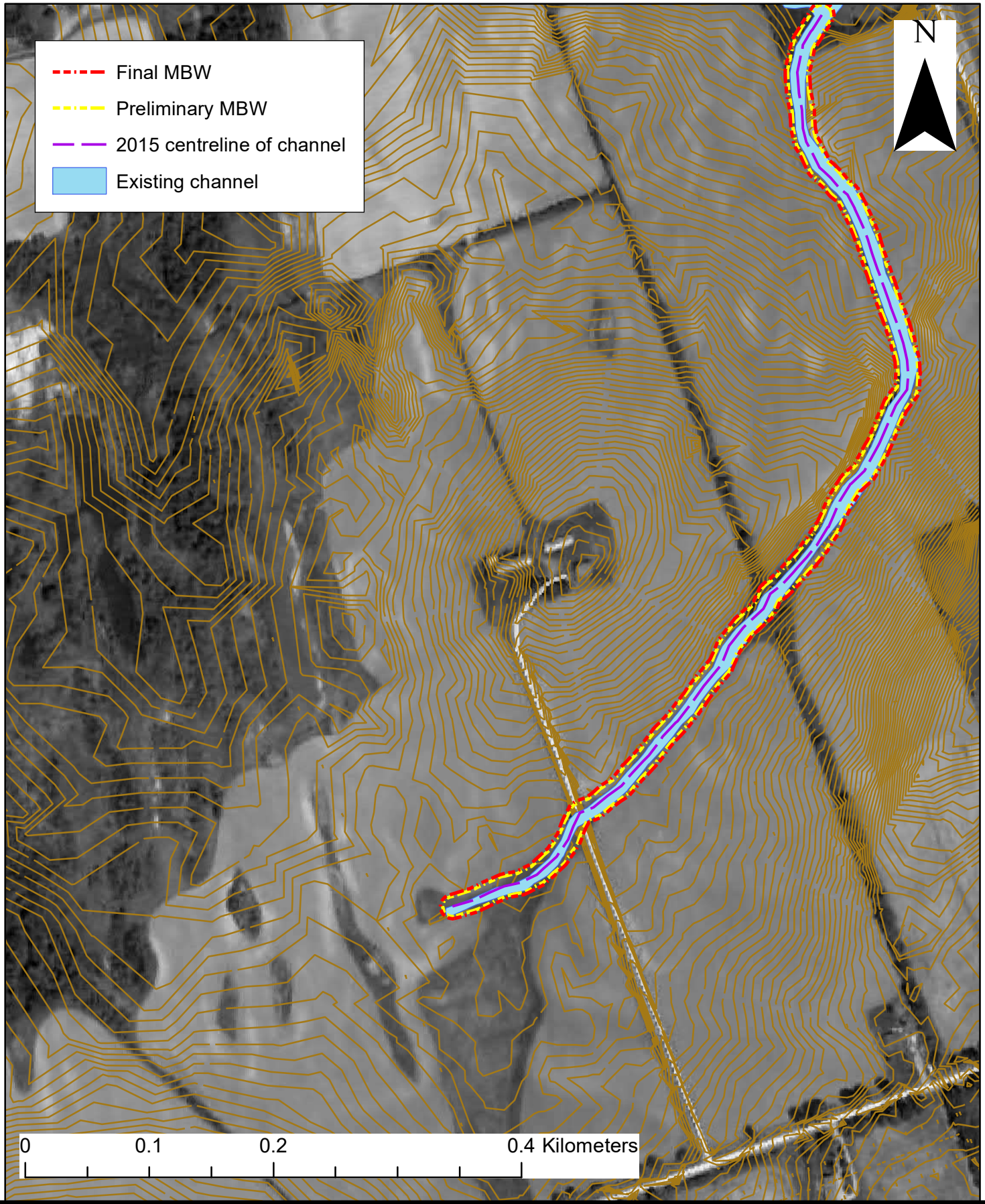
Maps 1 -4

Drawing 1

Appendix A: Field Photographs

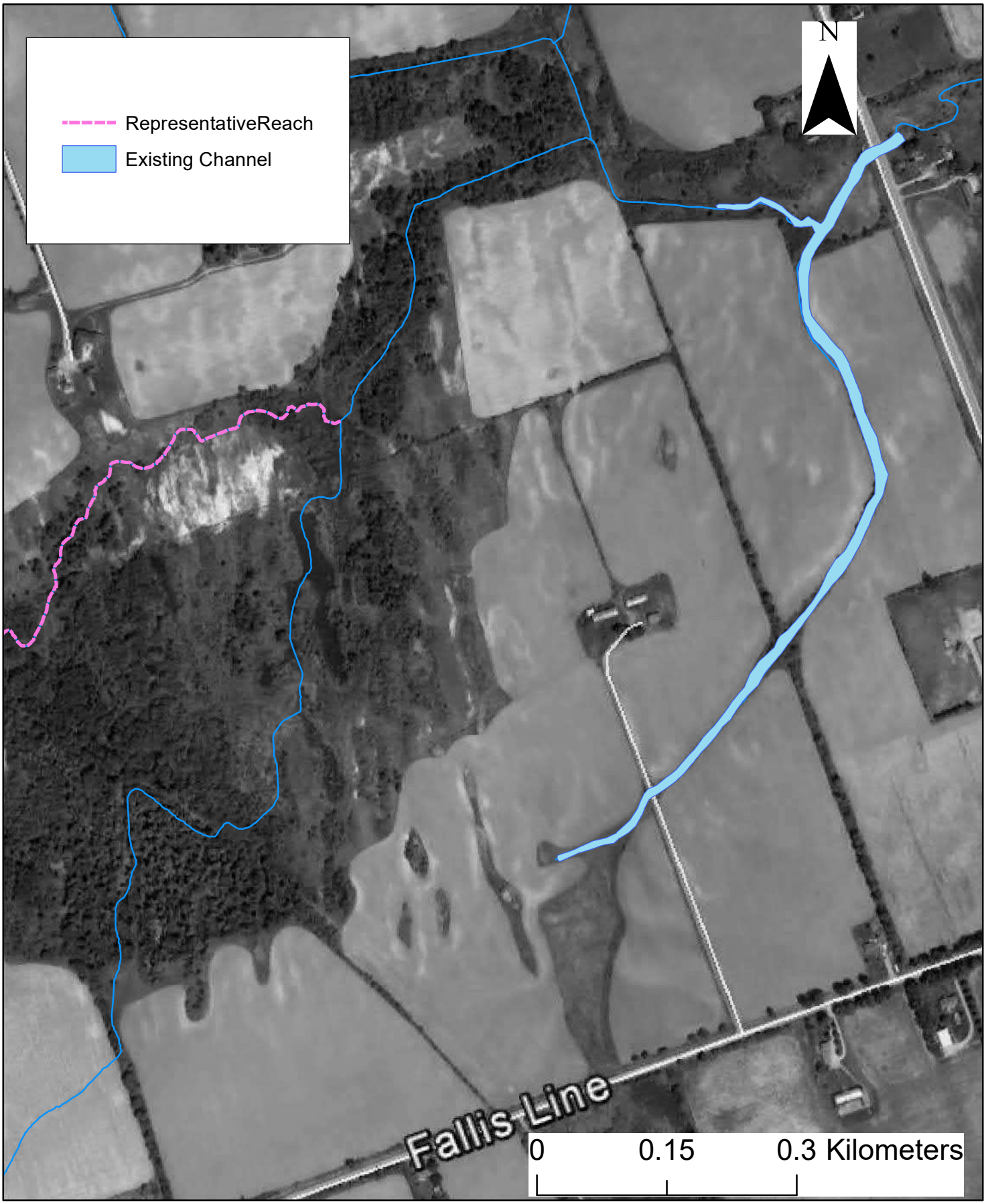
Appendix B: Topographic and Geomorphic Survey

Appendix C: Field Sheets

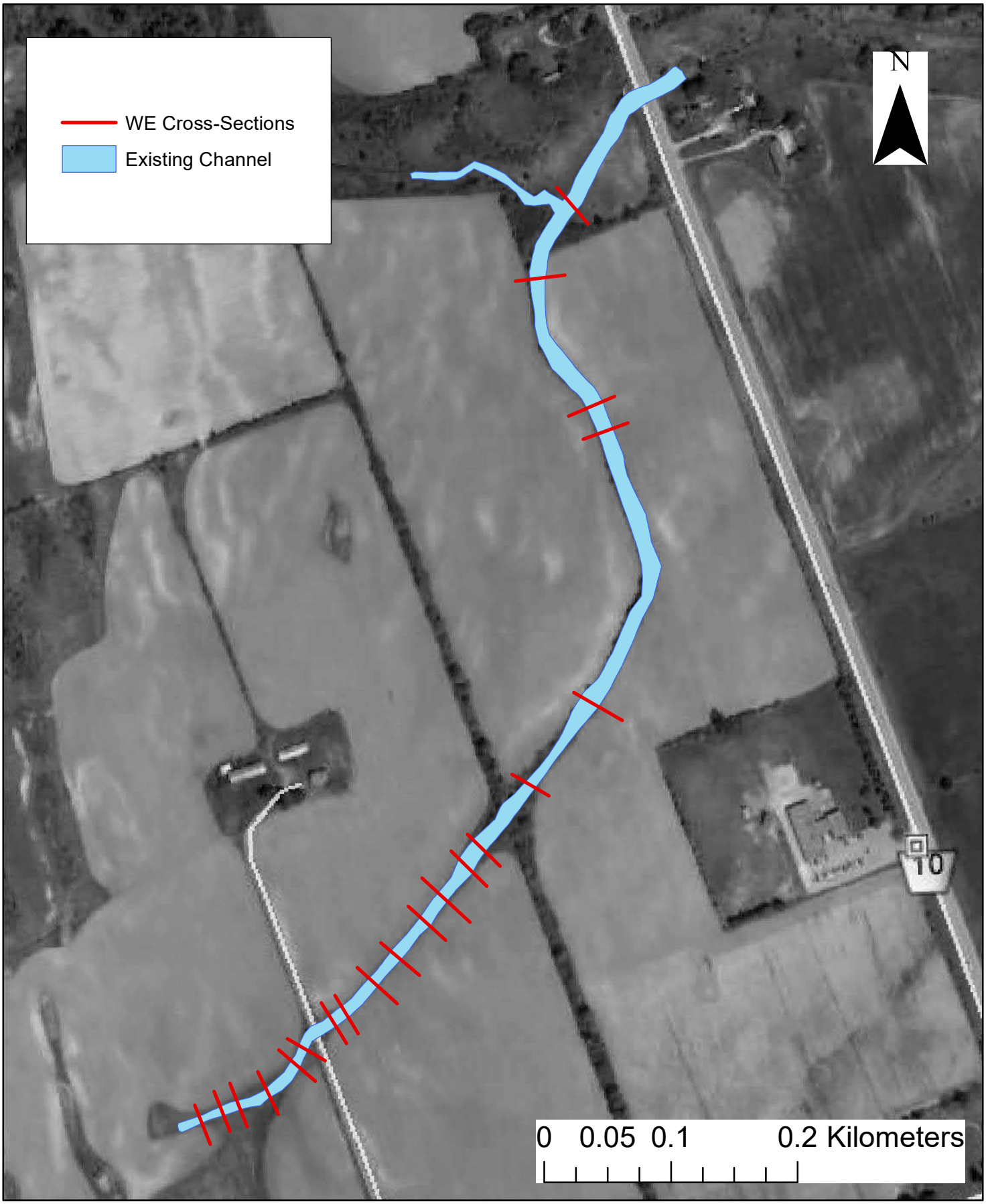


water's edge
ENVIRONMENTAL SOLUTIONS TEAM LTD

Millbrook Subdivision Phase 2 Millbrook, Ontario		Map No.: 1	Date: May. 19, 2017
Meander Beltwidth Assessment and Analysis		Checked By: EG	Drawn By: EHG

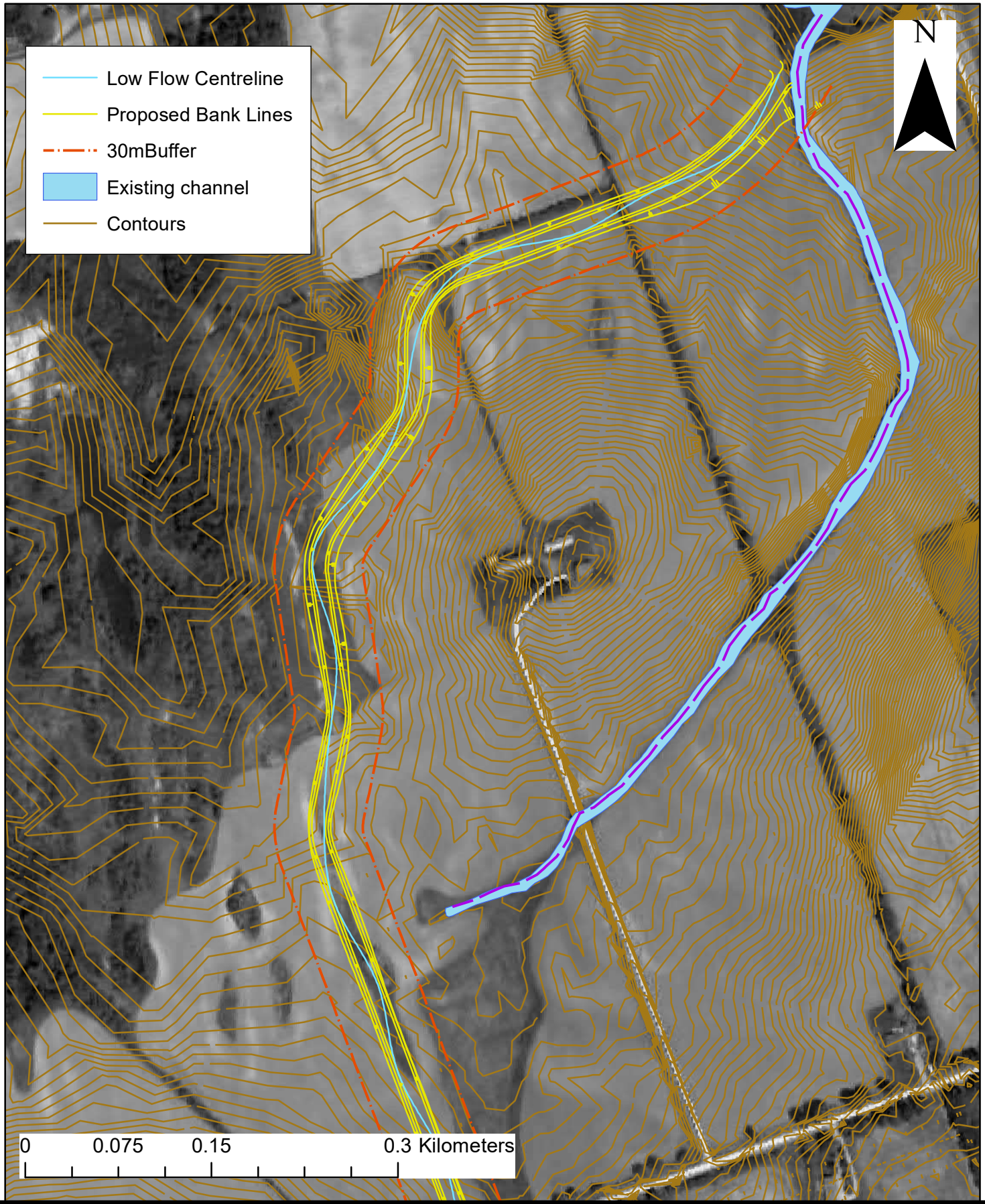


water's edge ENVIRONMENTAL SOLUTIONS TEAM LTD	Millbrook Subdivision Phase 2 Millbrook, Ontario	Map No.: 2	Date: Jun. 5, 2017
	Meander Beltwidth Representative Reach	Checked By: EG	Drawn By: EHG



water's edge
ENVIRONMENTAL SOLUTIONS TEAM LTD

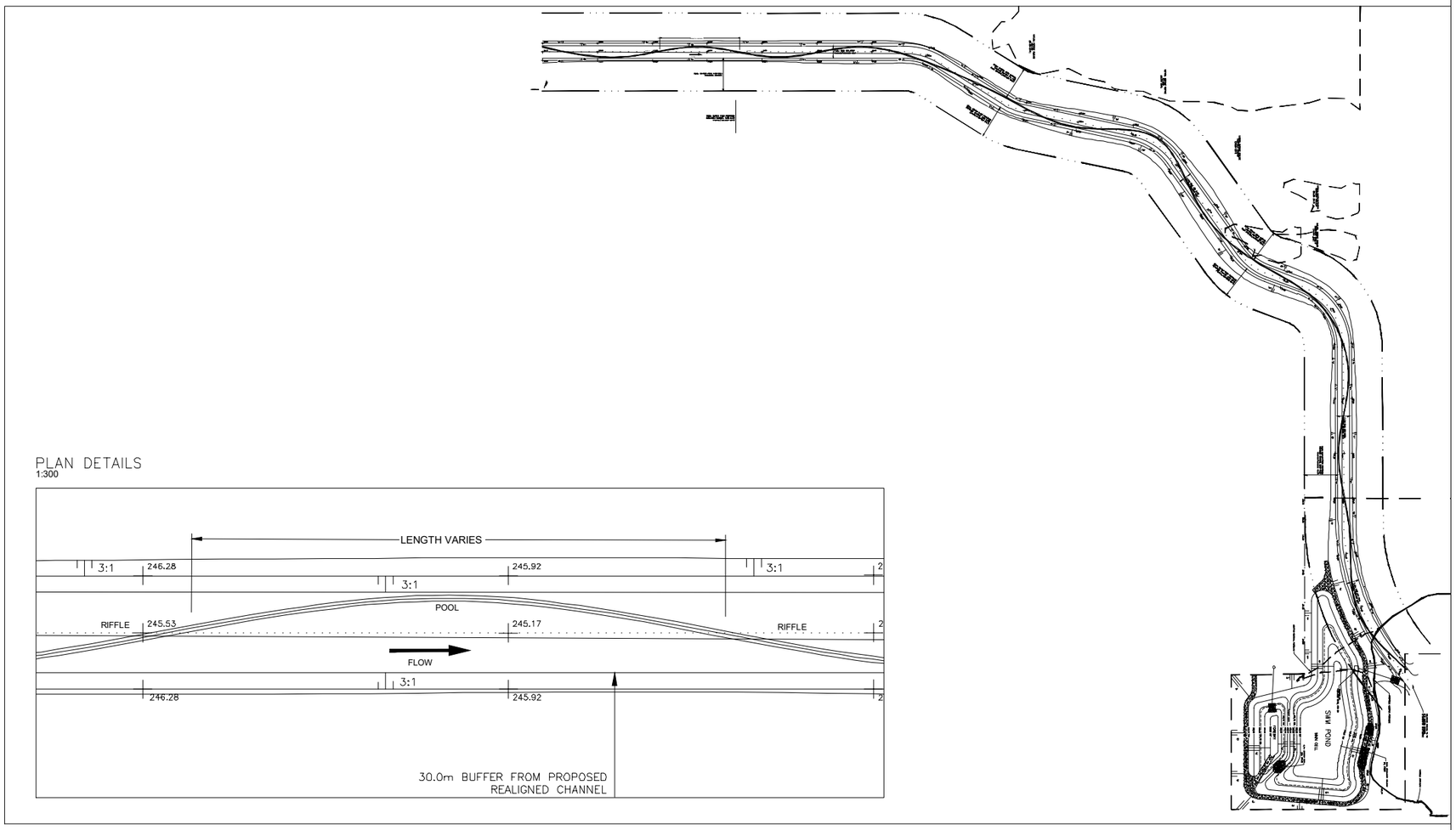
Millbrook Subdivision Phase 2 Millbrook, Ontario		Map No.: 3	Date: May. 19, 2017
Water's Edge Cross-Sections Geomorphic Cross-Section Analysis		Checked By: EG	Drawn By: EHG



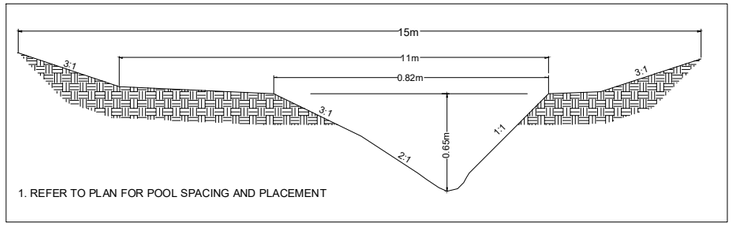
water's edge
ENVIRONMENTAL SOLUTIONS TEAM LTD.

Millbrook Subdivision Phase 2 Millbrook, Ontario		Map No.: 4	Date: Jul. 26, 2017
Existing and Proposed Channel Channel Alignment Assessment		Checked By: EG	Drawn By: EHG

PLAN
1:2000

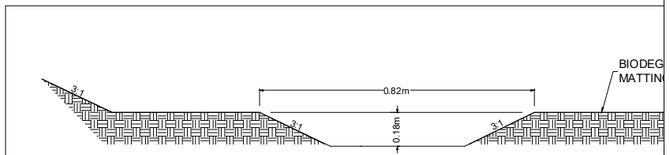


PLAN DETAILS
1:300



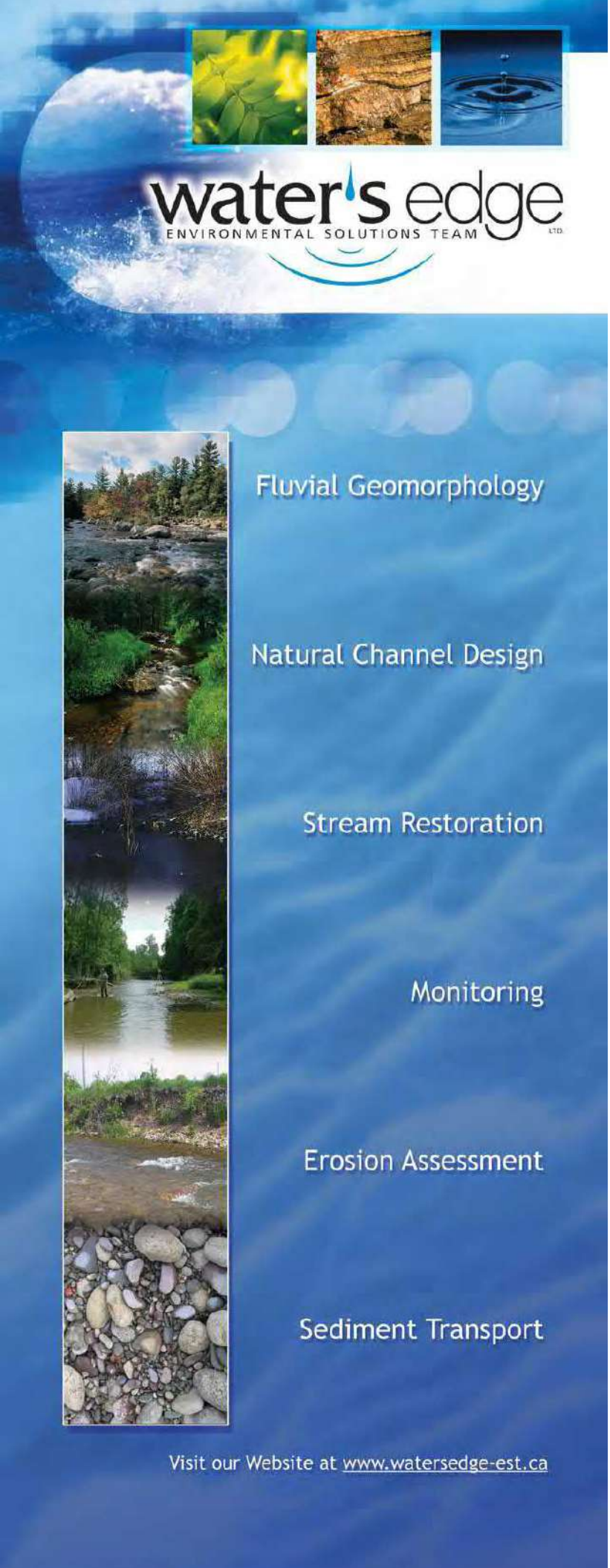
1. REFER TO PLAN FOR POOL SPACING AND PLACEMENT

D1 POOL (TYPICAL)
N.T.S.



1. D50 = 50mm
2. Depth = 0.18m

D2 RIFFLE: (TYPICAL)
N.T.S.



APPENDIX A:

Field Photographs (May 24, 2017)

PHOTOGRAPH NO.: 1
FROM: Left bank
LOOKING: Upstream at the headwaters of the tributary
COMMENT: Grassy, forbes-like channel, small cross-sectional geometry

PHOTOGRAPH NO.: 2
FROM: Left bank
LOOKING: Upstream at Cross-Section 1
COMMENT: Channel width has appeared to have naturally increased from upstream; banks are stable

PHOTOGRAPH NO.: 3
FROM: Left bank
LOOKING: Downstream at Cross-Section 1
COMMENT: Banks and floodplains are stabilized by a variety of long grasses; appear to be stable

PHOTOGRAPH NO.: 4
FROM: Left bank
LOOKING: Upstream at Cross-Section 2
COMMENT: Small tree on left bank; tall vegetation within the channel

PHOTOGRAPH NO.: 5
FROM: Left bank
LOOKING: Downstream at Cross-Section 2
COMMENT: Channel bed has significantly more dense grasses and vegetation

PHOTOGRAPH NO.: 6
FROM: Left Bank
LOOKING: Upstream at Cross-Section 3
COMMENT: Tall vegetation in channel (increase in roughness of the bed) is slightly narrower than the downstream pool; naturally, there is a greater water depth in the pool

PHOTOGRAPH NO.: 7
FROM: Left Bank
LOOKING: Downstream at Cross-Section 3
COMMENT: Tall vegetation within the channel bed is seen again; downstream there is a small shrub on the right bank diverting flow to the left

PHOTOGRAPH NO.: 8
FROM: Left Bank
LOOKING: Upstream at Cross-Section 4
COMMENT: Channel width has narrowed; numerous breaks in the slope of the banks

PHOTOGRAPH NO.: 9
FROM: Left bank
LOOKING: Downstream at Cross-Section 4
COMMENT: Deeper pool is seen with less dense vegetation on the channel bed; width has increased

PHOTOGRAPH NO.: 10
FROM: Left bank
LOOKING: Upstream at Cross-Section 5
COMMENT: Small exposed, bar-like, depositional features within the channel have grown new grasses

PHOTOGRAPH NO.: 11
FROM: Left bank
LOOKING: Downstream at Cross-Section 5
COMMENT: Significant flattening of vegetation is seen on both the left and right banks due to runoff

PHOTOGRAPH NO.: 12
FROM: Left bank
LOOKING: Upstream at Cross-Section 6
COMMENT: Section of small, dense shrubs, flow path of channel is less defined and there is diversion of flow around the vegetation

PHOTOGRAPH NO.: 13
FROM: Left bank
LOOKING: Downstream at Cross-Section 6
COMMENT: Small shrubs on right bank have grown over top of the channel and diverted flow path

PHOTOGRAPH NO.: 14
FROM: Left bank
LOOKING: Upstream at Cross-Section 7
COMMENT: Very little flow is present; bed, banks and terraces are stabilized by short grasses

PHOTOGRAPH NO.: 15
FROM: Left bank
LOOKING: Downstream at Cross-Section 7
COMMENT: Tall vegetation is seen downstream and channel narrows slightly

PHOTOGRAPH NO.: 16
FROM: Left bank
LOOKING: Upstream at Cross-Section 8
COMMENT: Some tall grasses on the left bank have been flattened due to runoff; channel width is smaller but cut deeper

PHOTOGRAPH NO.: 17
FROM: Left bank
LOOKING: Downstream at Cross-Section 8
COMMENT: Shrub on the right bank is diverting flow into a patch of taller willows

PHOTOGRAPH NO.: 18
FROM: Left bank
LOOKING: Upstream at Cross-Section 9
COMMENT: Little flow through channel, riparian buffer is made of small grasses and some erosion is seen on left bank due to agricultural activities

PHOTOGRAPH NO.: 19
FROM: Left bank
LOOKING: Downstream at Cross-Section 9
COMMENT: Some flattening of vegetation due to runoff is seen on left bank

PHOTOGRAPH NO.: 20
FROM: Left bank
LOOKING: Upstream at Cross-Section 10
COMMENT: Grasses are slightly taller on the banks, channel bed is cut slightly deeper

PHOTOGRAPH NO.: 21
FROM: Left bank
LOOKING: Downstream at Cross-Section 10
COMMENT: Grasses have overgrown and are creating shade over the channel; some anthropogenic erosion seen on left bank

PHOTOGRAPH NO.: 22
FROM: Left bank
LOOKING: Upstream at Cross-Section 11
COMMENT: Some flattening of vegetation seen on the left bank; little flow in channel; stable tree is noted on the right bank

PHOTOGRAPH NO.: 23
FROM: Left bank
LOOKING: Downstream at Cross-Section 11
COMMENT: Channel has narrowed and become slightly deeper; two small trees and shrubs are noted on the right banks

PHOTOGRAPH NO.: 24
FROM: Left bank
LOOKING: Upstream at Cross-Section 12
COMMENT: Width of riparian buffer has increased; channel has widened and there is less vegetation overhanging the channel

PHOTOGRAPH NO.: 25
FROM: Left bank
LOOKING: Downstream at Cross-Section 12
COMMENT: Channel meanders slightly to the right before entering a reach with a dense thicket of older growth vegetation

PHOTOGRAPH NO.: 26
FROM: Upstream
LOOKING: Upstream at Cross-Section 13
COMMENT: Berm of earth and river stone has been built on the left bank; dense growth of older trees on both the left and right banks; channel bed is composed of more sandy silts and fewer long grasses

PHOTOGRAPH NO.: 27
FROM: Left bank
LOOKING: Downstream at Cross-Section 13
COMMENT: Woody debris is covering the channel

PHOTOGRAPH NO.: 28
FROM: Left bank
LOOKING: Upstream at Cross-Section 14
COMMENT: Few younger, small shrubs have grown on the left bank, grassy berm (appears to be man-made) is on the right bank

PHOTOGRAPH NO.: 29
FROM: Left bank
LOOKING: Downstream at Cross-Section 15
COMMENT: Flow in channel is significantly greater; Larger shrubs on the left bank; Berm on the right bank

PHOTOGRAPH NO.: 30
FROM: Left bank
LOOKING: Berm built of earthen river stone, located between Cross-Section 15 and 16
COMMENT: Berm has eliminated connectivity of main channel to the floodplain; dense tree cover

PHOTOGRAPH NO.: 31
FROM: In the stream
LOOKING: Upstream at Cross-Section 16
COMMENT: Channel bed appears to be degrading; banks have eroded a bit but remain fairly stable.

PHOTOGRAPH NO.: 32
FROM: In the stream
LOOKING: Downstream at Cross-Section 16
COMMENT: Large stone riprap (approximately 15 to 30 cm) in size have been placed in the channel bed; channel bed composed of sandy-silt; downstream there is a slight increase of channel width and banks have slightly collapsed

PHOTOGRAPH NO.: 33
FROM: In the stream
LOOKING: Upstream at Cross-Section 17
COMMENT: Old gate on the left bank is falling in; some bank instability; runoff has resulted in riling on the left bank; bed of channel appears to be degrading; some sinuosity of channel

PHOTOGRAPH NO.: 34
FROM: Center of channel
LOOKING: Downstream at Cross-Section 17
COMMENT: Left bank is slightly upstable; riparian buffer has increased

PHOTOGRAPH NO.: 35
FROM: Center of channel
LOOKING: Upstream at Cross-Section 18
COMMENT: Some toeing of banks; bed has degraded; lack of connection between banks and floodplains

PHOTOGRAPH NO.: 36
FROM: Center of channel
LOOKING: Downstream at Cross-Section 18
COMMENT: Runoff and bank instability appear on the left bank; river flowing into dense thicket of vegetation

PHOTOGRAPH NO.: 37
FROM: Center of channel
LOOKING: Upstream (between Cross-Section 18 and 19) at culvert
COMMENT: Culvert has been compressed; river stone (range in size from 15cm to 30cm) at the outlet; water flowing beneath the culvert from other side

PHOTOGRAPH NO.: 38
FROM: Center of channel, slightly downstream of Cross-Section 22
LOOKING: Upstream (between Cross-Section 18 and 19) at culvert
COMMENT: River-stone riprap has significant moss cover and little water flowing overtop; downstream is sandy-silt

PHOTOGRAPH NO.: 39
FROM: Left bank
LOOKING: Downstream (between Cross-Section 18 and 19 and downstream of culvert)
COMMENT: Bed composed of sandy-silt with some larger stones; significant meander in the channel and development of a point bar terrace on the right bank; banks appear to be fairly stable; some overhanging vegetation on the right bank

PHOTOGRAPH NO.: 40
FROM: Right bank
LOOKING: Upstream at Cross-Section 19 (at confluence of study reach with Baxter Creek)
COMMENT: Channel is significantly wider with substantially greater flow depth;

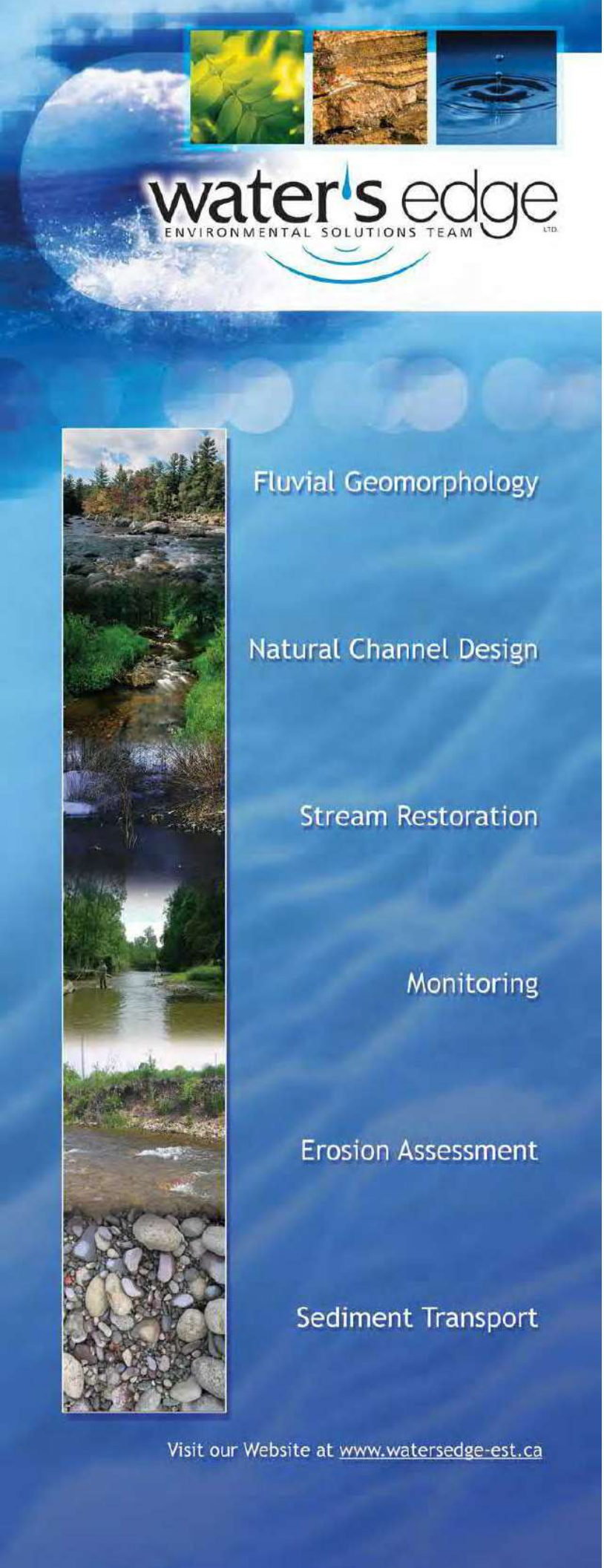
PHOTOGRAPH NO.: 41
FROM: Right bank
LOOKING: Downstream at Cross-Section 19 (at confluence of study reach with Baxter Creek)
COMMENT: Bed is composed of a mix of grasses and larger river stone; right bank is saturated

PHOTOGRAPH NO.: 42
FROM: Center of channel
LOOKING: Upstream at Cross-Section 20
COMMENT: Exposed, depositional bar has formed on the right bank

PHOTOGRAPH NO.: 43
FROM: Right bank
LOOKING: Downstream at Cross-Section 20
COMMENT: Discharge has increased; right bank is saturated and slightly unstable

PHOTOGRAPH NO.: 44
FROM: Right bank
LOOKING: Upstream at Cross-Section 21
COMMENT: Larger cobbles and boulders in the channel have diverted the flow; these features have increase channel roughness and encouraged further sediment to accumulate resulting in the growth of depositional features with grassy vegetation

PHOTOGRAPH NO.: 45
FROM: Right bank
LOOKING: Downstream at Cross-Section 21 at culvert (downstream of Cross-Section 21)
COMMENT: Right bank is saturated; some flow diversion channels exist on right floodplain; right floodplain has resulted in grassy islands; concrete, rectangular culvert underpasses County Road 10



APPENDIX B:

Topographic and Geomorphic Survey

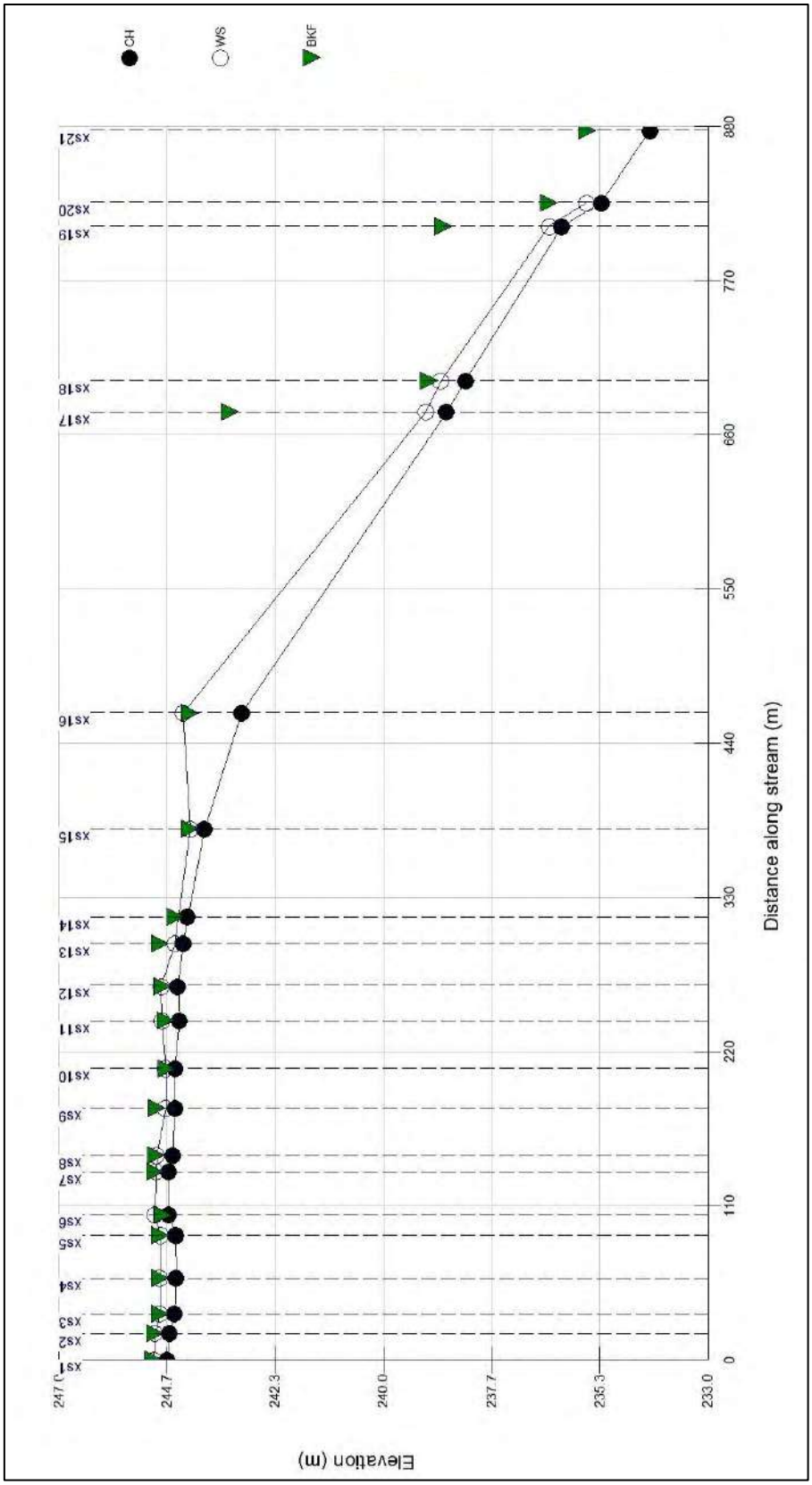


Figure C.1 – Long profile of study reach.

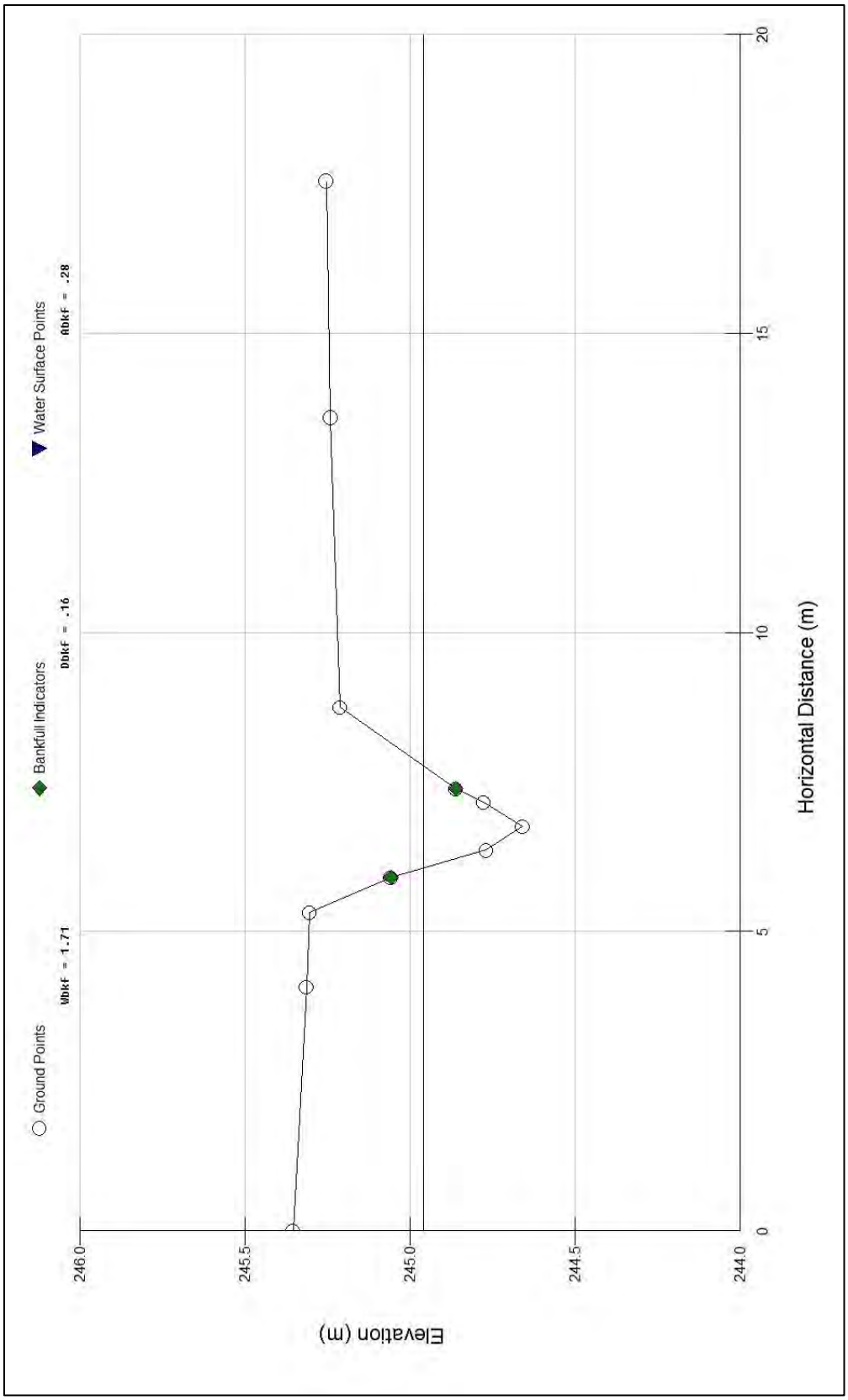


Figure C.2 – Cross-section 1 of study reach.

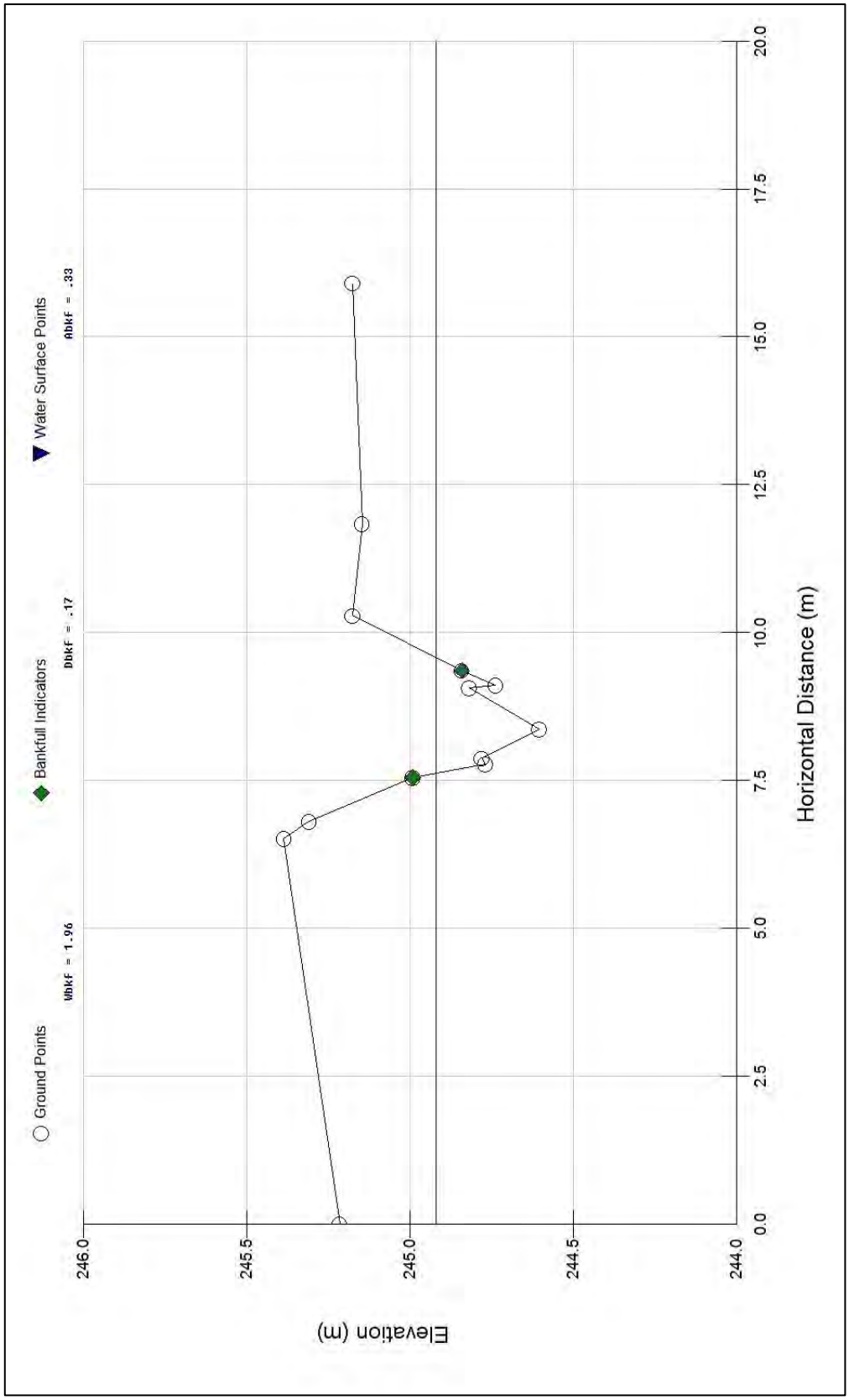


Figure C.3 – Cross-section 2 of study reach.

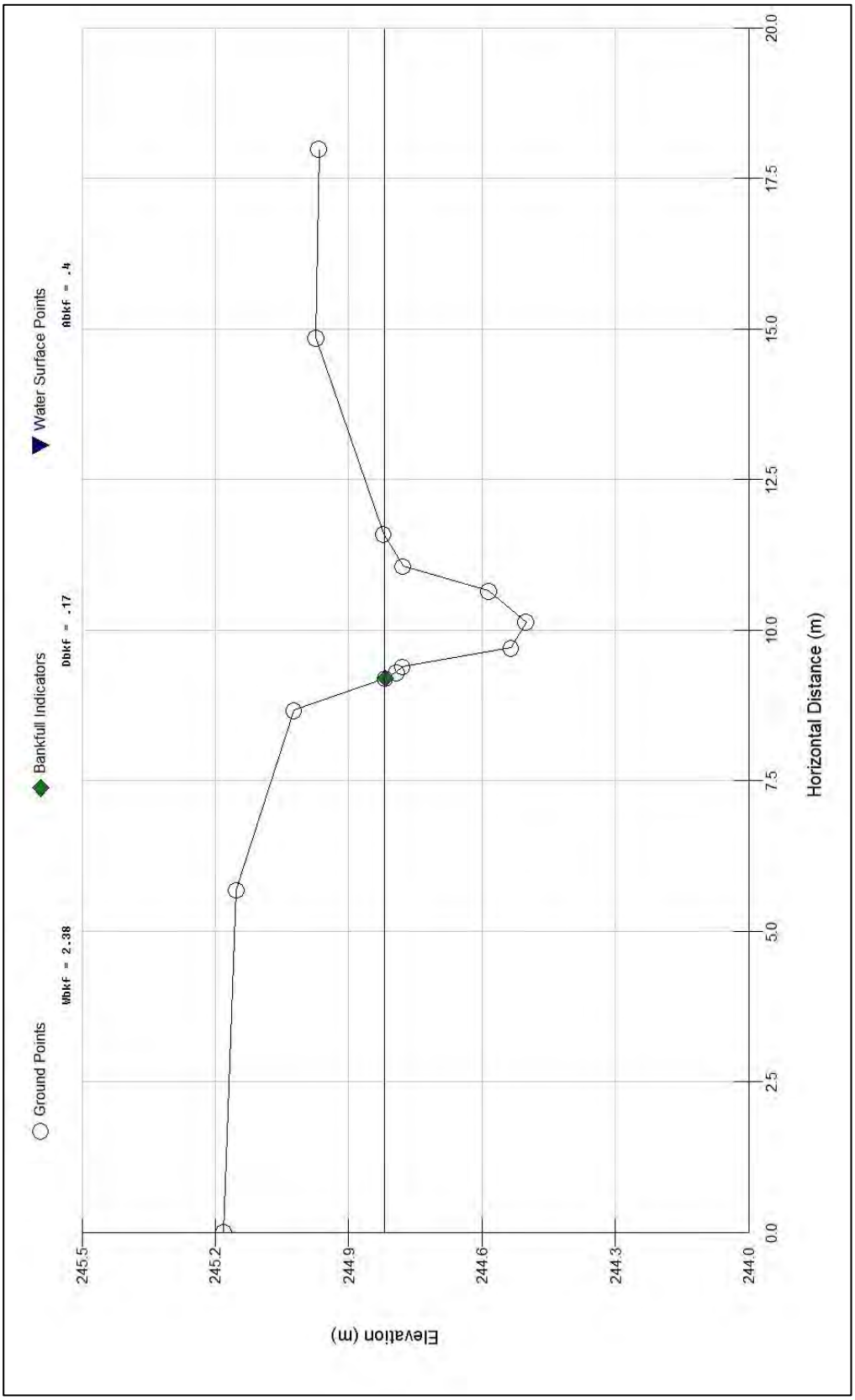


Figure C.4 – Cross-section 3 of study reach.

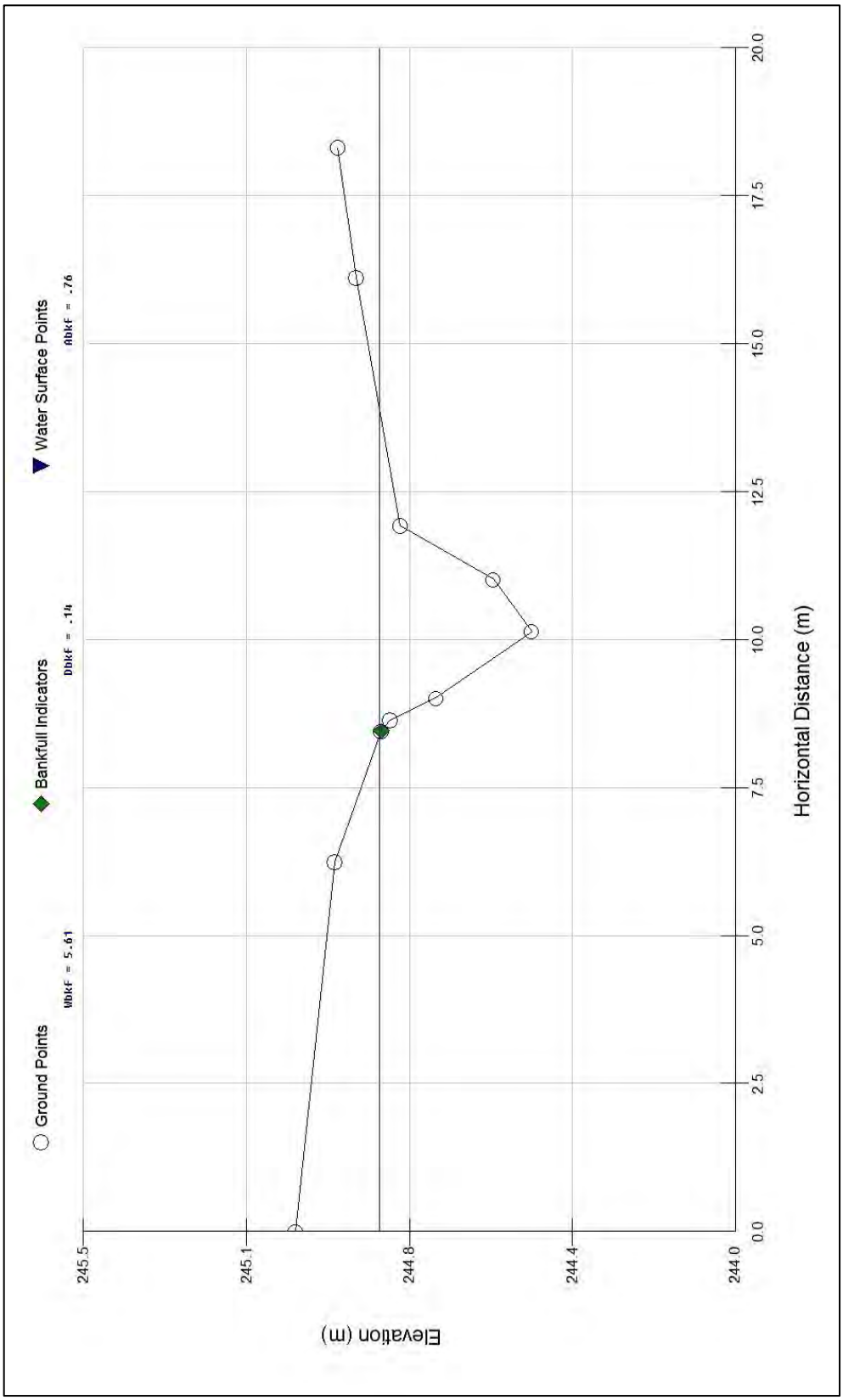


Figure C.5 – Cross-section 4 of study reach.

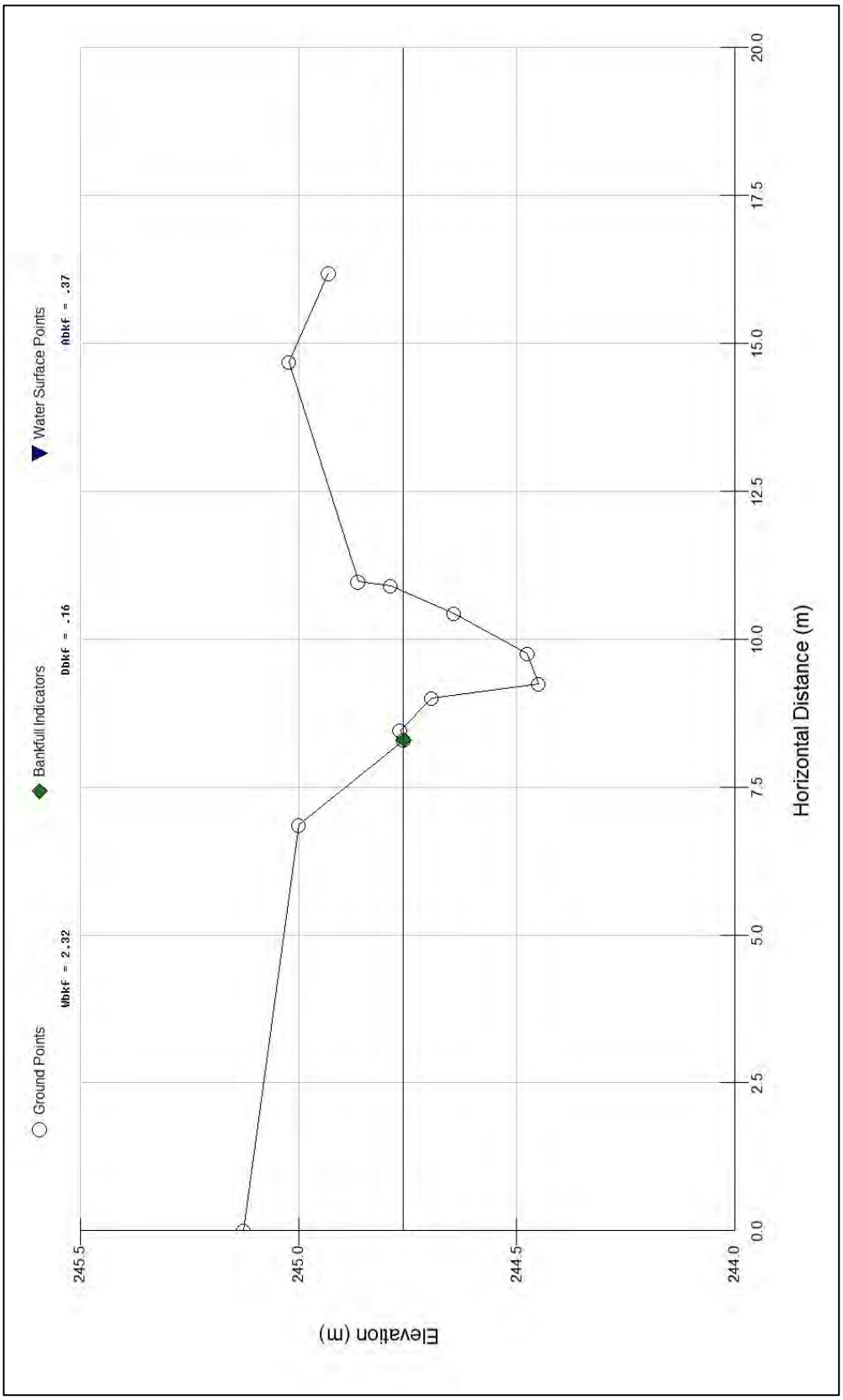


Figure C.6 – Cross-section 5 of study reach.

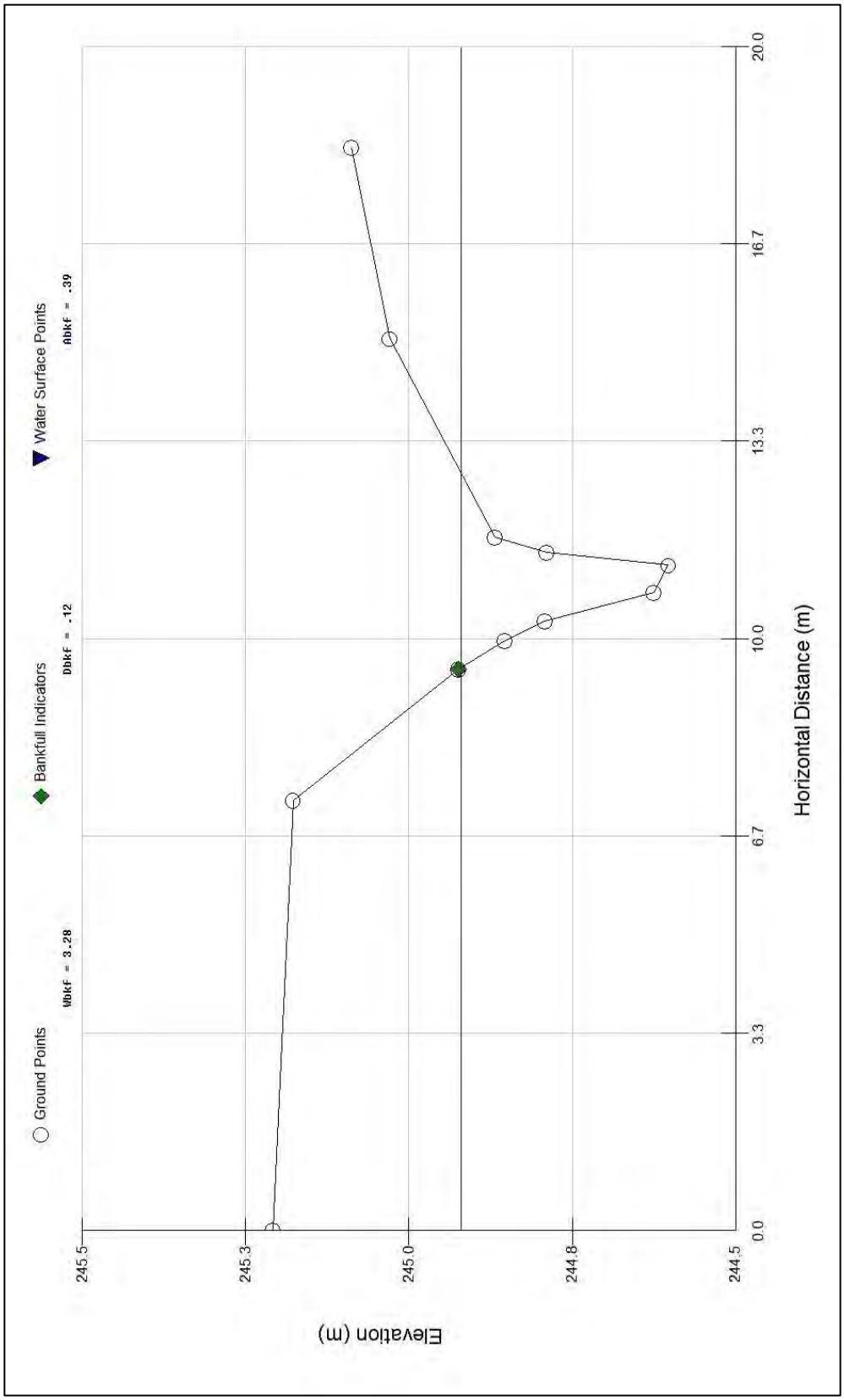


Figure C.7 – Cross-section 6 of study reach.

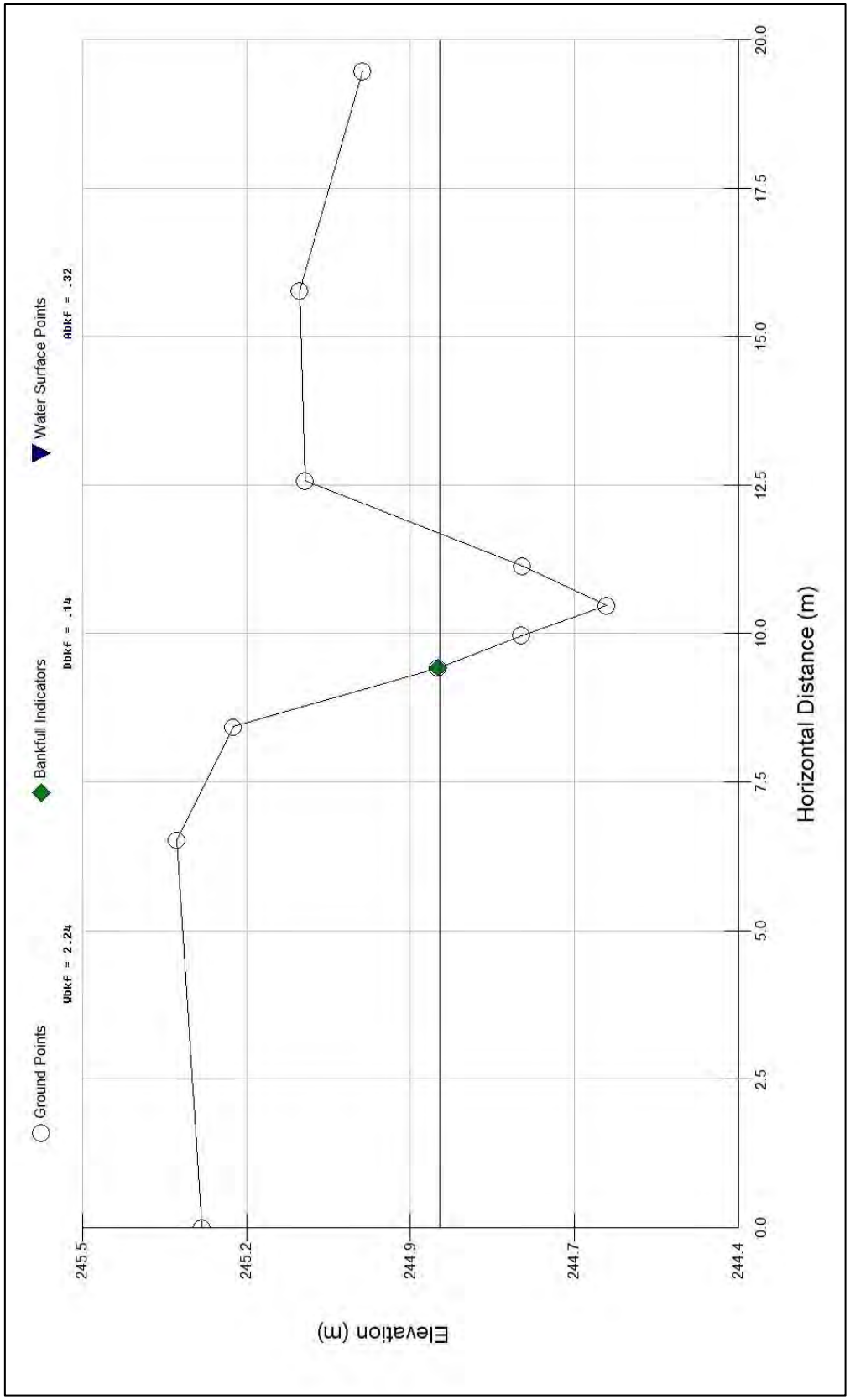


Figure C.8 – Cross-section 7 of study reach.

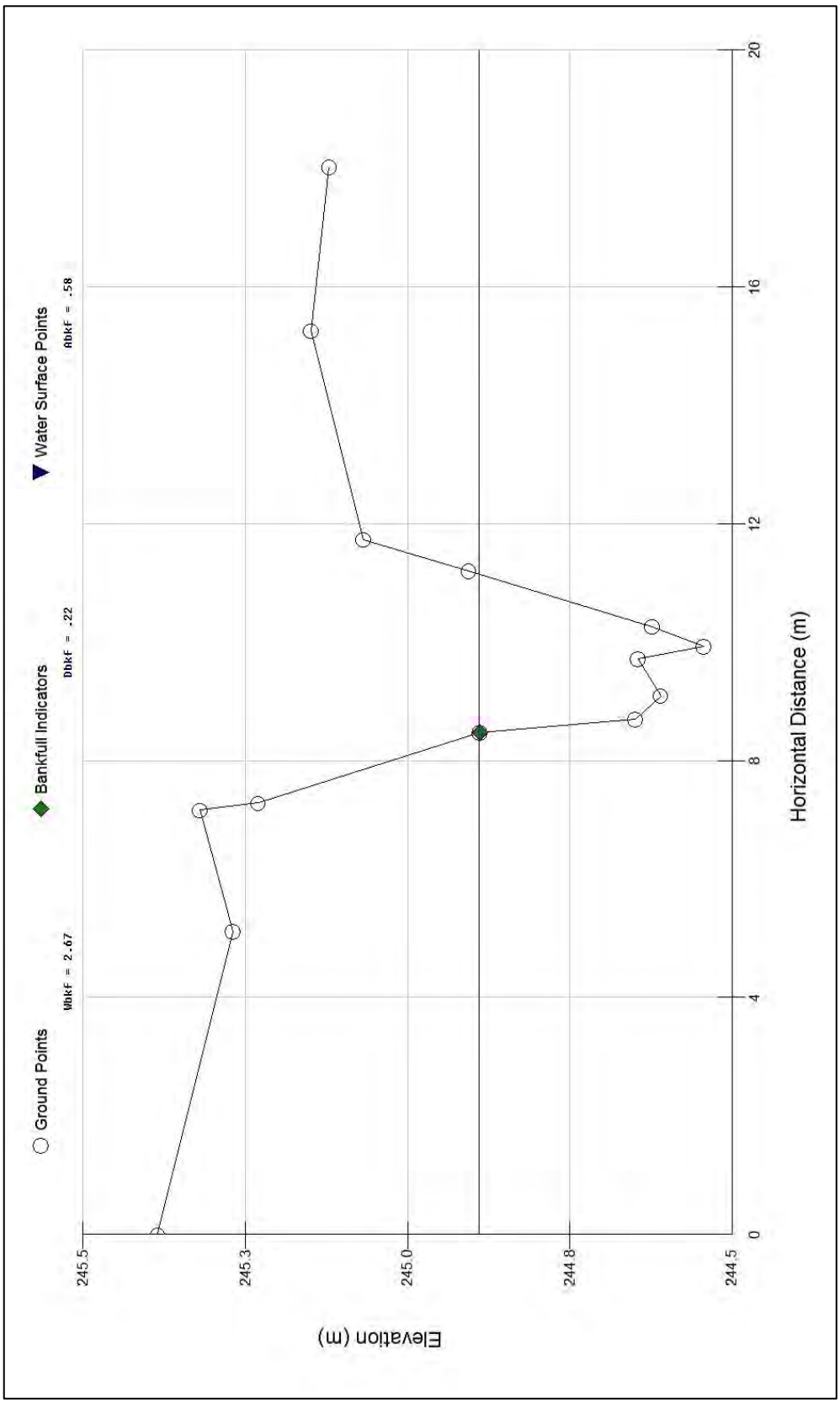


Figure C.9 – Cross-section 8 of study reach.

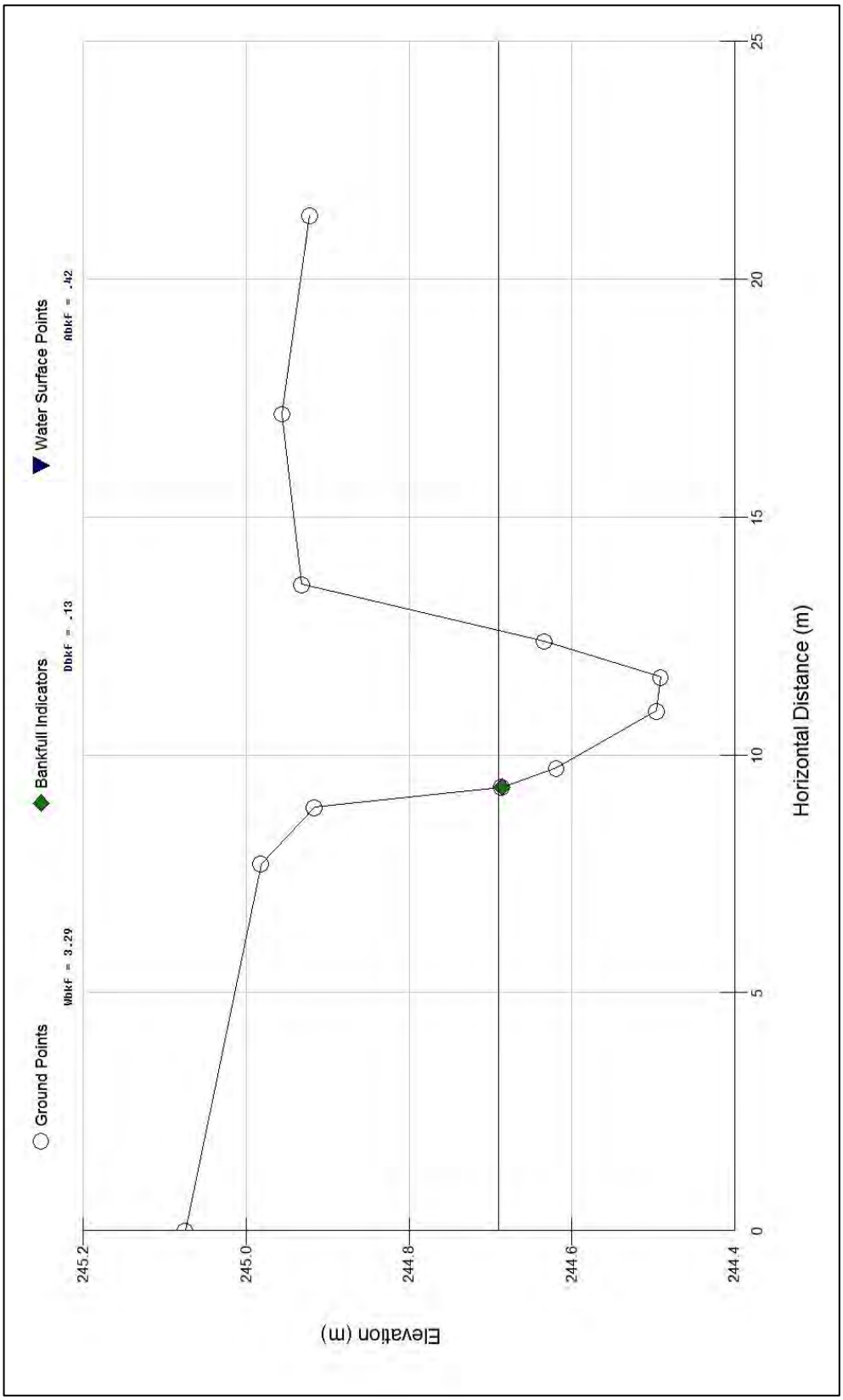


Figure C.10 – Cross-section 9 of study reach.

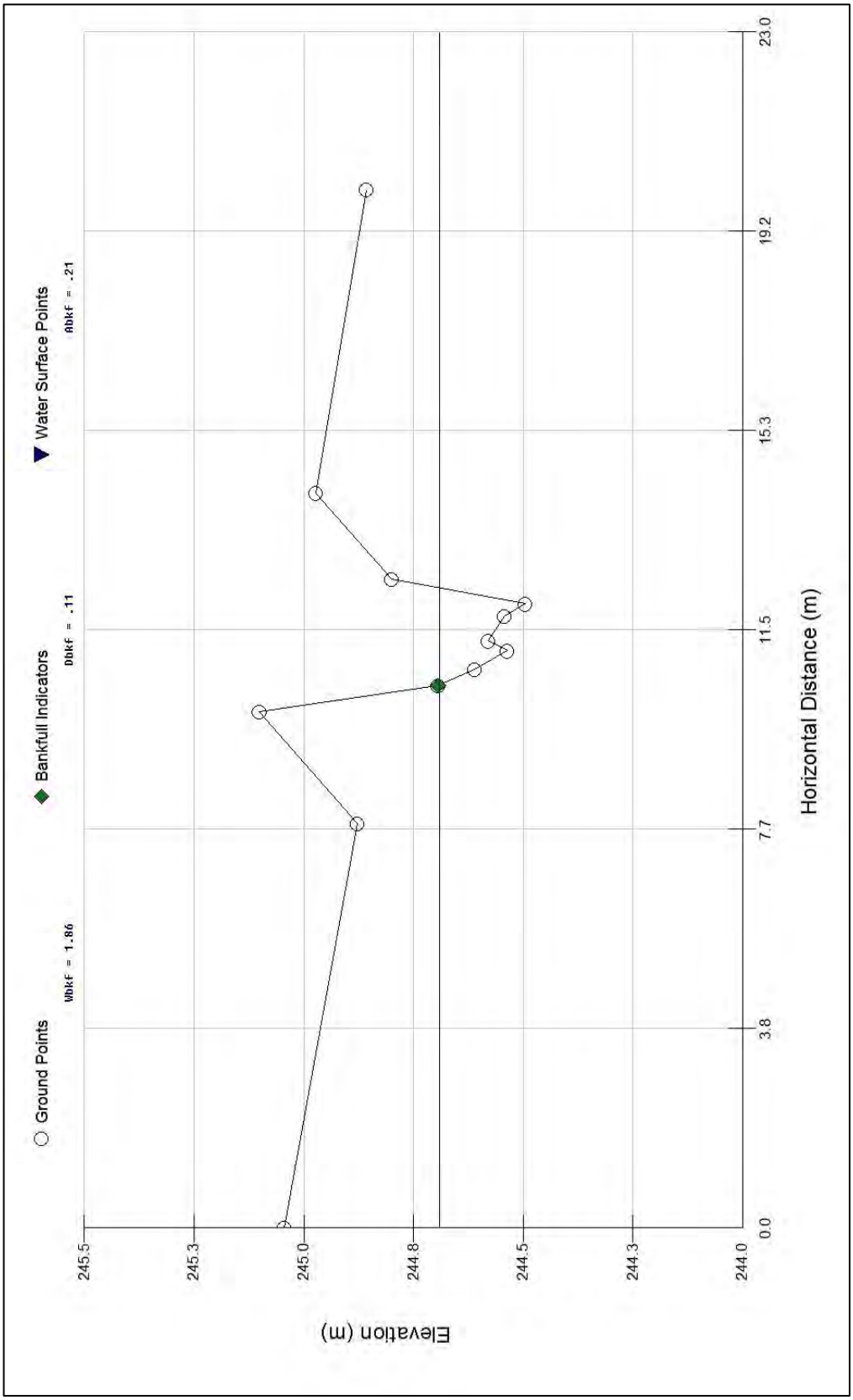


Figure C.11 – Cross-section 10 of study reach.

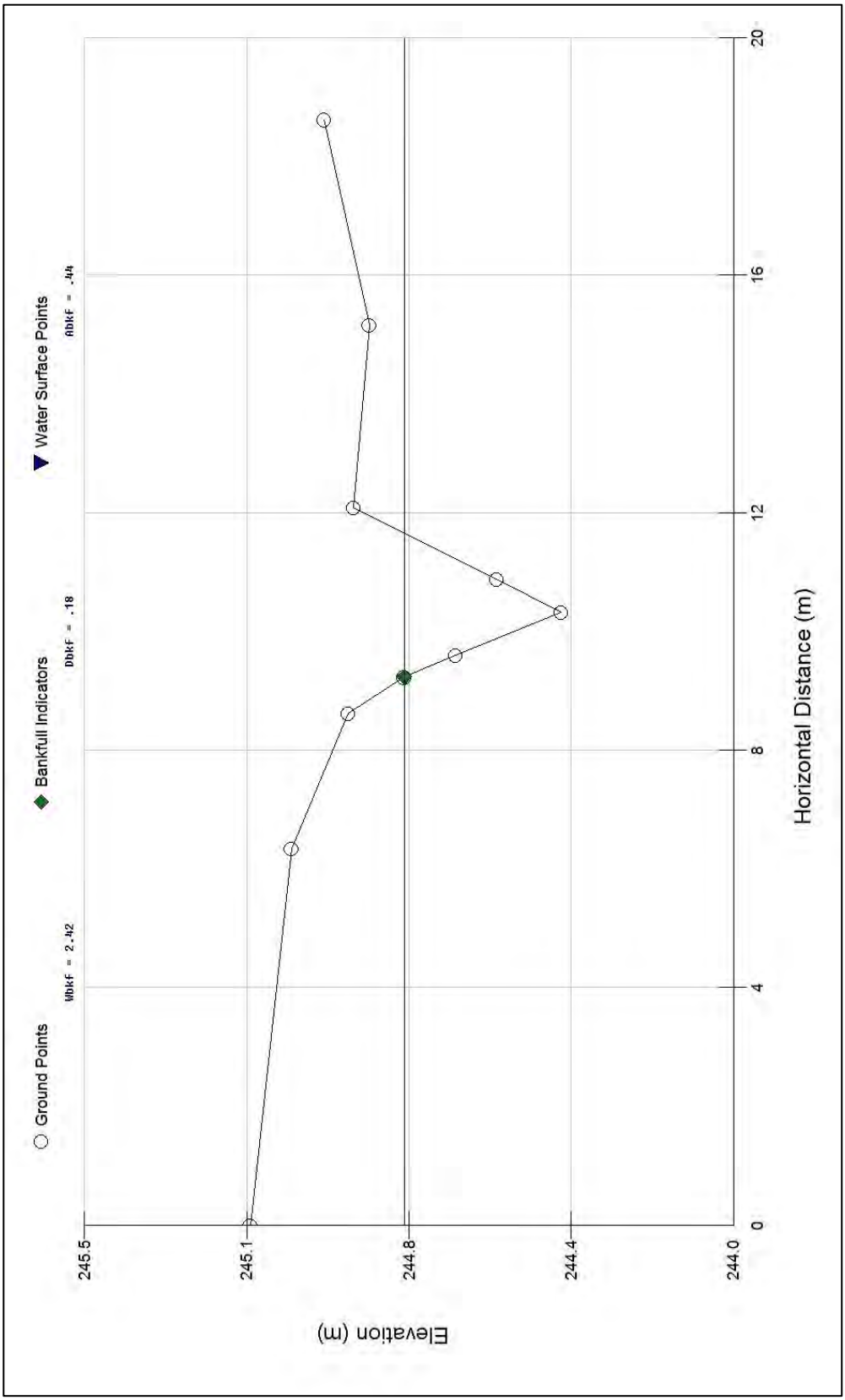


Figure C.12 – Cross-section 11 of study reach.

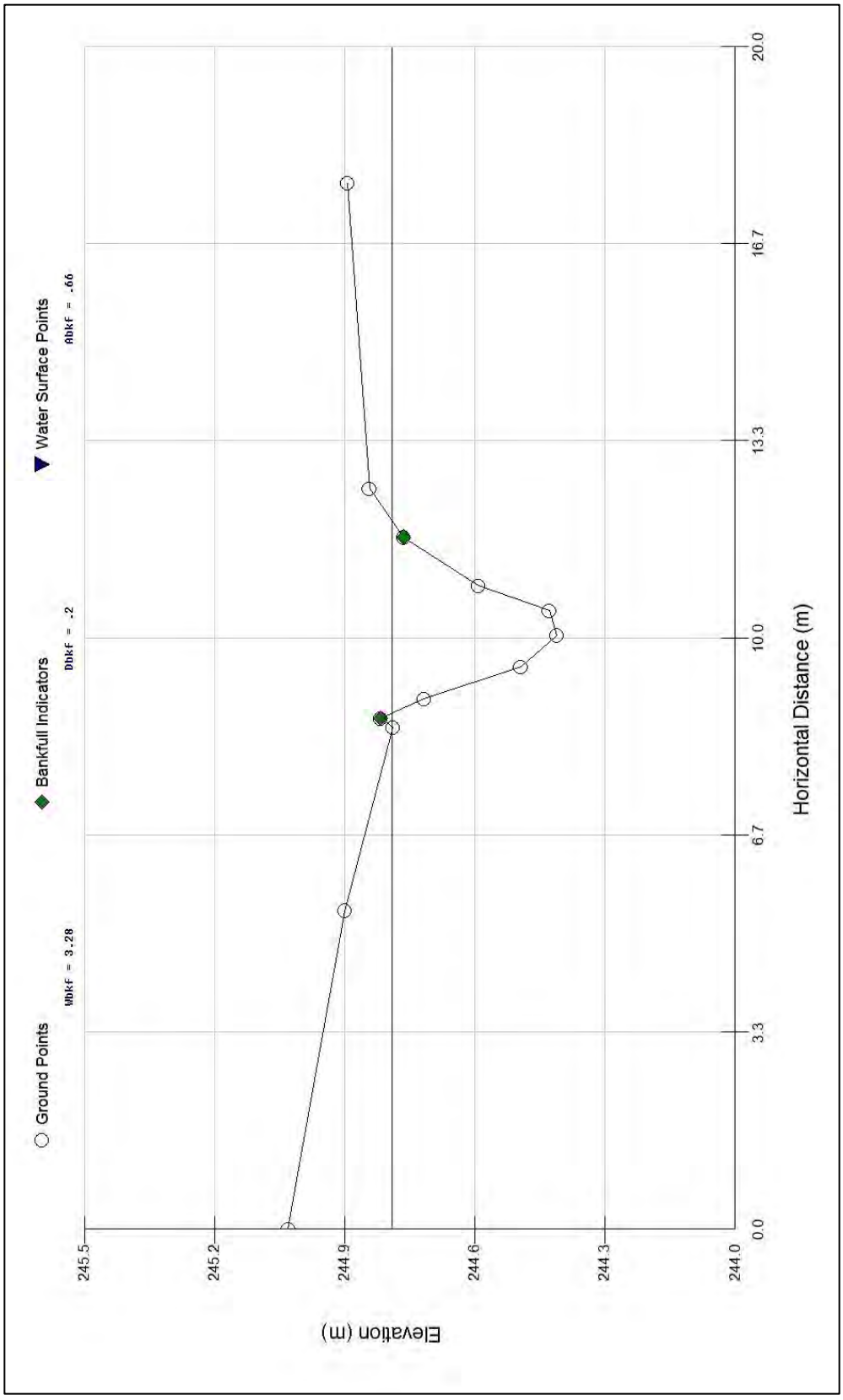


Figure C.13 – Cross-section 12 of study reach.

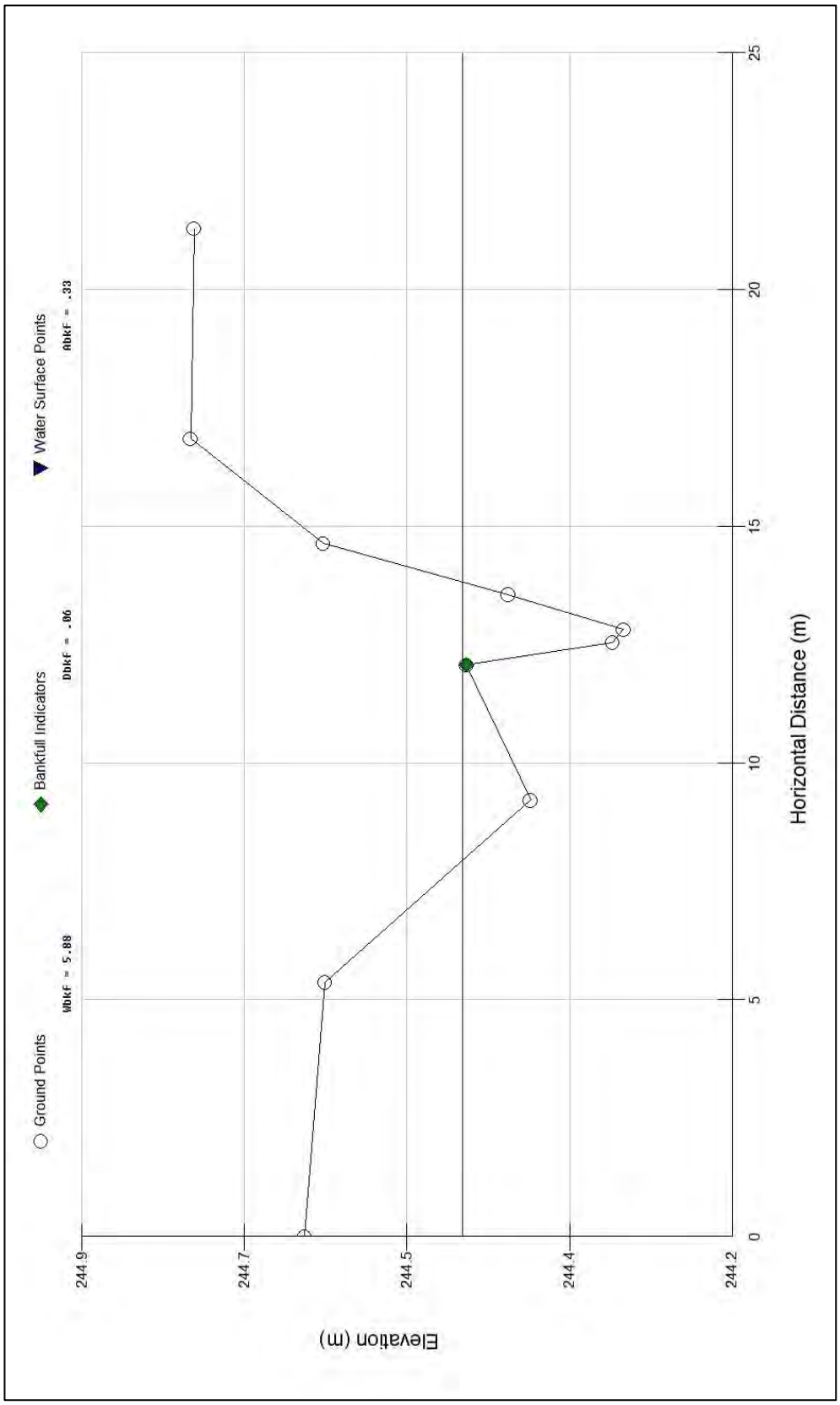


Figure C.14 – Cross-section 13 of study reach.

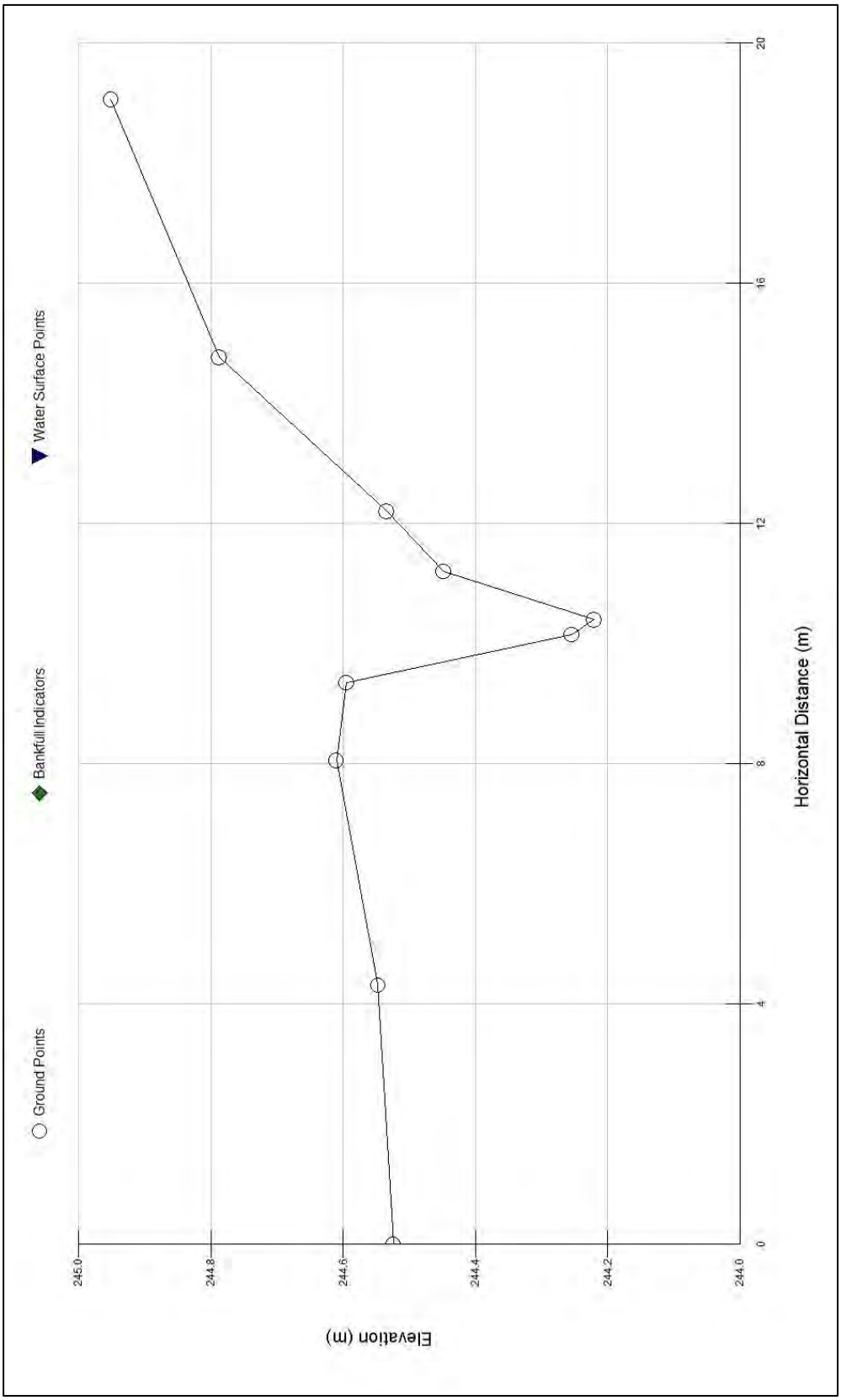


Figure C.15 – Cross-section 14 of study reach.

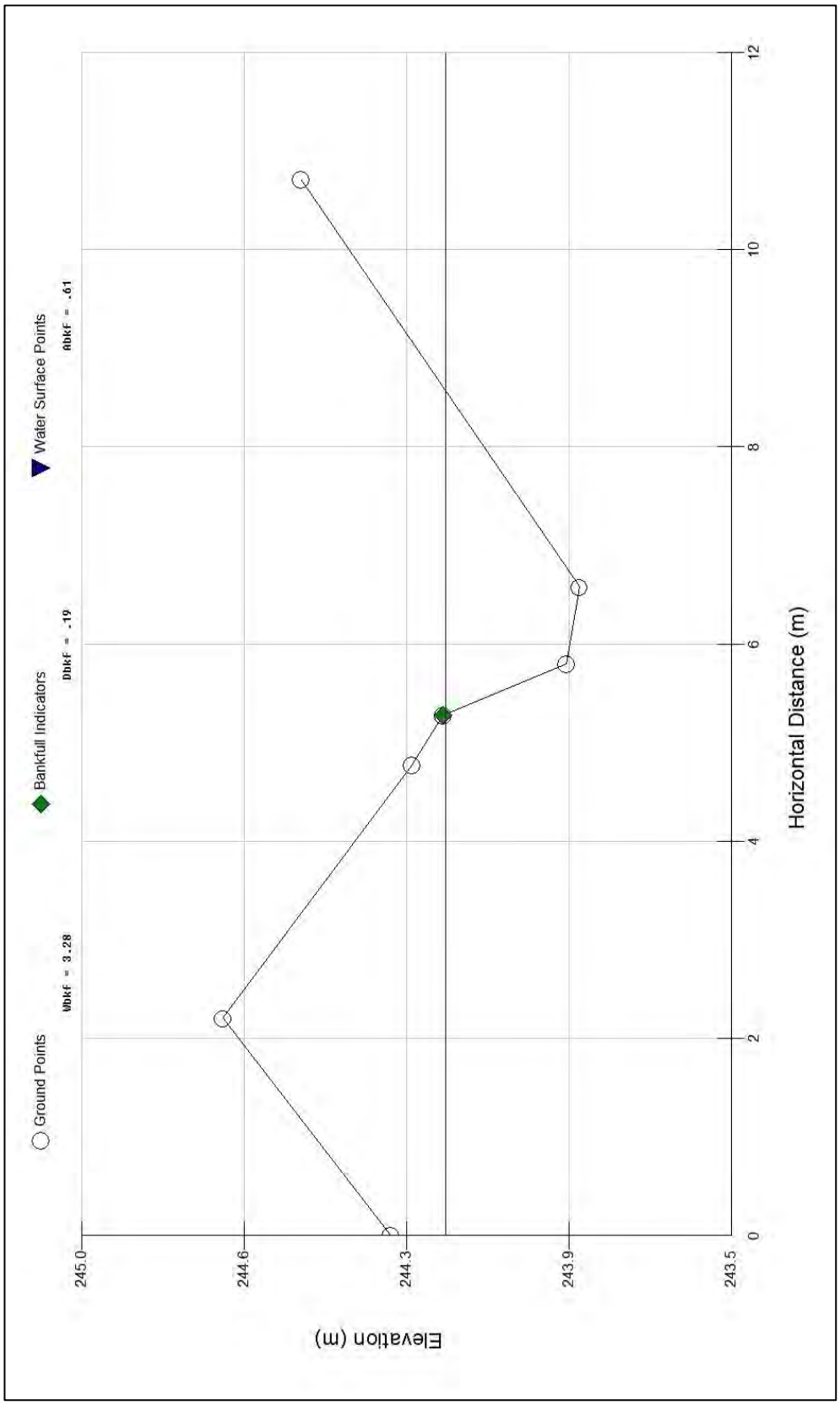


Figure C.16 – Cross-section 15 of study reach.

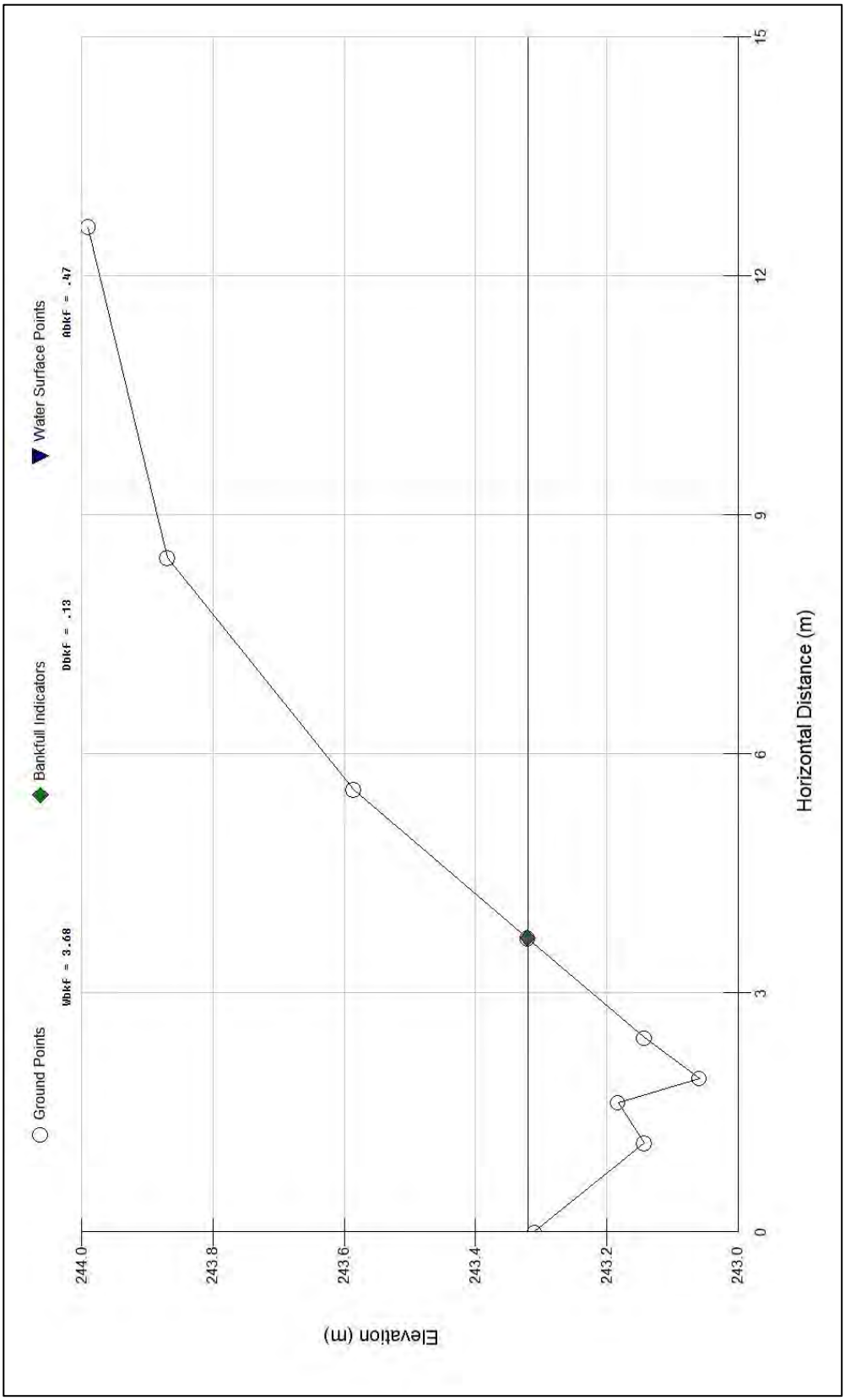


Figure C.17 – Cross-section 16 of study reach.

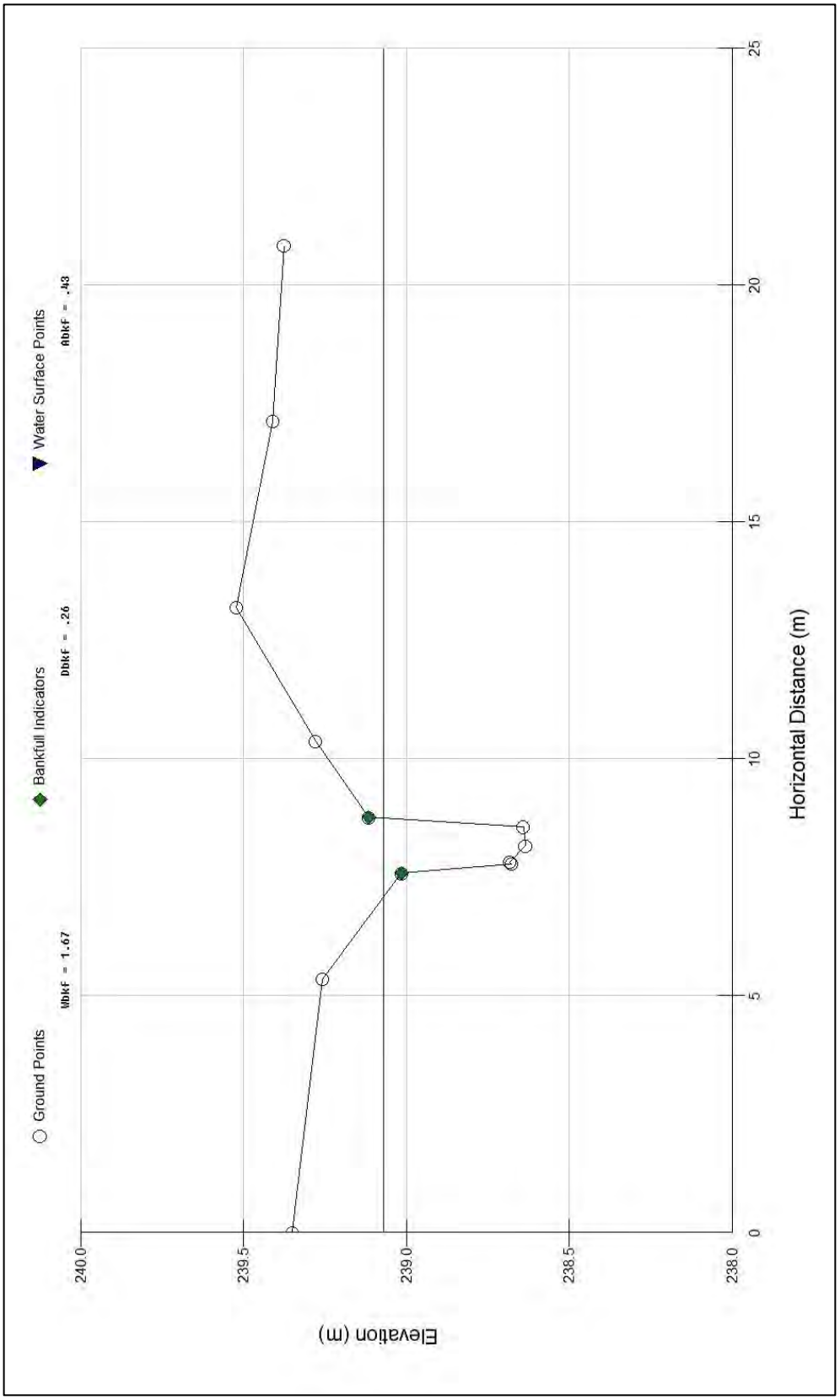


Figure C.18 – Cross-section 17 of study reach.

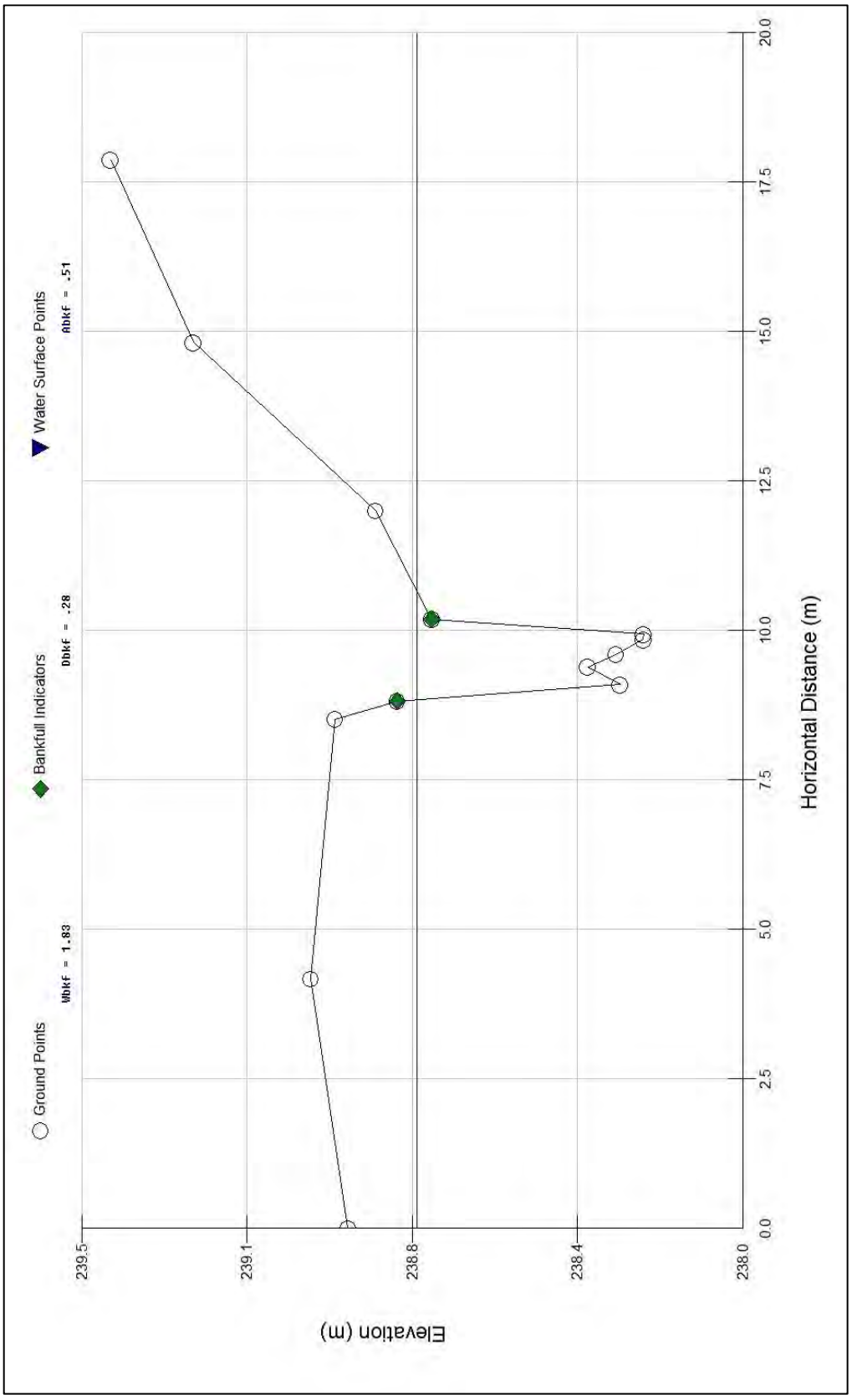


Figure C.19 – Cross-section 18 of study reach.

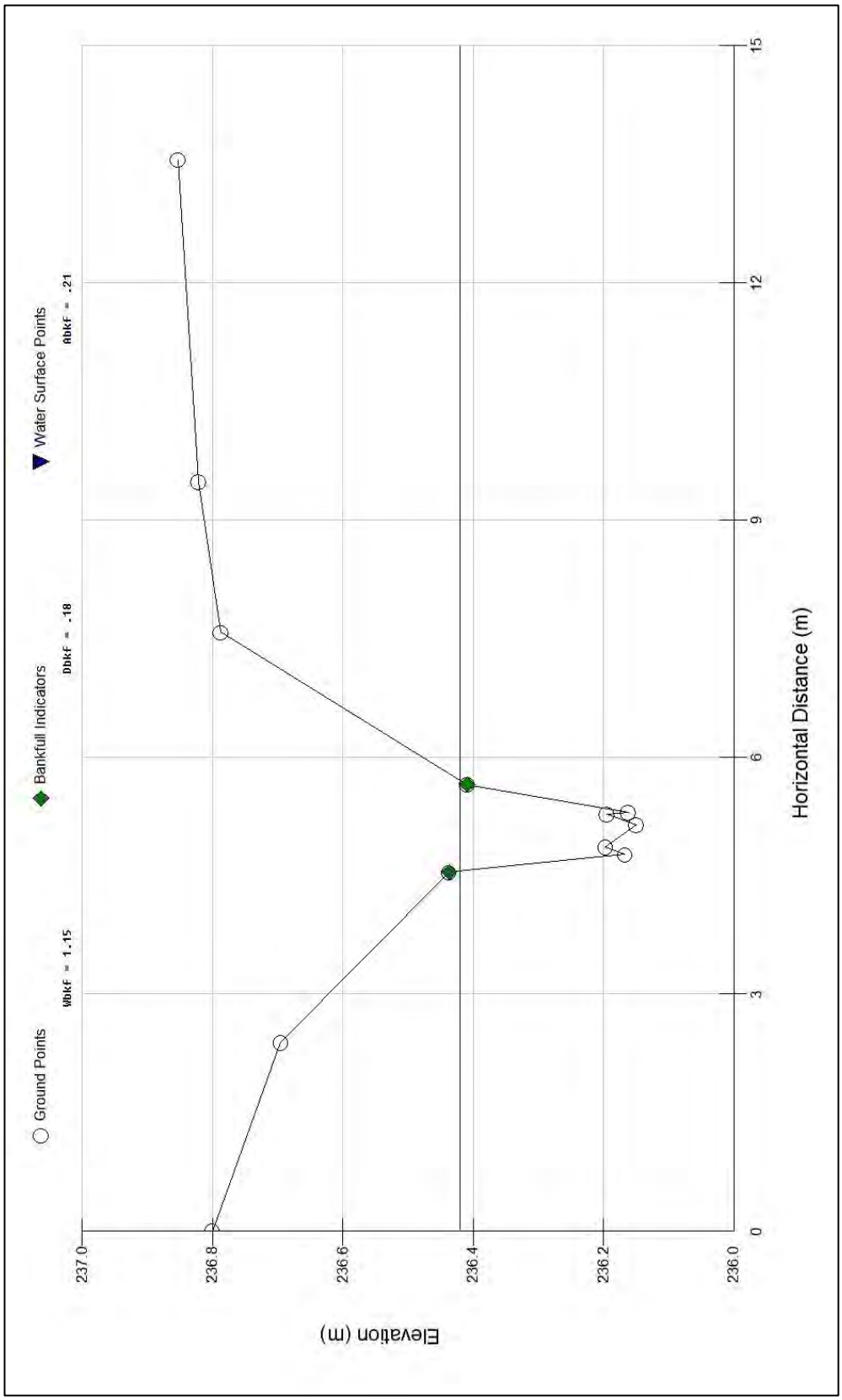


Figure C.20 – Cross-section 19 of study reach.

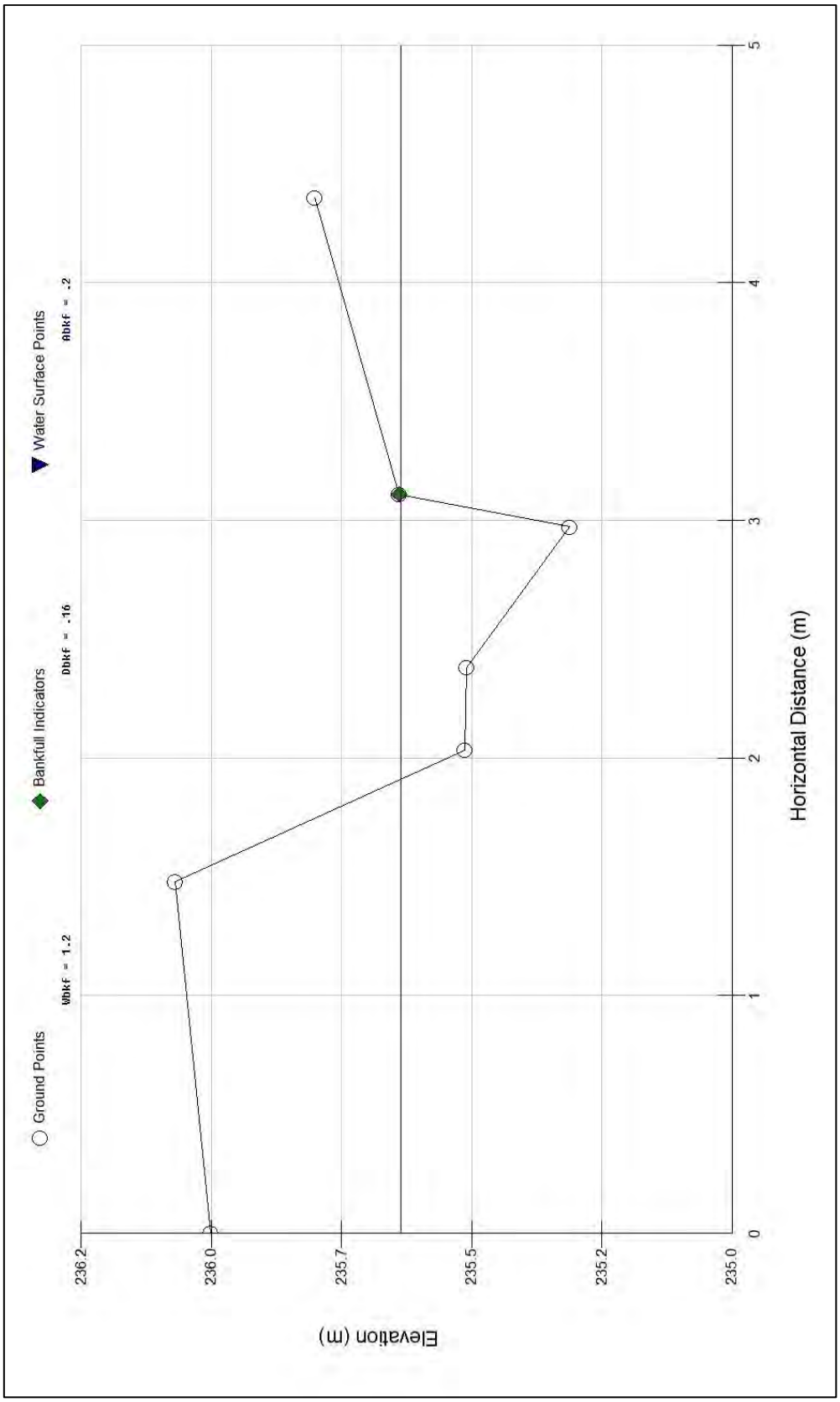


Figure C.21 – Cross-section 20 of study reach.

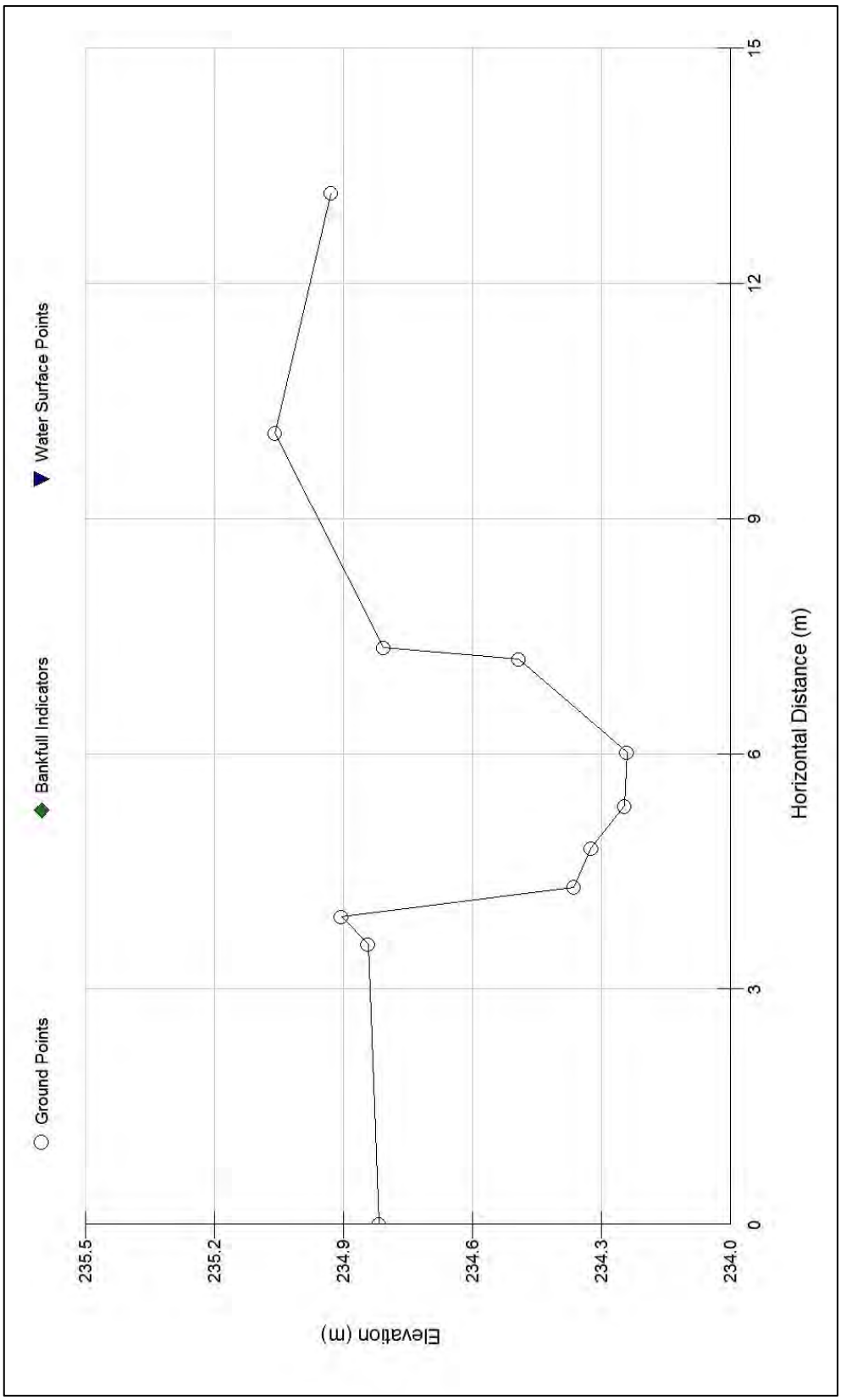
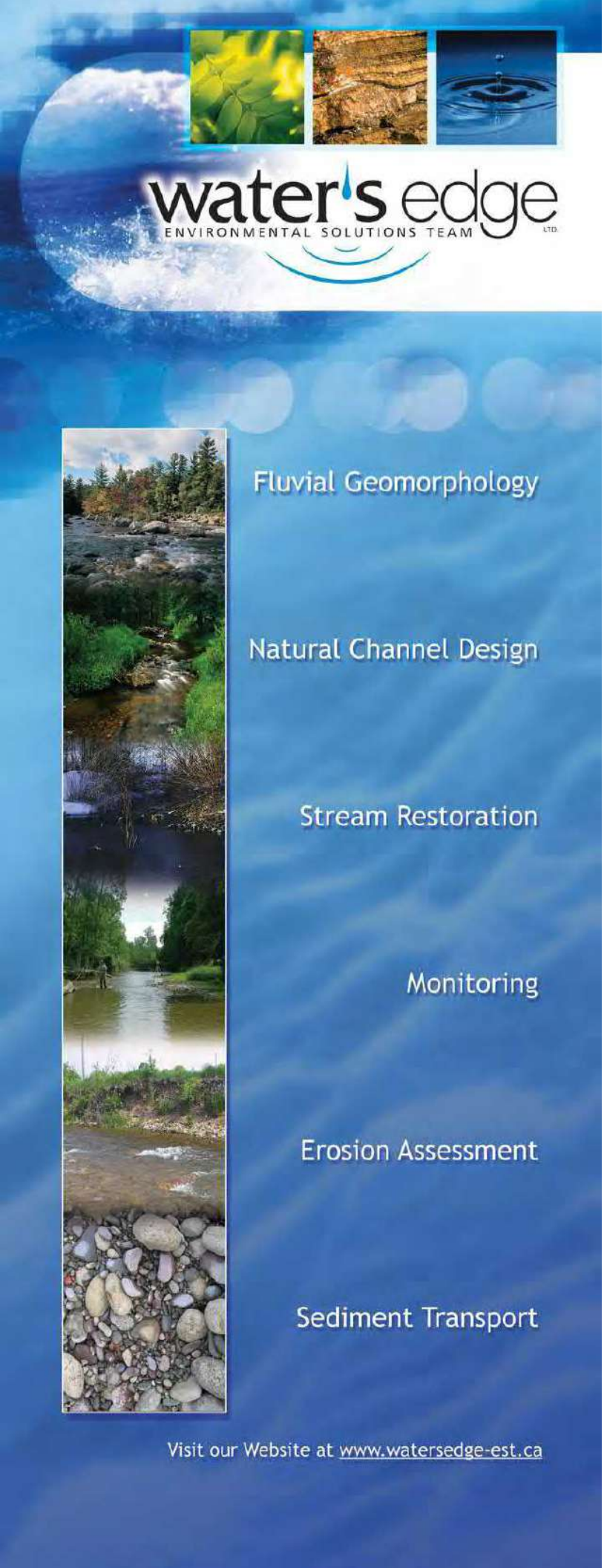


Figure C.22 – Cross-section 21 of study reach.



APPENDIX C:

Field Sheets

Rapid Geomorphic Assessment

Date: 25-May-17
Evaluator: EHG
Stream: Tributary of Millbrook Subdivision Phase 2 - 17007
Conditions: Overcast (7am) transition to sunny with few clouds (11am)

Form / Process (1)	Geomorphic Indicator No (2)	Description (3)	Present No (4)	Present Yes (5)	Factor Value (6)
Evidence of Aggradation	1	Lobate bar	1		
	2	Coarse material in riffles embedded	1		
	3	Siltation in pools		1	
	4	Medial bars		1	
	5	Accretion on point bars	1		
	6	Poor longitudinal sorting of bed materials		1	
	7	Deposition in the overbank zone	1		
		Sum of Indices	4	3	0.43
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	n/a		
	2	Exposed sanitary/storm sewer/pipeline/etc.	n/a		
	3	Elevated storm sewer outfall(s)	n/a		
	4	Undermined gabion baskets/concrete aprons/etc.	n/a		
	5	Scour pools d/s of culverts/storm sewer outlets	n/a		
	6	Cut face on bar forms	n/a		
	7	Head cutting due to knick point migration	n/a		
	8	Terrace cut through older bar material	n/a		
	9	Suspended armour layer visible in bank	n/a		
	10	Channel worn into undisturbed overburden/bedrock	n/a		
		Sum of Indices	0	0	n/a
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc.		1	
	2	Occurrence of large organic debris		1	
	3	Exposed tree roots	1		
	4	Basal scour on inside meander bends	1		
	5	Basal scour on both sides of channel through riffle	1		
	6	Gabion baskets/concrete walls/etc. out flanked	n/a		
	7	Length of basal scour >50% through subject reach	1		
	8	Exposed length of previously buried pipe/cable/etc.	n/a		
	9	Fracture lines along top of bank	1		
	10	Exposed building foundation	n/a		
		Sum of Indices	5	2	0.29
Evidence of Planimetric Form Adjustment (PI)	1	Formation of cut (s)		1	
	2	Single thread channel to multiple channel		1	
	3	Evolution of pool-riffle form to low bed relief form	1		
	4	Cutoff channel(s)	1		
	5	Formation of island(s)		1	
	6	Thalweg alignment out of phase meander form	1		
	7	Bar forms poorly formed/reworked/removed	1		
		Sum of Indices	4	3	0.43
Stability Index (SI) = (AI + DI+ WI+ PI) /m					0.29
		Condition:	Transitional		

-grassy, forbe-like channel that primarily serves as a drainage ditch for surrounding agricultural fields
-upstream channel bed is grassy and straight, downstream channel bed is sandy/silt with some meanders
-compression of culvert underpassing the transition between agricultural fields (not included in DI section of RGA form it is not an urban issue)

RAPID STREAM ASSESSMENT TECHNIQUE (RSAT) Evaluation

Creek Name: **RSAT Section #:**

Assessor: **Date:**

Coordinates:

Evaluation Category	Relative Significance	Criteria	Rating Excellent	Good	Fair	Poor	Score
1 Channel Stability	Indicative of hydrologic/flow regime alteration and general condition of physical aquatic habitat. Provides insight into past, present and possible future changes in channel morphometry	Bank Stability	>80%	71-80 %	50-70 %	< 50 %	10
		Stream Bend Stability Outer bank height/bank overhang	<0.60 m / <0.60m	0.60 to 0.90 m / 0.60 to 0.75 m	0.90 to 1.20 m / 0.75 to 0.90 m	>1.20 m / >0.90 m	10
		Exposed roots and falls	old and large / 0-1	some young / 2-3	young common / 4-5	young abundant / >6	11
		Bottom 1/3 of Bank	resistant plant/soil	resistant plant/soil	highly erodable plant/soil	highly erodable plant/soil	9
		Cross-Section	V or U	V or U	Trapezoidal	Trapezoidal	10
		Typical Score:	**9 to 11**	**6 to 8**	**3 to 5**	**0 to 2**	**10.00**
	NOTES:	Stable with rectangular or u shaped cross sections					
2 Channel Scour and Sediment Deposition	Relates to level of uncontrolled stormwater runoff, sediment load and transport and degradation of instream habitat.	Riffle Embeddedness	<25% sand & silt	25-50%	50-75%	>75%	7
		# of deep pools / substrate	high # / <30% fines	mod # / 30-60% fines	low-mod # / 60-80% fines	few # / >80 % fines	5
		Streak marks/sediment deposits absent	marks / dep absent	uncommon	common	common	7
		large sand deposits/fresh	rare / no fresh dep.	uncommon and small localized dep	common and small localized dep.	common and heavy dep along major portion	7
		Point bar/vege/sand	few / well vege / none	small/well vege/little	mod-large& unstable/high am't of sand common	mod-large& unstable/high am't of sand at most bends	5
		Typical Score:	**7 to 8**	**5 to 6**	**3 to 4**	**0 to 2**	**3.00**
	NOTES:	Upstream is predominately grassed beds and downstream has some sandy/silt beds with cobble/boulders in some places.					
3 Physical In-stream Habitat	Relates to the ability of a stream to meet basic physical requirements necessary for the support of a well-balanced aquatic community (eg: depth of flow, water velocity, water temperature, substrate type and quality, etc).	Wetted Perimeter	> 85% of bottom width	61-85%	40 - 60 %	< 40 %	7
		Diversity of structure, velocity and depth of flow	All forms present, diverse vel. and depth of flow	Good mix of form, rel. diverse velocity and depth	Few pools, riffles and runs dominant, vel & depth gen shallow/slow	dominated by 1 type (usually runs) and 1 vel/depth (usually slow & shallow	1
		Riffle substrate	cobble, gravel, rubble, boulder mix with little sand & >50 % cobble	Good mix of gravel, cobble and rubble & 25-49% cobble	predominantly small cobble, gravel and sand & 5 - 24 % cobble	Predominantly gravel with high % sand & <5% cobble	1
		Riffle depth	>0.20 m	0.15 - 0.19 m	0.10 - 0.14 m	< 0.10 m	1
		Large Pool Depth	> 0.60 m	0.45 - 0.59 m	0.30 - 0.44 m	< 0.30 m	1
		Channel Process	No channel alteration of significant point bar formation or enlargement	Slight increase in point bar formation or slight amount of channel mod.	Mod. increase in point bars and / or channel mod.	extensive channel alteration or point bar formation / enlargement	7
		Riffle-Pool Ratio	0.9 - 1.1 to 1	0.7 - 0.89 to 1 or 1.11 - 1.3 to 1	0.5 - 0.69 to 1 or 1.31 - 1.5 to 1	< 0.49 to 1 or > 1.51 to 1	1
		Stream Temp. on a Summer Afternoon	< 20 ○ C	20 to 24 ○ C	24 to 26 ○ C	>27 ○ C	5
		Typical Score:	**7 to 8**	**5 to 6**	**3 to 4**	**0 to 2**	**2.43**
	NOTES:	See above comments.					
4 Water Quality	Indicative of watershed perturbations / general level of human activity, point and non-point source loads, and aquatic habitat conditions.	Substrate Fouling (on rock underside)	None: 0 -10%	Light: 11-20%	Mod: 21 - 50 %	High >50%	7
		Total Dissolved Solids (TDS)	<50mg/L	50-100 mg/L	101-150 mg/L	>150 mg/L	8
		Clearness of Water	>0.90 m visibility	0.45 - 0.89 m	0.15 - 0.44 m	<0.15 m visible	7
		Odour	None	Slight organic odour	Slight - Moderate odour	Moderate to strong odour	8
		Typical Score:	**7 to 8**	**5 to 6**	**3 to 4**	**0 to 2**	**7.50**
	NOTES:	Downstream sections (specifically downstream of confluence) has much more coverage.					
5 Riparian Habitat Conditions	Provides insight into change(s) in stream energetics, temperature regime, and both aquatic and terrestrial habitat conditions	Width of Riparian Buffer	Wide > 200' with mature forests on both sides	Forested buffer >100' along major portion	Predom. Wooded but major localized gaps	Mostly non-wooded vegetation, narrow width.	2
		Canopy coverage (Shading)	>80% shading	60-79% shading	50-60 % shading	<50 % shading	1
		Typical Score:	**6 to 7**	**4 to 5**	**2 to 3**	**0 to 1**	**1.50**
	NOTES:	Flows through three agricultural fields					
6 Biological Indicators	Best overall indication of stream health and level of watershed perturbation	Diversity of macro-invert community	Diverse community present (mayflies, stoneflies, and cased caddisflies (few snails or leeches)	Mayflies and caddisflies (stoneflies absent)	Pollution-tolerant species; aquatic worms dominant	Poor diversity dominated by midgeflies, aquatic worms and snails.	2
		Number of Individuals	Mod to High #	Mod to High #	Low - Mod #	Low #	1
		Typical Score:	**7 to 8**	**5 to 6**	**3 to 4**	**0 to 2**	**1.50**
	NOTES:	Some small fish noted downstream.					

TOTAL SCORE:	**25.93**
CONDITION:	**Fair**

Attachment C:

Site Photos

Photo 1 October 14, 2016 Looking downstream toward County Road 10 from the far upstream end of Tributary B. Channel difficult to detect. Dry and overgrown with grasses.	
Photo 2 October 14, 2016 Channel bed more evident walking downstream. No bare soil, only dense grass.	
Photo 3 October 14, 2016 Downstream of driveway. Caved in culvert, almost completely closed in. Dry channel.	

Photo 4 October 14, 2016 Downstream of driveway culvert. Grassed channel. Dry.	
Photo 5 June 20, 2017 Downstream of driveway channel at WC-3. No flow observed, some pooled water. Stream bed overgrown with grasses. Water pooled in agricultural fields to either side of the tributary from recent rain events.	
Photo 6 June 20, 2017 Downstream of driveway channel at WC-3, no flow observed in channel.	

Photo 7 October 14, 2016 Entering hedgerow. Channel contained some bare substrate, but was dry and covered with leaf litter.	
Photo 8 October 14, 2016 Within hedgerow.	
Photo 9 October 14, 2016 View of hedgerow looking west.	

Photo 10 October 14, 2016 Hedgerow. Contained rocks/boulders along banks (from farm fields). Channel was overgrown.	
Photo 11 October 14, 2016 Grassed section of channel. Dry. Looking downstream.	
Photo 12 June 20, 2017 Grassed section of channel looking upstream at WC-4.	

Photo 13 June 20, 2017 Flow observed in channel downstream of driveway at WC-4.	
Photo 14 October 14, 2016 Substrate further downstream near laneway crossing. More cobble than bare substrate near the culvert entrance.	
Photo 15 October 14, 2016 Partially plugged culvert looking upstream at laneway crossing.	

Photo 16 October 14, 2016 Substrate downstream of laneway culvert. Bare in some spots, contained weeds and some rocks.	
Photo 17 October 14, 2016 Channel downstream of laneway. Contained bare soil, eroded banks and apples from trees within hedgerow.	
Photo 18 October 14, 2016 Confluence of Tributary B and C looking upstream into Tributary B. There is a steep drop of approximately 0.5-1 m from the bed of Tributary B to the bed of Tributary C, through this small grassed channel.	

Photo 19 June 20, 2017 Confluence of Tributary B and C, looking into Tributary C.	
Photo 20 October 14, 2016 Tributary C looking downstream toward County Road 10 at confluence with Tributary B. Dry with grasses in bed.	
Photo 21 June 20, 2017 Tributary C looking downstream toward County Road 10 near the confluence with Tributary B, at WC-5. Substantial flow.	

Photo 22

October 14, 2016

Looking upstream at Tributary C from bridge at County Road 10. Evidence of groundwater inputs downstream of the confluence of Tributary C and B, which was dry.

Attachment D:

Landscaping and Planting Plan

GENERAL NOTES

THE LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR ANY COSTS ASSOCIATED WITH THE FAILURE OF THE LANDSCAPE CONTRACTOR TO OBTAIN THE APPROVAL OF THE LANDSCAPE ARCHITECT PRIOR TO MAKING ANY CHANGES TO THE SPECIFIED MATERIALS AND/OR ANY OTHER SPECIFIED INSTRUCTIONS.

CONTRACTOR TO CONTACT ALL UTILITY COMPANIES TO CHECK LOCATIONS AND OBTAIN STAKEOUTS OF ALL UTILITY LINES BEFORE EXCAVATION. OBTAIN ALL NECESSARY PERMITS BEFORE COMMENCEMENT OF CONSTRUCTION. REPORT IN WRITING ANY DISCREPANCIES IN THE DRAWINGS, SPECIFICATIONS AND CONTRACT DOCUMENTS TO THE LANDSCAPE ARCHITECT BEFORE THE END OF THE BIDDING PROCESS AND COMMENCEMENT OF CONSTRUCTION. THESE SPECIFICATIONS MAY BE SUPERSEDED BY ADDITIONAL SPECIFICATIONS SET OUT IN THE TENDER DOCUMENTS. CONTRACTOR TO REVIEW ALL DOCUMENTS.

GRADING

ROUGH GRADING

ROUGH GRADE AND FILL AREAS TO ESTABLISH SUBGRADE AS REQUIRED. PROVIDE DRAINAGE PATTERN AS INDICATED ON DRAWINGS. ROUND SMOOTHLY ALL TOPS AND TOES OF SLOPES. COMPACT ALL AREAS TO 95% STANDARD PROCTOR DENSITY UNLESS SPECIFIED OTHERWISE, EXISTING TREES TO REMAIN ON SITE ARE TO BE PROTECTED AS PER MUNICIPAL STANDARDS.

FINE GRADING

FINE GRADE ALL AREAS TO FINISHED GRADES AS SHOWN ON LAYOUT OR GRADING PLAN OR ARCHITECT'S SITE PLAN. PROVIDE UNIFORM SLOPES AWAY FROM THE BUILDING, UNLESS SPECIFIED OTHERWISE. SLOPES MAY NOT EXCEED 33 1/3% (3:1) UNLESS OTHERWISE SPECIFIED

SOIL

REPORTS

LANDSCAPE CONTRACTOR TO PROVIDE A **SOIL REPORT OF ANY NEW MATERIAL BROUGHT TO THE SITE**. THE REPORT MUST CONFIRM TEXTURE AND FERTILITY. THE REPORT MUST ALSO CONFIRM THE SOIL IS FREE FROM HEAVY METALS, TOXIC ELEMENTS, AND GROWTH INHIBITING COMPONENTS.

STOCK PILED ON SITE TOPSOIL MUST BE TESTED BY AGRI-FOODS LABORATORIES 503 IMPERIAL RD N, GUELPH, ON N1H 6T8 (519) 837-1600

- A TOPSOIL BASIC TEST IS REQUIRED, BEFORE CONDUCTING TEST THE LANDSCAPE CONTRACTOR IS TO INQUIRE IF AN ATRAZINE AND/OR HEAVY METAL TEST IS REQUIRED,
- ALLOW AT LEAST 2 WEEKS FOR THE TEST(S) TO BE CONDUCTED PRIOR TO INSTALLATION ON SITE,
- SUBMIT TOPSOIL REPORT TO TERRAPLAN FOR REVIEW AND RECOMMENDATIONS FOR AMENDMENT,
- ALL TOPSOIL MUST MEET SPECIFICATIONS,

STOCK PILED ON SITE PLANTING SOIL MUST BE TESTED BY AGRI-FOODS LABORATORIES 503 IMPERIAL RD N, GUELPH, ON N1H 6T8 (519) 837-1600

- A SOIL BASIC TEST IS REQUIRED, BEFORE CONDUCTING TEST THE LANDSCAPE CONTRACTOR IS TO INQUIRE IF AN ATRAZINE AND/OR HEAVY METAL TEST IS REQUIRED,
- ALLOW AT LEAST 2 WEEKS FOR THE TEST(S) TO BE CONDUCTED PRIOR TO INSTALLATION ON SITE,
- SUBMIT TOPSOIL REPORT TO TERRAPLAN FOR REVIEW AND RECOMMENDATIONS FOR AMENDMENT,

TOPSOIL FOR SODDED AREAS:

MIXTURE OF MINERAL PARTICULATES, MICRO ORGANISMS AND ORGANIC MATTER WHICH PROVIDES SUITABLE MEDIUM FOR SUPPORTING INTENDED PLANT GROWTH.
GRO-BARK: GRO-TURF - ORGANIC TOP DRESS (905) 846-5151 OR APPROVED EQUAL
SCARIFY THE SUBSOIL PRIOR TO THE SPREADING THE TOPSOIL. REMOVE ALL DEBRIS AND LEAVE A FINE-TEXTURED EVEN SURFACE. ALL TOPSOIL TO BE IMPORTED UNLESS PREVIOUSLY APPROVED BY LANDSCAPE ARCHITECT. OBTAIN APPROVAL FOR THE QUALITY OF ANY IMPORTED TOPSOIL BEFORE DELIVERY TO THE SITE.

PLANTING SOIL

PLANTING SOIL FOR BACKFILLING TREE PLANTING PITS SHALL CONSIST OF A MIXTURE OF 5 PARTS TOPSOIL AND 1 PART PEAT MOSS OR SCREENED LEAF COMPOST BLENDED IN A UNIFORM MIXTURE. BACKFILL SOIL SHALL NOT BE MIXED IN A FROZEN OR MUDDY (SATURATED) CONDITION. BACKFILL SOIL SHALL BE FERTILE, FRIABLE SANDY LOAM CAPABLE OF SUSTAINING VIGOROUS PLANT GROWTH WITH AN ACIDITY RANGE FROM 6.5 TO 7.5 pH AND FREE FROM ANY PLANT GROWTH INHIBITING COMPOUNDS. BACKFILL SOIL SHALL BE FREE FROM CLAY LUMPS AND OTHER EXTRANEOUS MATTER. STONES SHALL BE LESS THAN 25mm IN DIAMETER SHALL COMPROMISE NO MORE THAN 5% OF BACKFILL SOIL BY VOLUME.
DURING THE BACKFILLING PROCESS, BONE MEAL SHALL BE INCORPORATED INTO THE BACKFILL SOIL MIXTURE IN A UNIFORM DISTRIBUTION AT A QUANTITY OF 0.5 Kg PER CUBIC METRE OF BACKFILL SOIL.
PROVIDE RECENT SOIL REPORT PRIOR TO ORDER, FERTILIZER TO BE MIXED INTO SOIL OFF SITE AS REQUIRED.

FERTILIZER: AS REQUIRED BASED ON PROVIDED SOIL REPORT PRIOR TO ORDERING MINERAL FERTILIZER ADDED AS REQUIRED AT THE DIRECTION OF THE LANDSCAPE ARCHITECT
MAJOR SOIL NUTRIENTS PRESENT IN FOLLOWING RATIOS:

- NITROGEN (N): 20 TO 40 MICROGRAMS OF AVAILABLE N PER GRAM OF SOIL,
- PHOSPHORUS (P): 10 TO 20 MICROGRAMS OF PHOSPHATE PER GRAM OF SOIL,
- POTASSIUM (K): 80 TO 120 MICROGRAMS OF POTASH PER GRAM OF SOIL,
- CALCIUM, MAGNESIUM, SULPHUR AND MICROAUTRIENTS PRESENT IN BALANCED RATIOS TO SUPPORT GERMINATION AND/OR ESTABLISHMENT OF INTENDED VEGETATION.

NOTE: IF THE EXISTING SOIL CONDITIONS ARE CLAY OR WET IN NATURE, CONTACT THE LANDSCAPE ARCHITECT FOR INSTRUCTIONS OF A SUITABLE SOIL MIXTURE OR DRAINAGE DETAIL. FAILURE TO DO THIS MAY RESULT IN DELAY OF APPROVAL AND ACCEPTANCE.

THE LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR ANY COSTS ASSOCIATED WITH THE FAILURE OF THE LANDSCAPE CONTRACTOR TO OBTAIN THE APPROVAL OF THE LANDSCAPE ARCHITECT PRIOR TO MAKING ANY CHANGES TO THE SPECIFIED MATERIALS AND/OR ANY OTHER SPECIFIED INSTRUCTIONS.

PREPARATION OF PLANTING BEDS ALL PLANT BEDS TO BE CONTINUOUS.

- EXCAVATE ALL PLANTING BEDS TO THE DEPTH AS INDICATED ON THE DRAWINGS AND DETAILS, MIN 600mm (2.0').
- BACKFILL ALL PANTING BEDS AS PER SPECIFICATION UNDER PLANTING SOIL SECTION.
- ALL PLANTING BED EDGES TO BE MAINTAINED BY SOD EDGE TRIMMER.
- ALL PLANTING BEDS TO HAVE A 25mm (1") CUT AT EDGE TO BE MAINTAIN A CLEAN SEPARATION BETWEEN SOD AND BED,
- PREPARE THE PLANTING BEDS FOR PLANTING BEFORE THE DELIVERY OF THE PLANT MATERIAL TO THE JOB SITE.

SOD

- USE #1 BLUEGRASS - FESCUE SOD SOD WHICH CONFORMS WITH THE SPECIFICATIONS OF THE NURSERY SOD GROWERS ASSOCIATION OF ONTARIO,
- ALL SODDED AREAS SHALL RECEIVE A MINIMUM OF 100mm (4") OF TOPSOIL
- SOD SLOPES ARE NOT TO EXCEED 3:1, IF APPROVED BY LANDSCAPE ARCHITECT A SLOPE IN EXCESS OF 4:1 TO BE PEGGED USING WOOD PEGS ,
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR CUTTING ALL SODDED AND SEEDED AREAS AT LEAST TWO (2) TIMES BEFORE FINAL INSPECTION FOR ACCEPTANCE OF THE LANDSCAPE WORK.

PLANT MATERIALS ALL PLANT MATERIAL SHALL CONFORM TO THE STANDARDS OF THE CANADIAN NURSERY TRADES ASSOCIATION FOR SIZE AND SPECIES.

- ALL SHRUB AND TREE MATERIAL SHALL BE CONTAINER GROWN, POTTED, OR BALL AND BURLAP, UNLESS OTHERWISE NOTED.
- BARE ROOT PLANTING SHALL BE ACCEPTABLE FOR CERTAIN SPECIES DURING EARLY SPRING UPON APPROVAL OF THE LANDSCAPE ARCHITECT ONLY.
- CONTRACTOR SHALL MAKE REQUESTS FOR ROOT CONDITION SUBSTITUTION IN WRITING TO THE LANDSCAPE ARCHITECT PRIOR TO COMMENCEMENT OF PLANTING OPERATIONS.
- ALL PLANT MATERIAL TO BE CLAY GROWN STOCK UNLESS OTHERWISE NOTED.

PLANT MATERIAL SIZES AND CONDITIONS

- THE INDIVIDUAL **PLANT GROUPING TOTAL AS ILLUSTRATED ON THE PLANTING PLAN SUPERSEDES THE ESTIMATED QUANTITY ON THE MASTER PLANT LIST.** CONTRACTOR MUST REPORT ANY DISCREPANCIES TO THE LANDSCAPE ARCHITECT IN WRITING BEFORE COMMENCING ANY WORK.
- CONTRACTOR WILL ASSUME FULL RESPONSIBILITY IF LANDSCAPE ARCHITECT IS NOT NOTIFIED OF DISCREPANCIES,
- ALL TREES, SHRUBS AND GROUND COVERS SHALL BE PLANTED AS DETAILED, AND AS SHOWN ON THE LANDSCAPE DRAWING
- PLANT MATERIAL SIZES, SPACING, AND CONDITIONS ARE TO BE AS INDICATED ON THE LANDSCAPE DRAWING,
- USE ONLY PLANT MATERIAL TRUE TO NAME, SIZE, AND GRADE AS SPECIFIED ON PLANTING PLAN. PROVIDE SUFFICIENT LABELS OR MARKINGS TO INDICATE CLEARLY THE VARIETY, SIZE AND GRADE OF EACH SPECIMEN, OR BUNDLE.
- OBTAIN APPROVAL FOR SUBSTITUTIONS AS TO VARIETY, SIZE OR GRADE FROM THE LANDSCAPE ARCHITECT.
- USE ONLY NURSERY STOCK GROWN UNDER PROPER HORTICULTURAL PRACTICES, VIABLE, FREE FROM PEST AND DISEASE AND UNDAMAGED,
- LANDSCAPE CONTRACTOR TO INSTALL NEW SOD AND NEW TOPSOIL AS PER SPECIFICATIONS AND GENERAL NOTES THROUGHOUT THE SITE AS DESIGNED.
- NEW TOPSOIL AND SOD SHALL EXTEND THROUGH THE MUNICIPAL BOULEVARD TO THE REAR OF THE MUNICIPAL CURB.

SODDED AREAS AND PLANTING BED EDGING

CONTRACTOR TO INSTALL NEW SOD AND NEW TOPSOIL AS PER SPECIFICATIONS AND GENERAL NOTES THROUGHOUT THE SITE AS DESIGNED. NEW TOPSOIL AND SOD SHALL EXTEND THROUGH THE MUNICIPAL BOULEVARD TO THE REAR OF THE MUNICIPAL CURB.

ALL PLANTING BEDS THAT ARE SURROUNDED BY SOD SHOULD BE CUT AND EDGED AT A 45° ANGLE, SO THERE IS A CLEAR AND WELL DEFINED SEPARATION BETWEEN THE PLANTING BEDS AND SODDED AREAS.

PLANT MATERIAL INSTALLATION

ALL TREES, SHRUBS AND GROUND COVERS SHALL BE PLANTED AS DETAILED AND AS SHOWN ON THE PLANTING PLAN. ALL BEDS TO RECEIVE A COVER OF CLEAN MULCH TO A DEPTH OF 75mm(3"), FOR GUYING AND STAKING TREES, REFER TO PLANTING DETAILS. WRAP ALL DECIDUOUS TREES UNDER EXPERIENCED SUPERVISION ONLY TO THE SPECIFICATIONS OF THE LANDSCAPE ONTARIO HORTICULTURAL TRADES ASSOCIATION (LOHTA).

PLANT MATERIAL SIZES AND CONDITIONS ARE TO BE AS INDICATED ON THE LANDSCAPE DRAWING.

THE INDIVIDUAL PLANT GROUPING TOTAL AS ILLUSTRATED ON THE PLANTING PLAN SUPERSEDES THE ESTIMATED QUANTITY ON THE MASTER PLANT LIST. CONTRACTOR MUST REPORT ANY DISCREPANCIES TO THE LANDSCAPE ARCHITECT IN WRITING BEFORE COMMENCING ANY WORK. CONTRACTOR WILL ASSUME FULL RESPONSIBILITY IF LANDSCAPE ARCHITECT IS NOT NOTIFIED OF DISCREPANCIES.

* MULCH - SHREDDED PINE MULCH BY "GRO BARK" OR APPROVED EQUAL. LANDSCAPE ARCHITECT TO APPROVE MULCH BEFORE INSTALLATION. GENERAL MAINTENANCE

PROPER MAINTENANCE PROCEDURES ARE TO BE FULLY ADMINISTERED FOR ALL NEWLY CONSTRUCTED LANDSCAPE WORK, IN ACCORDANCE WITH LANDSCAPE ONTARIO SPECIFICATIONS (SECTION 1E - MAINTENANCE WORK). THIS SHALL APPLY ONLY DURING THE CONSTRUCTION PERIOD, UNLESS OTHERWISE SPECIFIED. CONTRACTOR IS RESPONSIBLE FOR MAINTENANCE OF SOD AND PLANTING UNTIL FINAL ACCEPTANCE BY LANDSCAPE ARCHITECT.

RODENT PROTECTION - THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL TREES AND SHRUBS FOR WINTER PROTECTION AND FROM RODENT INJURY FOR THE DURATION OF THE GUARANTY PERIOD. PROTECTIVE GUARDS SHALL BE EMPLOYED AROUND ALL DECIDUOUS TREES. GUARDS TO BE 150MM DIA. PVC PIPE OR AS MUNICIPAL GUIDELINES. GUARDS SHALL BE INSTALLED PRIOR TO THE APPLICATION OF THE MULCH AND SHOULD BE PLACED A MINIMUM OF 50MM (2") OUT FROM THE TREE TRUNK ON ALL SIDES.

ALL SHRUBS AND CONIFEROUS TREES SHALL HAVE AN APPLICATION OF "SKOOT" OR APPROVED EQUIVALENT RODENT FORMULA, TO BE APPLIED AT THE END OF OCTOBER. FOLLOW MANUFACTURER'S DIRECTIONS FOR APPLICATION.

GENERAL REQUIREMENTS

USE ABOVE SPECIFICATIONS IN CONJUNCTION WITH THE GENERAL LANDSCAPE SPECIFICATIONS OF THE LANDSCAPE ONTARIO HORTICULTURAL TRADES ASSOCIATION (LOHTA) AND THE NURSERY SOD GROWERS ASSOCIATION OF ONTARIO. USE ONLY PLANT MATERIAL TRUE TO NAME, SIZE AND GRADE AS SPECIFIED ON PLANTING PLAN; PROVIDE SUFFICIENT LABELS OR MARKINGS TO INDICATE CLEARLY THE VARIETY, SIZE AND GRADE OF EACH SPECIMEN OR BUNDLE.

OBTAIN APPROVAL FOR SUBSTITUTIONS AS TO VARIETY, SIZE OR GRADE FROM THE LANDSCAPE ARCHITECT. USE ONLY NURSERY STOCK GROWN UNDER PROPER HORTICULTURAL PRACTICES, VIABLE, FREE FROM PEST AND DISEASE AND UNDAMAGED. CHECK LOCATIONS AND OBTAIN STAKEOUTS OF ALL UTILITY LINES BEFORE EXCAVATION. OBTAIN ALL NECESSARY PERMITS BEFORE COMMENCEMENT OF CONSTRUCTION. REPORT IN WRITING ANY DISCREPANCIES IN THE DRAWINGS, SPECIFICATIONS AND CONTRACT DOCUMENTS TO THE LANDSCAPE ARCHITECT BEFORE THE END OF THE BIDDING PROCESS AND COMMENCEMENT OF CONSTRUCTION. THESE SPECIFICATIONS MAY BE SUPERSEDED BY ADDITIONAL SPECIFICATIONS SET OUT IN THE TENDER DOCUMENTS. CONTRACTOR TO REVIEW ALL DOCUMENTS.

GUARANTEE PERIOD

PROVIDE ONE FULL YEAR GUARANTEE ON ALL LANDSCAPE WORK FROM DATE OF FINAL ACCEPTANCE BY LANDSCAPE ARCHITECT. GUARANTEE PERIOD MAY BE EXTENDED TO TWO FULL YEARS DEPENDING ON MUNICIPAL STANDARDS. CONTRACTOR TO VERIFY WITH OWNER AND LANDSCAPE ARCHITECT.

1 LANDSCAPE SPECIFICATIONS NEW

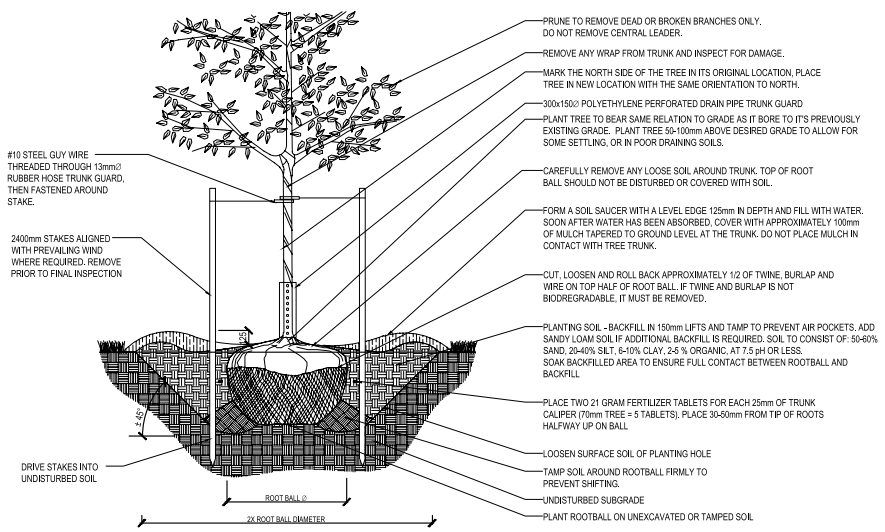
1:20

P-2016-16,153-09

2 PLANT MATERIAL INSTALLATION-STORM WATER MANAGEMENT POND

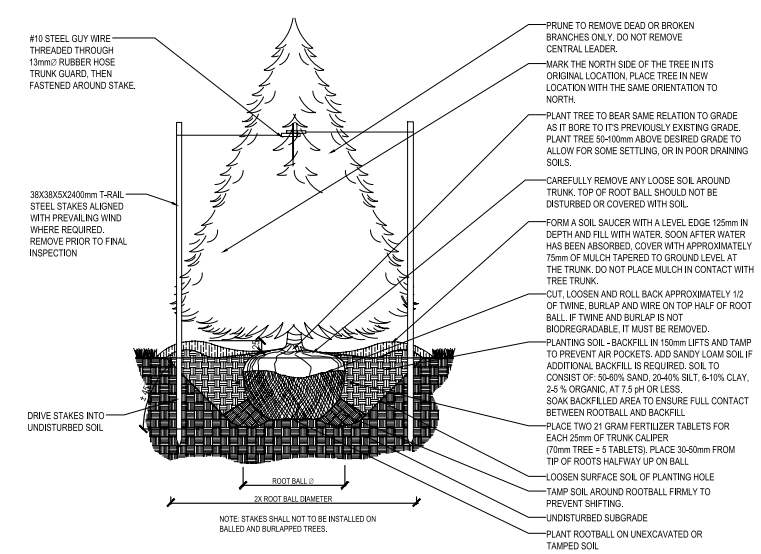
1:20

P-2016-16,153-11



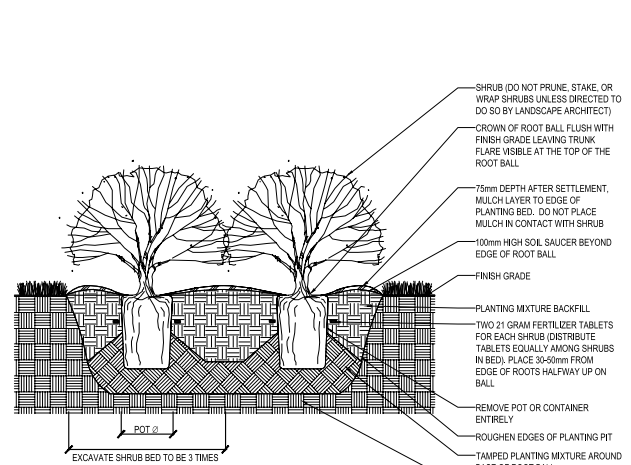
3 STAKED B&B DECIDUOUS TREE INSTALLATION DETAIL

SCALE=NO SCALE



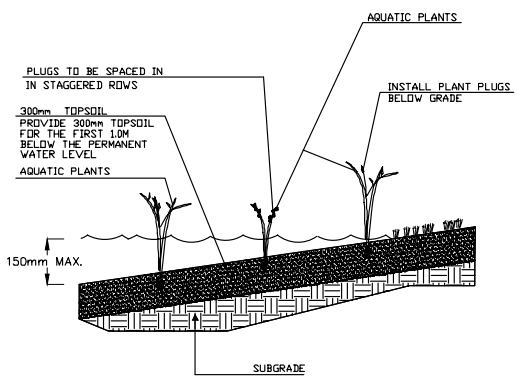
4 STAKED B&B CONIFEROUS TREE PLANTING DETAIL

SCALE=NO SCALE



5 POTTED SHRUB BED PLANTING DETAIL

NO SCALE



1. PLANT PLUGS SHOULD NOT BE PLANTED MORE THAN 150mm BELOW THE PERMANENT POOL ELEVATION.
2. THE ALIGNMENT SHOWN ON DRAWING LP-103 SHOULD BE USED AS A GUIDELINE ONLY. THE LANDSCAPE ARCHITECT WILL CONFIRM THE LOCATION AND ALIGNMENT ON SITE.

6 AQUATIC PLANTING DETAIL

NO SCALE

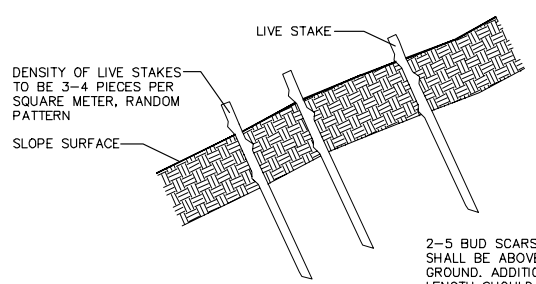
NOTE: THE CONTRACTOR IS TO SUPPLY TOPSOIL FILL MATERIAL TO THE DEPTHS INDICATED ON THE CHART BELOW.

TOPSOIL DEPTH CHART

LANDSCAPE AREAS	DEPTH IN mm
LAWN AREAS (SOD)	150
LAWN AREAS (SEED)	150
PLANTING BEDS - GRASSES, PERENNIALS AND GROUNDCOVER	300
PLANTING BEDS - MEDIUM AND SMALL SHRUBS	450
RAISED PLANTERS	600
SHADE AND ORNAMENTAL TREES	PER TREE INSTALLATION DETAIL

7 SOIL DEPTH CHART

SCALE=NO SCALE



NOTES:
1. LIVE STAKES MUST BE CUT FROM DORMANT MATERIALS.
2. LIVE STAKES SHALL BE PLANTED THE SAME DAY AS HARVESTED, OR STORED FOR A PERIOD OF NO LONGER THAN (2) DAYS.
3. THE CONTRACTOR SHALL PROTECT PLANT MATERIAL FROM DRYING AND OVERHEATING AT THE TIME OF HARVEST, DURING TRANSPORT AND DURING THE CONSTRUCTION PROCESS. SOAK CUTTINGS FOR A MINIMUM OF 24 HOURS PRIOR TO INSTALLATION.
4. LIVE STAKES TO BE 25-50mm DIAMETER AND CUT TO A LENGTH OF 750-1000mm.
5. MAKE AN ANGLE CUT AT THE BASIL END, OR BOTTOM OF THE STAKE. TRIM ALL SIDE BRANCHES, TAKING CARE NOT TO DAMAGE THE BARK.
6. DO NOT PLANT UPSIDE DOWN.
7. LIVE STAKES SHOULD BE INSTALLED USING A DEADBLOW HAMMER(LARGE RUBBER MALLET WITH THE HEAD FILLED WITH LEAD PELLETS).
8. 80% OF STAKE TO BE BELOW SURFACE.
9. GENTLY TAMP THE LIVE STAKE INTO THE GROUND AT RIGHT ANGLES TO THE SLOPE.
10. IF THE SOIL IS COMPACT A PILOT HOLE MADE WITH A STEEL BAR SHOULD BE USED.
11. IF USING A PILOT HOLE REPACK THE SOIL AROUND THE STAKE.
12. DENSITY OF STAKES TO BE 3-4 PIECES PER SQUARE METER, RANDOM PATTERN.
13. NATIVE SPECIES TO INCLUDE:
SALIX BEBBIANA-BEAKED WILLOW
SALIX DISCOLOR-PUSSY WILLOW
SALIX EXIGUA-SANDBAR WILLOW

8 LIVE STAKE DETAIL

1:20

P-2017-17,181-01

NOT FOR CONSTRUCTION

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

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signed date

terraplan LANDSCAPE ARCHITECTS
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20 Champlain Blvd, Suite 102 - Toronto ON - M3H 2Z1 info@terraplan.ca www.terraplan.ca

CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

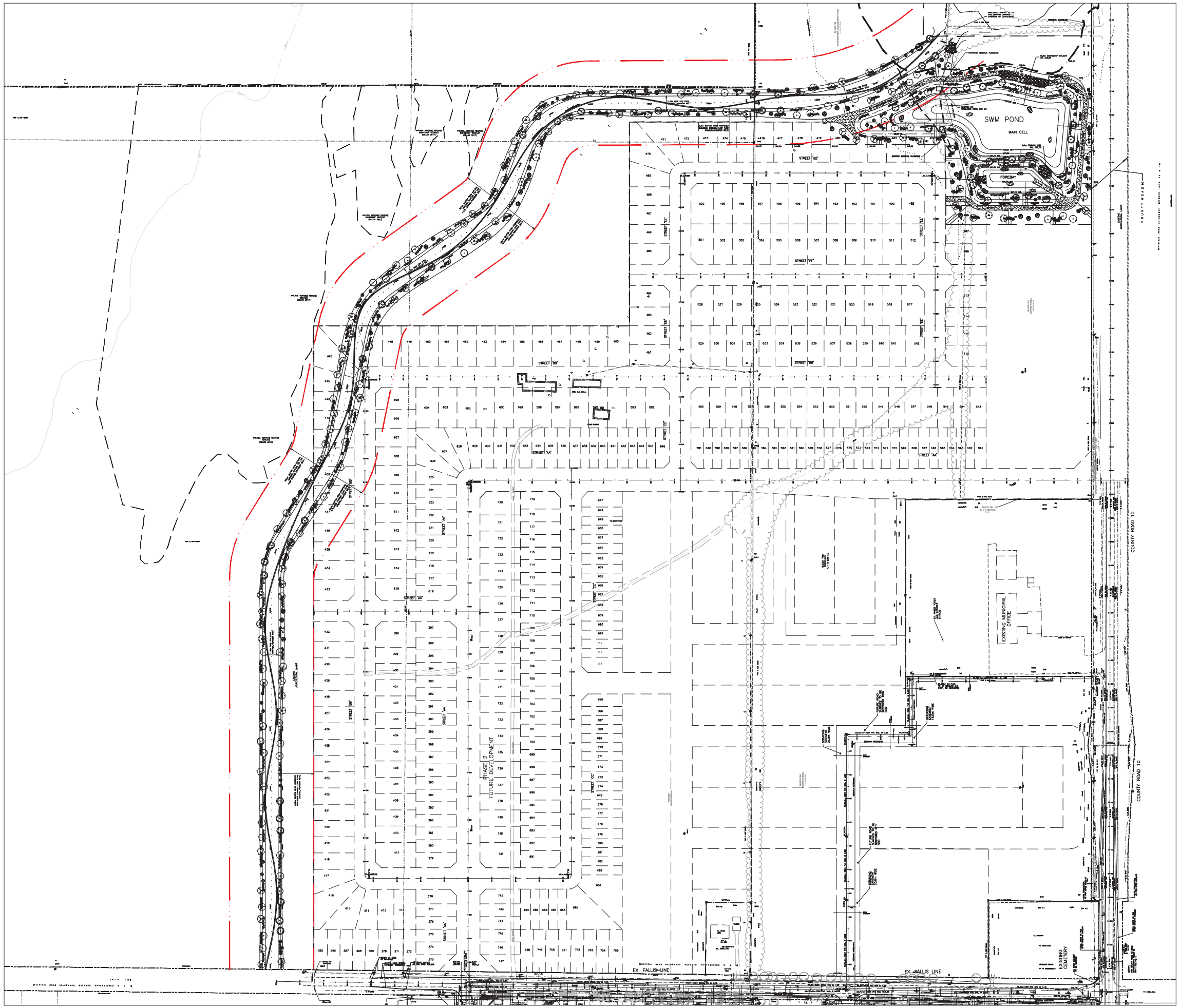
PROJECT

LANDSCAPE DETAILS

DRAWING

DRAWN:	TL
CHECKED:	
SCALE:	N.T.S.
DATE:	2017-07-04
PROJECT NO.:	17-181
SHEET NO.:	LD-100

ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO PAUL MARZA OALA MEMBER



GENERAL NOTES

1. Drawing is in metric scale. Dimensions under 1000 mm are shown as whole number.
2. No extra will be allowed for discrepancies between the drawings and actual site conditions unless reported in writing prior to commencement of work.
3. Do not leave any holes open overnight.
4. Make good all damage resulting from the work at no extra cost.
5. Keep area outside construction zone clean and usable by others at all times.
6. No stockpile is allowed on site without Owner's approval and direction.
7. Contractor is to submit samples of all proposed materials in this contract for approval prior to placing orders.
8. Contractor to request stake out and verify locations for all utilities prior to any construction, and report all conflicts to the Landscape Architects in writing. Contractor to obtain written instructions prior to starting work.
9. This drawing to be read in conjunction with Architect's site plan and engineering drawings.
10. All shrubs and coniferous planting to be in continuous beds. All planting to meet municipality's specifications.
11. Contractor to layout all landscape elements, and confirm locations with the Landscape Architect prior to proceeding.
12. Landscape contractor must always follow the approved engineering grading plans. Report any discrepancies to landscape architect and engineer.
13. Master plant list ,all plant material to be clay grown stock, Contractor to confirm that the plant quantities shown on the plant list conform to the landscape Drawings. Landscape drawings supersede the plant list totals. Any discrepancies not reported shall be the responsibility of the landscape contractor.
14. All shrubs to be fibre pot container stock. All trees to be string ball stock.
15. Contractor shall provide marked-up redline plans showing as-built conditions to the Landscape Architect prior to obtaining substantial completion.
16. Contractor to install new sod and new topsoil as per specifications and general notes throughout the site as designed. New topsoil and sod shall extend through the municipal boulevard to the rear of the municipal curb.
17. All planting beds that are surrounded by sod should be cut and edged at a 45° angle, so there is a clear and well defined separation between the planting beds and sodded areas.
18. The Landscape Contractor is to inform Terraplan 30 days prior to the start date of the landscape construction.
19. The Landscape Contractor must contact Terraplan to confirm start date 7 days prior to commencing the landscape construction.
20. In the event that the soil being used on the site deviates from the soil specifications provided by Terraplan, the Landscape Contractor must provide reputable soil analysis. Soil used on the site must be approved by Terraplan.
21. Terraplan inspections are required prior to payment.

NOT FOR CONSTRUCTION

LEGEND
ALL ITEMS ARE TO BE PROVIDED UNLESS OTHERWISE NOTED

- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB BED
- AQUATICS PLANTS
- 8190–STORMWATER POND MIXTURE FOR LOWER AREAS OF POND
- 8140–NATIVE UPLAND & FORAGE MIX FOR UPPER AREAS OF POND & DISTURBED AREAS

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

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CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

PROJECT
OVERALL LANDSCAPE PLAN

DRAWING

DRAWN: TL
CHECKED:
SCALE: 1:1500
DATE: 2017-07-04
PROJECT NO.: 17-181

SHEET NO.: LP-100

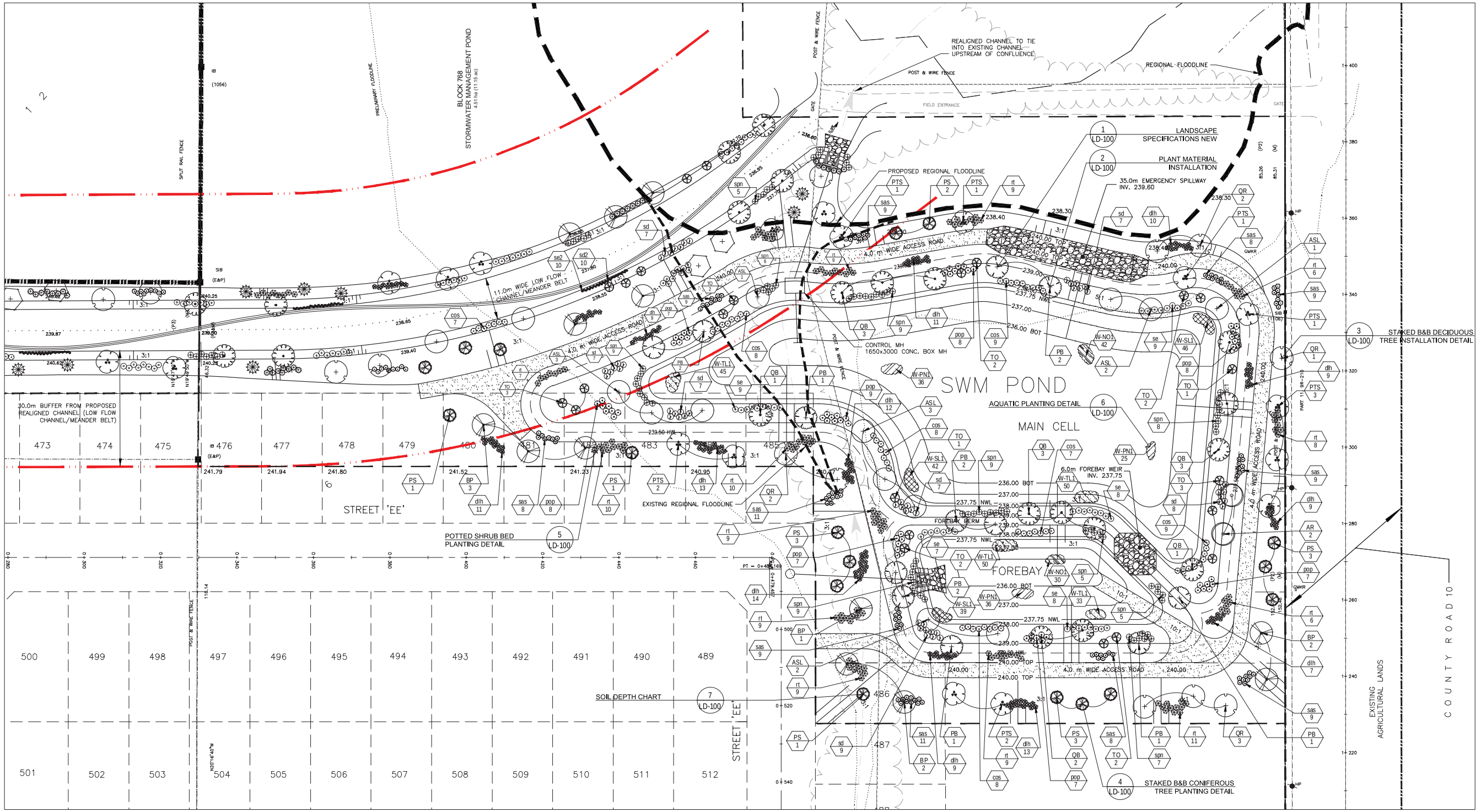
ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO PAUL MARSALA OALA MEMBER

September 19, 2017 2:29 PM I:\01-PROJECTS\2017\17-181 MILLBROOK PHASE 2-POND & CHANNEL\01-CAD\01-CURRENT\PLOT\02-SPA\17-181-LP-100-LANDSCAPEPLAN.DWG

NOT FOR CONSTRUCTION

LEGEND
ALL ITEMS ARE TO BE PROVIDED UNLESS OTHERWISE NOTED

- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB BED
- AQUATICS PLANTS
- PLANT KEY (ID / QTY)
- DETAIL KEY (3 / LD-100)



PLANT SCHEDULE SWM POND

CONIFEROUS TREE	CODE	QTY	BOTANICAL NAME	COMMON NAME	B&B	70	REMARKS
	PS	14	PINUS STROBUS	WHITE PINE	POT	80CM HT.	NATIVE
	TO	18	THUJA OCCIDENTALIS	WHITE CEDAR	POT	80CM HT.	NATIVE
DECIDUOUS TREES	**CODE**	**QTY**	**BOTANICAL NAME**	**COMMON NAME**	**B&B**	**70**	**REMARKS**
	AR	2	ACER RUBRUM	RED MAPLE	B & B OR POT	1.5M HT.	NATIVE
	ASL	12	ACER SACCHARINUM	SILVER MAPLE	B & B OR POT	1.5M HT.	
	BP	8	BETULA PAPYRIFERA	PAPER BIRCH	B & B OR POT	1.5M HT	NATIVE
	PB	12	POPULUS BALSAMIFERA	BALSAM POPLAR	B & B OR POT	1.5M HT.	
	PTS	11	POPULUS TREMULOIDES	QUAKING ASPEN	B & B OR POT	1.5M HT.	NATIVE
	QB	13	QUERCUS BICOLOR	SWAMP WHITE OAK	B & B OR POT	1.5M HT.	NATIVE
	QR	8	QUERCUS RUBRA	RED OAK	B & B OR POT	1.5M HT.	NATIVE
DECIDUOUS SHRUBS	**CODE**	**QTY**	**BOTANICAL NAME**	**COMMON NAME**	**CONT**	**HT.**	**REMARKS**
	cos	49	CORNUS STOLONIFERA	RED OSIER DOGWOOD	BAREROOT	30CM HT.	NATIVE
	dlh	127	DIERVILLA LONICERA	BUSH HONEYSUCKLE	BAREROOT	30CM HT.	NATIVE
	pop	61	PHYSOCARPUS OPULIFOLIUS	NINEBARK	BAREROOT	30CM HT.	NATIVE
	rt	112	RHUS TYPHINA	STAGHORN SUMAC	BAREROOT	30CM HT.	NATIVE
	sd	45	SALIX DISCOLOR	PUSSY WILLOW	BAREROOT	30CM HT.	NATIVE
	se	41	SALIX EXIGUA	SANDBAR WILLOW	BAREROOT	30CM HT.	NATIVE
	spn	67	SAMBUCUS CANADENSIS	ELDERBERRY	BAREROOT	30CM HT.	NATIVE
	sas	100	SYMPHORICARPOS ALBUS	SNOWBERRY	BAREROOT	30CM HT.	
AQUATIC PLANTS	**CODE**	**QTY**	**BOTANICAL NAME**	**COMMON NAME**	**CONT**	**SPACING**	**REMARKS**
	W-NO1	72	NYMPHAEA ODORATA	WHITE WATER-LILY	BARE ROOT TUBER, PLT. @ 60CM O/C	600mm	
	W-PN1	97	POTAMOGETON NATANS	FLOATING-LEAVED PONDWEED	30CM ROOTED CUTTING, PLT. @ 60CM O/C	600mm	
	W-SL1	127	SAGITTANA LATIFOLIA	BROADLEAVED ARROWHEAD	1" PLUG, PLT. @ 60CM O/C	600mm	
	W-TL1	178	TYPHA LATIFOLIA	BROADLEAVED CATTAIL	BARE ROOT TUBERS, PLT. @ 60CM O/C	600mm	

NOTE:
SHRUBS TO BE BAREROOT ONLY IF INSTALLED IN THE SPRING. SHRUBS TO BE CONTAINER GROWN IF INSTALLED ANY OTHER TIME OF THE YEAR.

1:500 0 5 10 15 20 25 50m

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

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CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

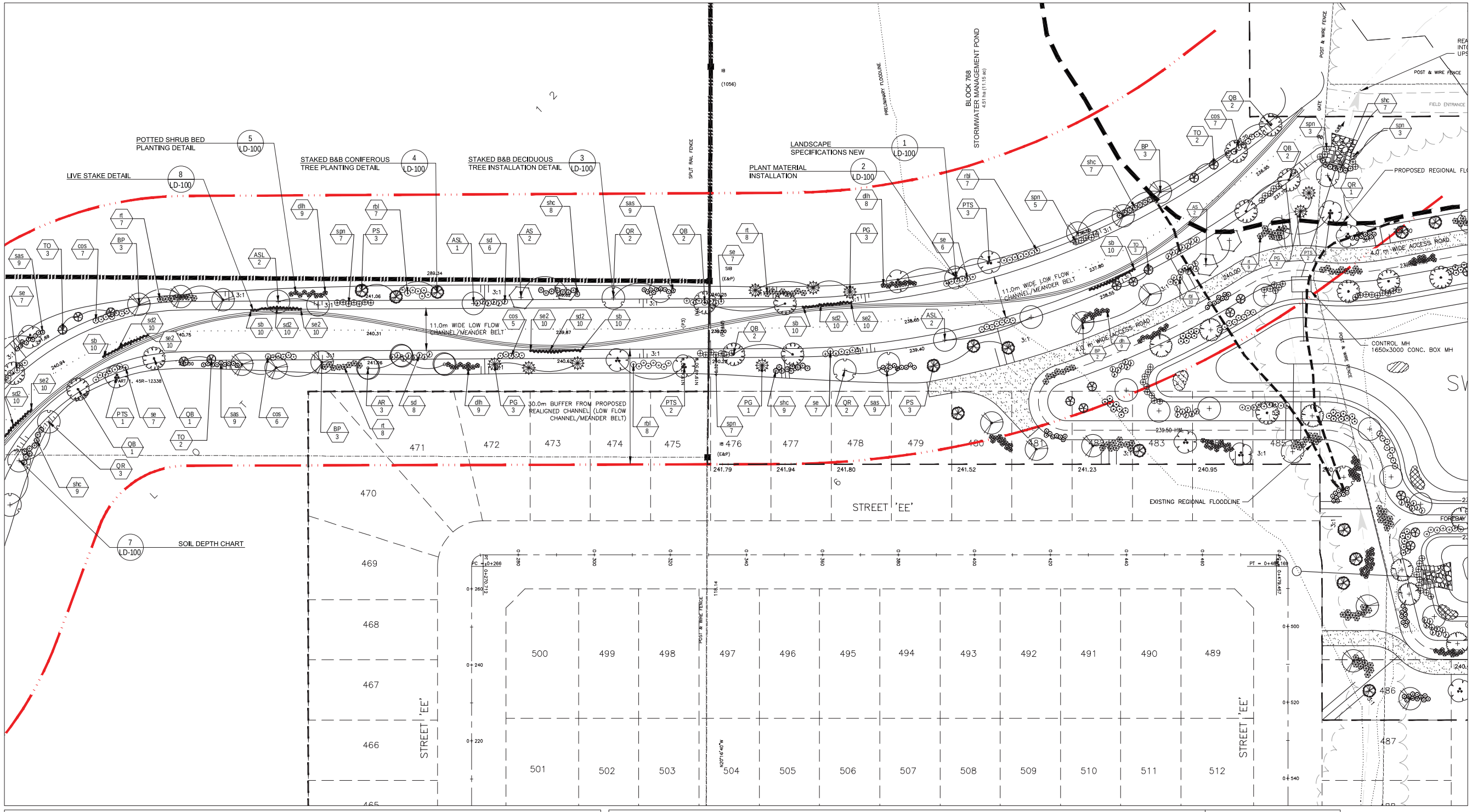
PROJECT
STORM WATER MANAGEMENT POND LANDSCAPE PLAN

DRAWING

DRAWN: TL
CHECKED:
SCALE: 1:500
DATE: 2017-07-04
PROJECT NO.: 17-181

SHEET NO.: LP-101

ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO — PAUL MARSALA — MEMBER — OALA



PLANT SCHEDULE CHANNEL

CONIFEROUS TREE	CODE	QTY	BOTANICAL NAME	COMMON NAME	B&B	70	REMARKS
	PG	14	PICEA GLAUCA	WHITE SPRUCE	POT	80CM HT.	NATIVE
	PS	16	PINUS STROBUS	WHITE PINE	POT	80CM HT.	NATIVE
	TO	28	THUJA OCCIDENTALIS	WHITE CEDAR	POT	80CM HT.	NATIVE
DECIDUOUS TREES	**CODE**	**QTY**	**BOTANICAL NAME**	**COMMON NAME**	**B&B**	**70**	**REMARKS**
	AR	12	ACER RUBRUM	RED MAPLE	B & B OR POT	1.5M HT.	NATIVE
	ASL	28	ACER SACCHARINUM	SILVER MAPLE	B & B OR POT	1.5M HT.	
	AS	20	ACER SACCHARUM	SUGAR MAPLE	B & B OR POT	1.5M HT	
	BP	25	BETULA PAPYRIFERA	PAPER BIRCH	B & B OR POT	1.5M HT	NATIVE
	PTS	25	POPULUS TREMULOIDES	QUAKING ASPEN	B & B OR POT	1.5M HT.	NATIVE
	QB	27	QUERCUS BICOLOR	SWAMP WHITE OAK	B & B OR POT	1.5M HT.	NATIVE
	QR	18	QUERCUS RUBRA	RED OAK	B & B OR POT	1.5M HT.	NATIVE

DECIDUOUS SHRUBS	CODE	QTY	BOTANICAL NAME	COMMON NAME	CONT	HT.	REMARKS
	cos	108	CORNUS STOLONIFERA	RED OSIER DOGWOOD	BAREROOT	30CM HT.	NATIVE
	dlh	106	DIERVILLA LONICERA	BUSH HONEYSUCKLE	BAREROOT	30CM HT.	NATIVE
	rt	96	RHUS TYPHINA	STAGHORN SUMAC	BAREROOT	30CM HT.	NATIVE
	rbl	93	ROSA BLANDA	SMOOTH ROSE	BAREROOT	30CM HT.	NATIVE
	sd	94	SALIX DISCOLOR	PUSSY WILLOW	BAREROOT	30CM HT.	NATIVE
	se	104	SALIX EXIGUA	SANDBAR WILLOW	BAREROOT	30CM HT.	NATIVE
	spn	92	SAMBUCUS CANADENSIS	ELDERBERRY	BAREROOT	30CM HT.	NATIVE
	shc	101	SHEPHERDIA CANADENSIS	BUFFALOBERRY	BAREROOT	30CM HT.	NATIVE
	sas	101	SYMPHORICARPOS ALBUS	SNOWBERRY	BAREROOT	30CM HT.	
LIVE STAKES	**CODE**	**QTY**	**BOTANICAL NAME**	**COMMON NAME**	**CONT**	**HT.**	**REMARKS**
	sb	160	SALIX BEBBIANA	BEAKED WILLOW	LIVE STAKE	25-50MM DIA., 750-1000MM LENGTH	NATIVE
	sd2	160	SALIX DISCOLOR	PUSSY WILLOW	LIVE STAKE	25-50MM DIA., 750-1000MM LENGTH	NATIVE
	se2	160	SALIX EXIGUA	SANDBAR WILLOW	LIVE STAKE	25-50MM DIA., 750-1000MM LENGTH	NATIVE

NOTE:
SHRUBS TO BE BAREROOT ONLY IF INSTALLED IN THE SPRING. SHRUBS TO BE CONTAINER GROWN IF INSTALLED ANY OTHER TIME OF THE YEAR.

1:500 0 5 10 15 20 25 50m

NOT FOR CONSTRUCTION

LEGEND
ALL ITEMS ARE TO BE PROVIDED UNLESS OTHERWISE NOTED

- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB BED
- LIVE STAKES
- PLANT KEY (ID / QTY)
- DETAIL KEY (3 / LD-100)

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

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CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

PROJECT

CHANNEL LANDSCAPE PLAN

DRAWING

DRAWN: TL
CHECKED:
SCALE: 1:500
DATE: 2017-07-04
PROJECT NO.: 17-181

ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO PAUL MARRAS MEMBER OALA

SHEET NO.: LP-102

September 18, 2017 2:35 PM I:\01-PROJECTS\2017\17-181 MILLBROOK PHASE 2\PDNS & CHANNEL\01-CADD\1-CURRENT\PLOT\SEPA\17-181-LP-100-LANDSCAPEPLAN.DWG

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LEGEND
ALL ITEMS ARE TO BE PROVIDED UNLESS OTHERWISE NOTED

- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB BED
- LIVE STAKES
- PLANT KEY (10 QTY)
- DETAIL KEY (3 / LD-100)

NOTE:
REFER TO DRAWING LP-102 FOR CHANNEL PLANT LIST.

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

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CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

PROJECT
CHANNEL LANDSCAPE PLAN

DRAWING

DRAWN: TL
CHECKED:
SCALE: 1:500
DATE: 2017-07-04
PROJECT NO.: 17-181

SHEET NO.: LP-103

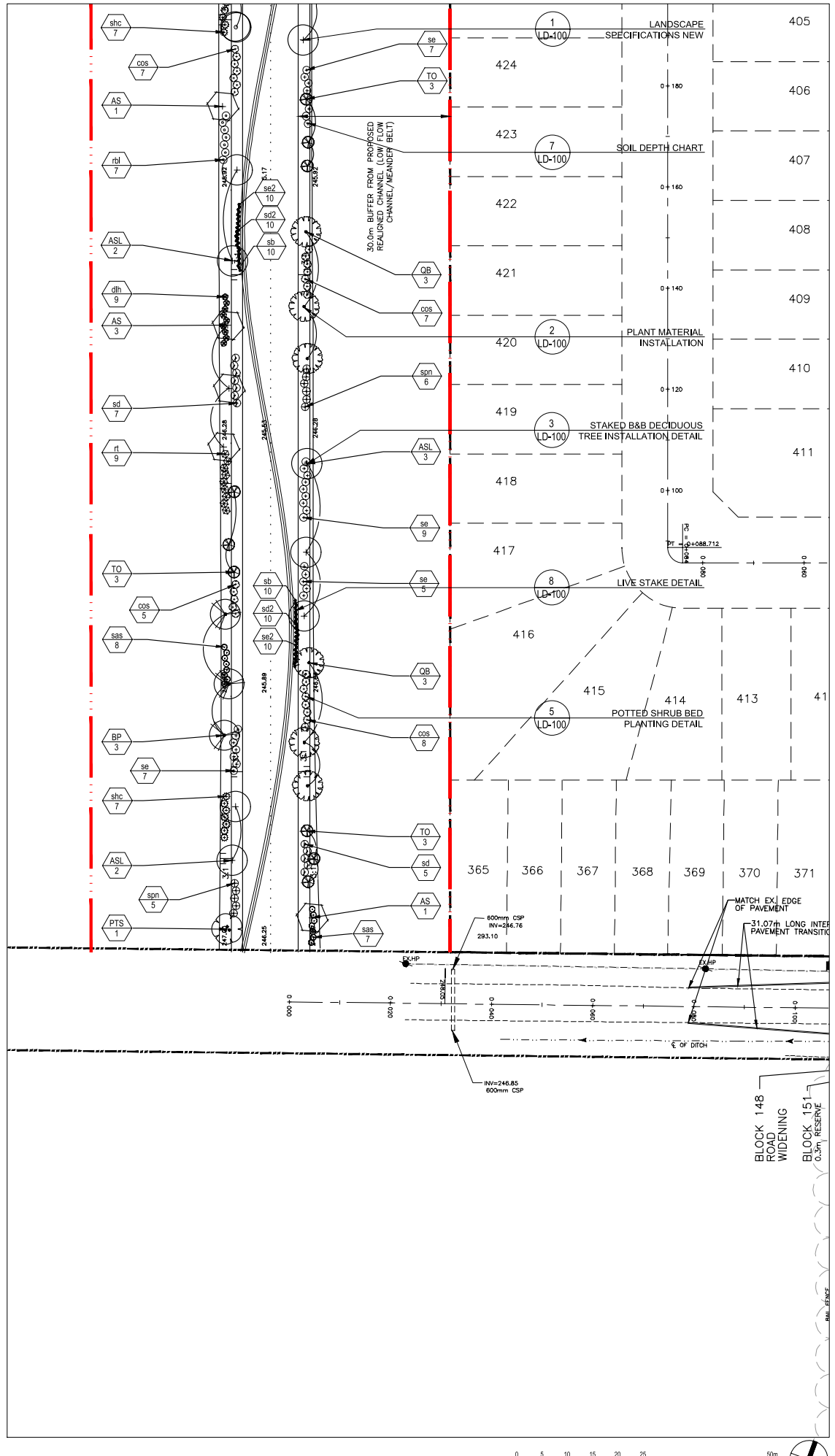
ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO — PAUL MARSALL — OALA MEMBER

POTTED SHRUB BED PLANTING DETAIL (5 / LD-100)
PLANT MATERIAL INSTALLATION (2 / LD-100)
LANDSCAPE SPECIFICATIONS NEW (1 / LD-100)
STAKED B&B CONIFEROUS TREE PLANTING DETAIL (4 / LD-100)
STAKED B&B DECIDUOUS TREE INSTALLATION DETAIL (3 / LD-100)
SOIL DEPTH CHART (7 / LD-100)
LIVE STAKE DETAIL (8 / LD-100)

NATURAL HERITAGE FEATURE WETLAND (DILLON 2017)
NATURAL HERITAGE FEATURE SIGNIFICANT WOODLOT (DILLON 2017)
30.0m BUFFER FROM NATURAL HERITAGE FEATURE (TO LOW FLOW CHANNEL/MEANDER BELT)
30.0m BUFFER FROM PROPOSED REALIGNED CHANNEL (TO LOW FLOW CHANNEL/MEANDER BELT)
11.0m WIDE LOW FLOW CHANNEL/MEANDER BELT
EXISTING AGRICULTURAL LANDS
STREET 'BB'
BARN

CHANNEL LANDSCAPE PLAN 2 (LP-103) 1:500
CHANNEL LANDSCAPE PLAN 1 (LP-103) 1:500
1:500 0 5 10 15 20 25 50m

September 18, 2017 2:27 PM I:\01-PROJECTS\2017\17-181 MILLBROOK PHASE 2\PKG & CHANNEL\01-CAD\01-CURRENT\PLOT\02-SPA-17-181-LP-104-LANDSCAPER.DWG



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NOT FOR CONSTRUCTION

LEGEND
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- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB BED
- LIVE STAKES
- ID / QTY — PLANT KEY
- 3 / LD-100 — DETAIL KEY

NOTE:
REFER TO DRAWING LP-102 FOR CHANNEL PLANT LIST.

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

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CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

PROJECT
CHANNEL LANDSCAPE PLAN

DRAWING

DRAWN: TL
CHECKED:
SCALE: 1:500
DATE: 2017-07-04
PROJECT NO.: 17-181

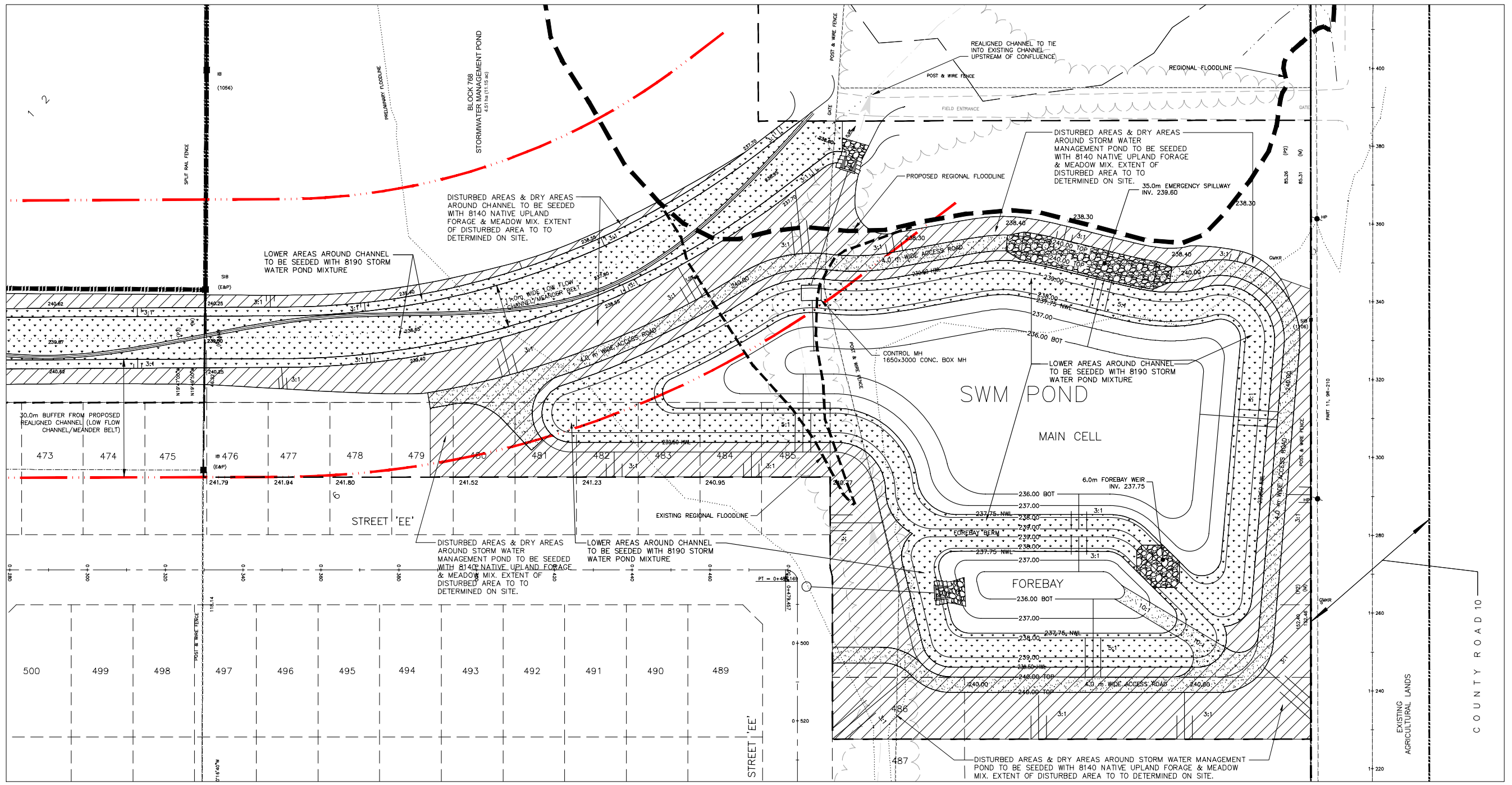
SHEET NO.: LP-104

ONTARIO ASSOCIATION OF LANDSCAPE ARCHITECTS — PAUL MARSALL — OALA MEMBER

NOT FOR CONSTRUCTION

LEGEND
ALL ITEMS ARE TO BE PROVIDED UNLESS OTHERWISE NOTED

- 8190–STORMWATER POND MIXTURE FOR LOWER AREAS OF POND
- 8140–NATIVE UPLAND & FORAGE MIX FOR UPPER AREAS OF POND & DISTURBED AREAS



8190 – STORMWATER POND MIXTURE
FOR LOWER AREAS OF POND:

SPECIES
Annual Ryegrass (Lolium multiflorum)–15%
Black Eyed Susan (Rudbeckia hirta)–3%
Canada Bluegrass (Poa Compressa)–25%
Fox sedge (carex vulpinoidea)–15%
Indiangrass (Sorghastrum nutans)–15%
New England Aster (Aster novae–angiais)–2%
Virginia Wild Rye (Elymus virginicus)–25%

8140–NATIVE UPLAND FORAGE & MEADOW MIX
FOR UPPER AREAS OF POND:

SPECIES
Canada Wild Rye (Elmus Canadensis)–35%
Fowl Bluegrass (Poa palustris)–10%
Fox sedge (carex vulpinoidea)–5%
Little Bluestem (Schizachyrium Scoparium)–5%
Sand Dropseed (Sporobolus cryptandrus)–10%
Virginia Wild Rye (Elymus virginicus)–35%

APPLICATION RATES FOR BOTH SEED MIXES 22–25 kg/ha

SEED ANNUAL RYEGRASS AS A NURSE CROP AND FOR EROSION CONTROL AT 22–25 kg/ha

SEED MIXES TO BE PROVIDED BY: OSC SEEDS
P.O. BOX 7
WATERLOO, ON N2J 3Z6
TEL. 1–519–886–0557
FAX 1–519–886–0605
EMAIL: seeds@oscseeds.com

SEED MIXES TO BE INSTALLED HYDRAULICALLY WITH SOIL GUARD BONDED FIBRE MATRIX BY FIBRAMULCH (905)761–6969.

HYDROSEEDING TO BE INSTALLED BY COMPETENT AND QUALIFIED CONTRACTOR.

THE CONTRACTOR SHALL NOT CARRY OUT THE WORK UNDER ADVERSE WEATHER CONDITIONS SUCH AS HIGH WIND, FROZEN GROUND OR GROUND COVERED WITH SNOW, ICE OR STANDING WATER.

A SOIL TEST SHOULD BE PERFORMED BY A COMPETENT HYDROSEEDING CONTRACTOR TO VERIFY MIXTURE AND PERCENTAGES REQUIRED.

TOPSOIL REQUIREMENTS:

ACTIVE STORAGE AND UPLAND AREAS:
PROVIDE 0.45 METERS OF TOPSOIL FOR THE FIRST 1.0 METER ABOVE THE PERMANENT WATER LEVEL.

WITHIN PERMANENT POOL:
PROVIDE 0.30 METERS OF TOPSOIL FOR THE FIRST(1.0) METER BELOW THE PERMANENT WATER LEVEL.

MONITORING:
THE PERMANENT WATER ELEVATION IN THE SWM POND SHOULD BE OBSERVED TWICE A YEAR FOR APPROXIMATELY TWO (2) YEARS BY THE DESIGN ENGINEER AND LANDSCAPE ARCHITECT TO ENSURE THAT THE FACILITY IS FUNCTIONING AS DESIGNED, PRIOR TO PLANTING AQUATICS (OTHER THAN TEMPORARY PLANTING OF CATTAILS IN SEDIMENT FOREBAY) IN ORDER TO ALLOW TIME FOR CONDITIONS IN THE POND TO STABILIZE. A TWO YEAR GUARANTEE OF THE PLANTED MATERIAL IS REQUIRED.

STABILIZATION:
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SEED MIX PREPARATION:
GRADE SUB–GRADE, ELIMINATE UNEVEN AREAS AND LOW SPOTS, ENSURE POSITIVE DRAINAGE. REMOVE DEBRIS, ROOTS, BRANCHES, STONES IN EXCESS OF 50MM DIAMETER AND OTHER DELETERIOUS MATERIALS. REMOVE SUBSOIL THAT HAS BEEN CONTAMINATED WITH OIL, GASOLINE OR CALCIUM CHLORIDE. DISPOSE OF REMOVED MATERIAL AS DIRECTED BY LANDSCAPE ARCHITECTS.

GRADE SUB–GRADE FOR HYDRO–SEEDING TO A UNIFORM SURFACE AND REMOVE VEGETATION WHICH MAY INTERFERE WITH SEEDING OPERATIONS. LOOSEN SOIL TO DEPTH OF 25MM MINIMUM AND REMOVE STONES AND FOREIGN MATERIAL WHICH PROTRUDE MORE THAN 75MM ABOVE THE SURFACE.

ALL AREAS TO BE HYDROSEEDED TO RECEIVE MIN. 150mm OF TOPSOIL.

MAINTENANCE:
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1:500 (0 5 10 15 20 25 50m)

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

signed _____ date _____

terraplan LANDSCAPE ARCHITECTS
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CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

PROJECT

STORM WATER MANAGEMENT POND AND CHANNEL SEED MIX PLAN

DRAWING

DRAWN: TL
CHECKED:
SCALE: 1:500
DATE: 2017-07-04
PROJECT NO.: 17-181

SHEET NO.: LP-105

ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO PAUL MARSALA MEMBER OALA

8190 – STORMWATER POND MIXTURE
FOR LOWER AREAS OF POND:

SPECIES
Annual Ryegrass (Lolium multiflorum)–15%
Black Eyed Susan (Rudbeckia hirta)–3%
Canada Bluegrass (Poa Compressa)–25%
Fox sedge (carex vulpinoidea)–15%
Indiangrass (Sorghastrum nutans)–15%
New England Aster (Aster novae–angiais)–2%
Virginia Wild Rye (Elymus virginicus)–25%

8140–NATIVE UPLAND FORAGE & MEADOW MIX
FOR UPPER AREAS OF POND:

SPECIES
Canada Wild Rye (Elmus Canadensis)–35%
Fowl Bluegrass (Poa palustris)–10%
Fox sedge (carex vulpinoidea)–5%
Little Bluestem (Schizachyrium Scoparium)–5%
Sand Dropseed (Sporobolus cryptandrus)–10%
Virginia Wild Rye (Elymus virginicus)–35%

APPLICATION RATES FOR BOTH SEED MIXES 22–25 kg/ha

SEED ANNUAL RYEGRASS AS A NURSE CROP AND FOR EROSION CONTROL AT 22–25 kg/ha

SEED MIXES TO BE PROVIDED BY: OSC SEEDS
P.O. BOX 7
WATERLOO, ON N2J 3Z6
TEL. 1–519–886–0557
FAX 1–519–886–0605
EMAIL: seeds@oscseeds.com

SEED MIXES TO BE INSTALLED HYDRAULICALLY WITH SOIL GUARD BONDED FIBRE MATRIX BY FIBRAMULCH (905)761–6969.

HYDROSEEDING TO BE INSTALLED BY COMPETENT AND QUALIFIED CONTRACTOR.

THE CONTRACTOR SHALL NOT CARRY OUT THE WORK UNDER ADVERSE WEATHER CONDITIONS SUCH AS HIGH WIND, FROZEN GROUND OR GROUND COVERED WITH SNOW, ICE OR STANDING WATER.

A SOIL TEST SHOULD BE PERFORMED BY A COMPETENT HYDROSEEDING CONTRACTOR TO VERIFY MIXTURE AND PERCENTAGES REQUIRED.

TOPSOIL REQUIREMENTS:

ACTIVE STORAGE AND UPLAND AREAS:
PROVIDE 0.45 METERS OF TOPSOIL FOR THE FIRST 1.0 METER ABOVE THE PERMANENT WATER LEVEL.

WITHIN PERMANENT POOL:
PROVIDE 0.30 METERS OF TOPSOIL FOR THE FIRST(1.0) METER BELOW THE PERMANENT WATER LEVEL.

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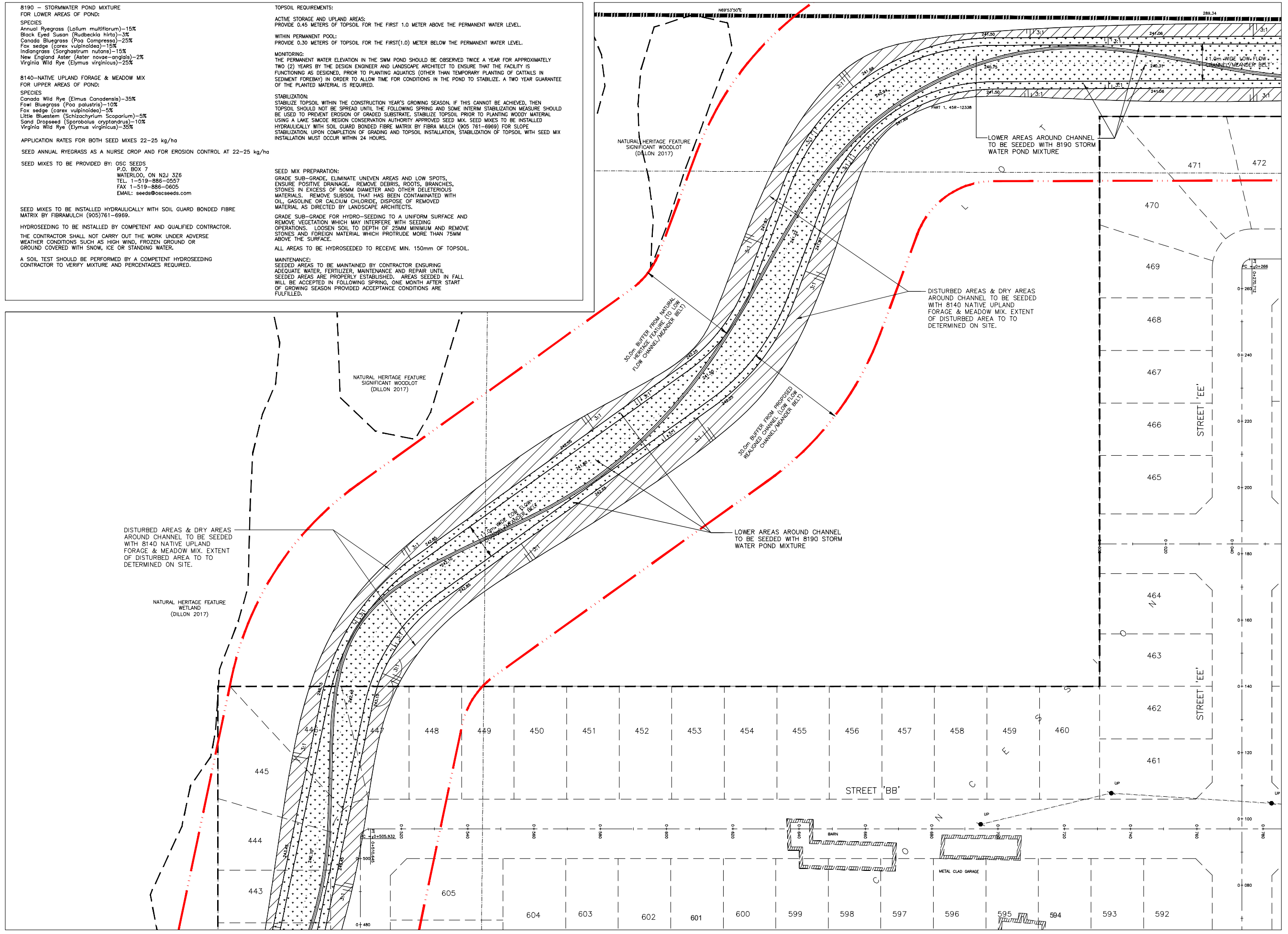

NOT FOR CONSTRUCTION

LEGEND
ALL ITEMS ARE TO BE PROVIDED UNLESS OTHERWISE NOTED

8190–STORMWATER POND MIXTURE FOR LOWER AREAS OF CHANNEL

8140–NATIVE UPLAND & FORAGE MIX FOR UPPER AREAS OF CHANNELL & DISTURBED AREAS

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

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CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

PROJECT
CHANNEL SEED MIX PLAN

DRAWING

DRAWN: TL
CHECKED:
SCALE: 1:500
DATE: 2017-07-04
PROJECT NO.: 17-181

SHEET NO.: LP-106

ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO — PAUL MARSALA — OALA MEMBER

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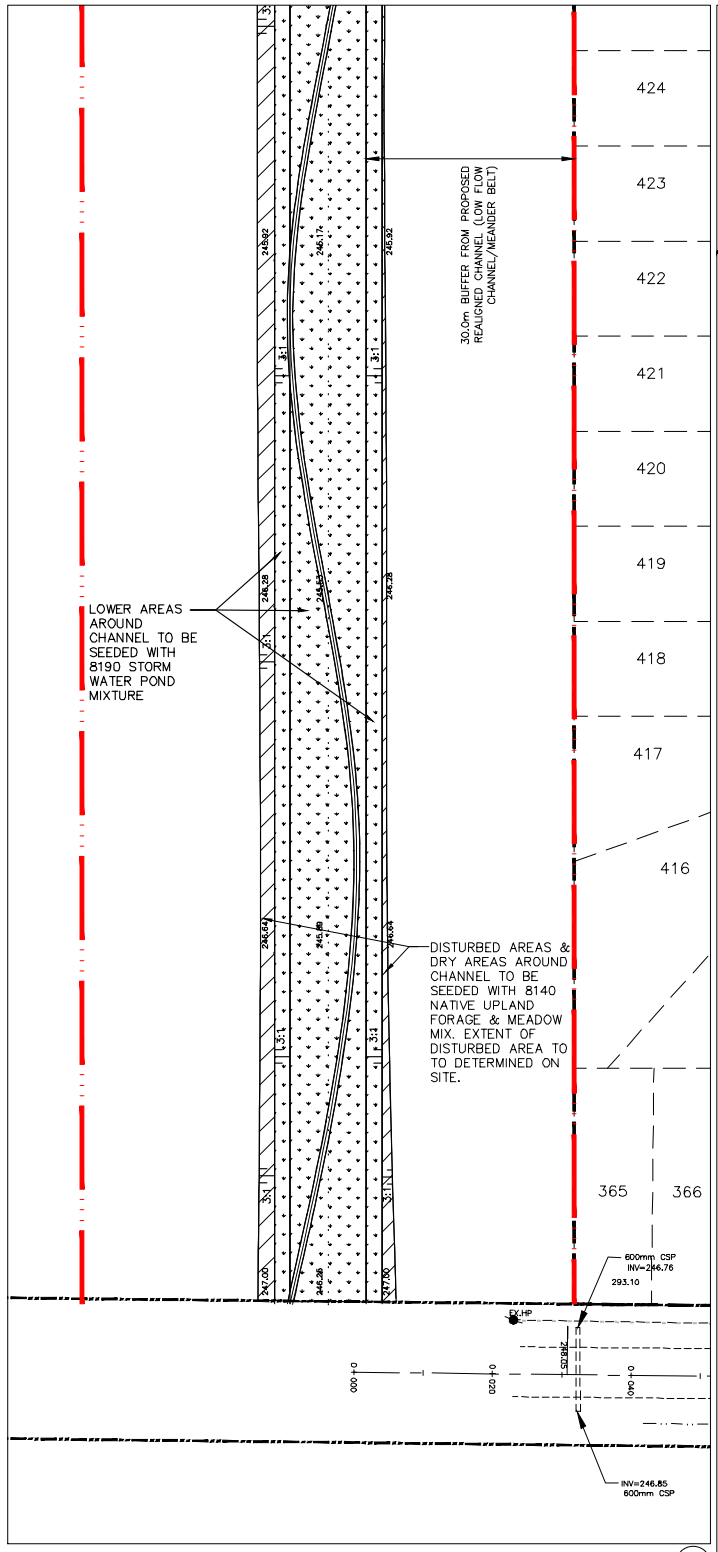
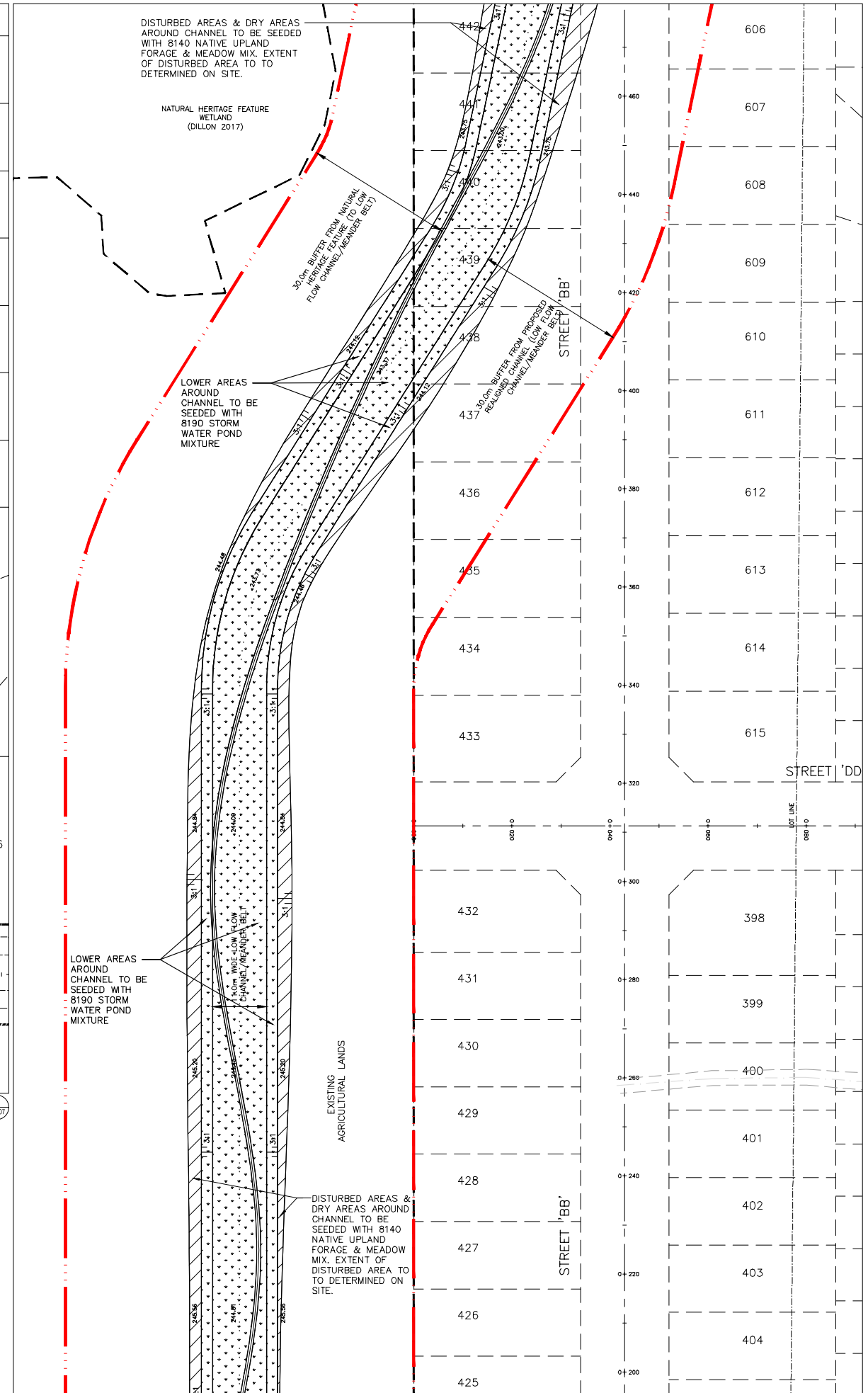


CHANNEL SEED MIX PLAN 2
1:500 LP-107



1:500 0 5 10 15 20 25 50m

CHANNEL SEED MIX PLAN 1
1:500 LP-107

NOT FOR CONSTRUCTION

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8140–NATIVE UPLAND & FORAGE MIX FOR UPPER AREAS OF CHANNELL & DISTURBED AREAS

no.	revision	date	by
1	ISSUED FOR CLIENT REVIEW	2017-09-15	TL

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON THE JOB AND REPORT ANY DISCREPANCY TO THE LANDSCAPE ARCHITECT BEFORE PROCEEDING WITH THE WORK.
ALL DRAWINGS AND SPECIFICATIONS ARE INSTRUMENTS OF SERVICE AND THE PROPERTY OF THE LANDSCAPE ARCHITECT WHICH MUST BE RETURNED AT THE COMPLETION OF THE WORK.
ALL DRAWINGS TO BE USED FOR CONSTRUCTION ONLY WHEN SIGNED BY THE LANDSCAPE ARCHITECT.

signed _____ date _____

terraplan LANDSCAPE ARCHITECTS
VISION. DELIVERED.
20 Champlain Blvd, Suite 102 - Toronto ON - M3H 2Z1 info@terraplan.ca www.terraplan.ca

CLIENT

MILLBROOK SUBDIVISION
PHASE 2
PETERBOROUGH, ONTARIO

PROJECT
CHANNEL SEED MIX PLAN

DRAWING

DRAWN: TL
CHECKED:
SCALE: 1:500
DATE: 2017-07-04
PROJECT NO.: 17-181

SHEET NO.: LP-107

ASSOCIATION OF LANDSCAPE ARCHITECTS ONTARIO PAUL MARSALL OALA MEMBER

September 18, 2017 2:34 PM I:\01-PROJECTS\2017\17-181 MILLBROOK PHASE 2\POND & CHANNEL\01-CAD\01-CURRENT\PLOT\02-SP\17-181-LR-100-LANDSCAPER.DWG

Attachment E:

ORCA Correspondence

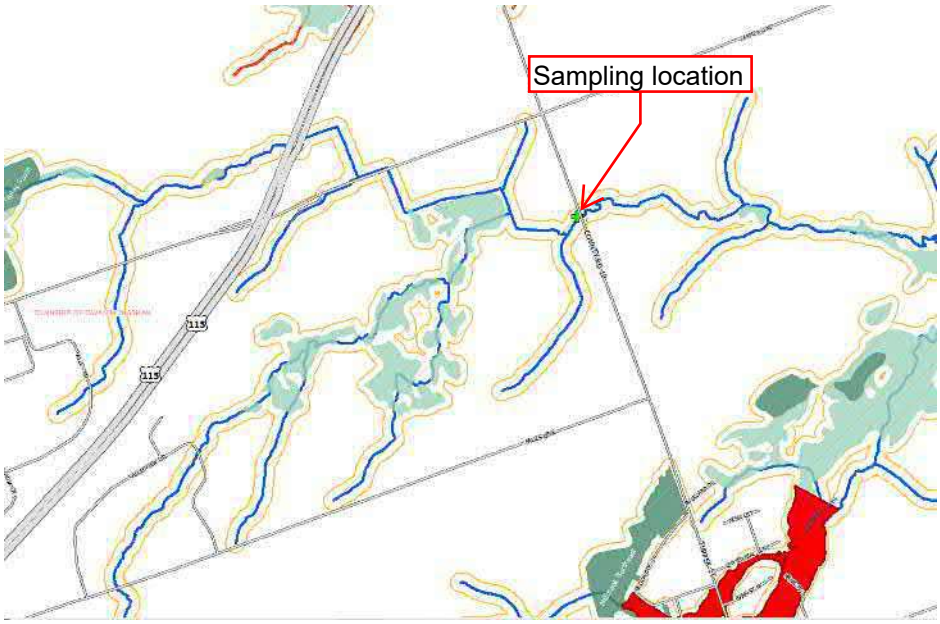
ORCA Plan Review and Permitting Data Request

To: **Whitney Moore, Dillon Consulting**
From: **Erin McGauley**
CC: **Jennifer Clinesmith, File**
Date: **November 9, 2016**
Subject: **Data Request, Dillon Consulting, Millbrook Subdivision (Larmer Line – Fallis Dr.)**
Related File: **2014-SD003 (Towerhill Subdivision)**

ORCA Plan Review and Permitting Environmental staff have received a data request from Dillon Consulting for fisheries information for the Millbrook subdivision site located between Larmer Line and Fallis Drive, west of County Road 10.

The following information is provided regarding fisheries resources and mapping of the area.
The headwater streams on the site are all identified as 'Cold Water' via the Peterborough Area Cold Water Stream Strategy. MNRF layers in ORCA's GIS system note the following details for all stream segments identified in the area of interest:

FISHERIES_MANAGEMENT_ZONE_ID:	99
FISH_SPECIES_SUMMARY:	brook stickleback, brassy minnow, pearl dace, common shiner, bluntnose minnow, eastern blacknose dace, white sucker, northern redbelly dace
ARA_IDENT_1:	PB-0002-BAX



Light blue areas on the map above show the location of unevaluated wetlands on the site, which appear to include open-water habitat which may support fish.

The Otonabee Region Conservation Authority
250 Milroy Drive, Peterborough, ON K9H 7M9
Phone: 705-745-5791 Fax: 705-745-7488
Email: otonabeeca@otonabee.com Website: www.otonabee.com

ORCA's policies regarding fish habitat and planning can be found in section 2.3 (7) of the Watershed Planning and Regulation Policy Manual found on ORCA's website: www.otonabee.com

Sincerely,

Erin McGauley, MSc.
ORCA Watershed Biologist

Attachment F:

DFO Correspondence

Fisheries and Oceans Canada | Pêches et Océans Canada

1028 Parsons Road
Edmonton, AB
T6X 0J4

February 5, 2018

Your file *Votre référence*
N/A

Our file *Notre référence*
17-HCAA-01461

Towerhill Developments Inc.
Attn: Andrew McLeod
2800 Highway 7
Concord, ON
L4K 1W8

Dear Mr. McLeod:

Subject: Implementation of mitigation measures to avoid and mitigate serious harm to fish – Channel Realignment, Millbrook Development, Tributary of Baxter Creek, Township of Cavan-Monaghan

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada received your proposal on October 13, 2017.

Your proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*.

Our review consisted of:

- "Request for Review", submitted by Dillon Consulting Ltd, on behalf of Towerhill Developments Inc., dated October 13, 2017.
- "Millbrook Subdivision, Fallis Line and Country Road 10, Millbrook, Ontario, Towerhill Development Inc., Natural Channel Design: Channel Realignment Design Brief", prepared by Water's Edge Environmental Solutions Team Ltd., dated July 26, 2017.
- Meeting with Dillon Consulting Inc., confirming habitat characteristics and barriers to fish passage, on January 17, 2018

We understand that you propose to infill an existing tributary to Baxter Creek near Millbrook, ON and replace it with a newly constructed channel located south of the original. Works will include:

- removal of vegetation for equipment staging and operation;
- infilling 2,470m² of a tributary; and
- constructing 12,896m² of a new, naturalized channel.

Provided that the mitigation measures outlined in the above stated documents are incorporated into your plans, the Program is of the view that your proposal will not result in serious harm to fish. No formal approval is required from the Program under the *Fisheries Act* in order to proceed with your proposal.

If your plans have changed or if the description of your proposal is incomplete, or changes in the future, you should consult our website (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or consult with a qualified environmental consultant to determine if further review is required by the Program.

Please notify this office at least 10 days before starting your project. A copy of this letter should be kept on site while the work is in progress.

If you have any questions, please contact Brett Ellis at (780) 495-2959, or by email at brett.ellis@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Jason Shpeley
A/Senior Fisheries Biologist
Fisheries Protection Program
Fisheries and Oceans Canada

cc. Allen Benson, Dillon Consulting Ltd.
Whitney Moore, Dillon Consulting Ltd.
Brett Ellis, Fisheries and Oceans Canada

Appendix F

Ecological Land Classification Photos

Ecological Land Classification Photos

Photo 1 June 21, 2017 FODM6-5 Fresh-Moist Sugar Maple Hardwood Forest	
Photo 2 June 21, 2017 SWDM4 Mineral Deciduous Swamp	
Photo 3 June 21, 2017 SWDM4 Mineral Deciduous Swamp	

Ecological Land Classification Photos

Photo 4 June 21, 2017 MAMM1-2 Cattail Mineral Meadow Marsh	
Photo 5 June 21, 2017 MAMM1-2 Cattail Mineral Meadow Marsh	
Photo 6 June 21, 2017 MAMM1-2 Cattail Mineral Meadow Marsh	

Ecological Land Classification Photos

Photo 7 June 21, 2017 MEMM4 Fresh-Moist Mixed Meadow	
Photo 8 June 21, 2017 MEMM3 Dry-Fresh Mixed Meadow	
Photo 9 June 21, 2017 TAGM5 Fencerow/ Riparian	

Ecological Land Classification Photos

Photo 10 June 21, 2017 OAGM1 Annual Row Crop (with isolated wetland pocket)	
Photo 11 June 21, 2017 OAGM1 Annual Row Crop (with isolated wetland pocket)	
Photo 12 June 21, 2017 CVR_4 Rural Residential	

Appendix G

Vegetation List

Family[1]	Scientific Name	Common Name	Invasive Ranking[2]	Noxious[3]	ELC Habitat Observed In[4]				*SARA*[5]	*ESA*[6]	SRank[7]	CC[8]	CW[9]	Regional Rarity[10]
					Deciduous Forest	Mixed Meadow	Cattail Marsh	Deciduous Swamp						
Equisetaceae	*Equisetum arvense*	Field Horsetail	---	---	●	●			---	---	S5	0	0	
Equisetaceae	*Equisetum fluviatile*	Water Horsetail	---	---				●	---	---	S5	7	-5	X
Dennstaedtiaceae	*Pteridium aquilinum*	Bracken Fern	---	---	●				---	---	S5	2	3	
Dryopteridaceae	*Dryopteris marginalis*	Marginal Wood Fern	---	---	●				---	---	S5	5	3	
Dryopteridaceae	*Matteuccia struthiopteris*	Ostrich Fern	---	---	●				---	---	S5	5	-3	
Dryopteridaceae	*Onoclea sensibilis*	Sensitive Fern	---	---	●			●	---	---	S5	4	-3	X
Cupressaceae	*Juniperus communis*	Ground Juniper	---	---	●	●			---	---	S5	4	3	
Cupressaceae	*Juniperus virginiana*	Eastern Red Cedar	---	---		●			---	---	S5	4	3	
Pinaceae	*Pinus sylvestris*	Scotch Pine	2	---		●			---	---	SNA	---	5	
Alismataceae	*Alisma triviale*	Northern Water-plantain	---	---			●	●	---	---	S5	---	---	X
Araceae	*Arisaema triphyllum*	Jack-in-the-pulpit	---	---	●				---	---	S5	5	-2	
Cyperaceae	*Carex bebbii*	Bebb's Sedge	---	---	●				---	---	S5	3	-5	
Cyperaceae	*Carex gracillima*	Graceful Sedge	---	---		●			---	---	S5	4	3	
Cyperaceae	*Carex grayi*	Asa Gray Sedge	---	---				●	---	---	S4	8	-4	
Cyperaceae	*Carex pedunculata*	Long-stalked Sedge	---	---	●				---	---	S5	5	5	
Cyperaceae	*Carex rostrata*	Beaked Sedge	---	---	●				---	---	S4?	7	-5	
Cyperaceae	*Carex vulpinoidea*	Fox Sedge	---	---			●	●	---	---	S5	3	-5	X
Cyperaceae	*Schoenoplectus tabernaemontani*	Soft-stemmed Bulrush	---	---				●	---	---	S5	5	-5	X
Poaceae	*Bromus inermis*	Awnless Brome	4	---		●			---	---	SNA	---	5	
Poaceae	*Dactylis glomerata*	Orchard Grass	4	---	●	●			---	---	SNA	---	3	
Poaceae	*Elymus hystrix*	Bottlebrush Grass	---	---				●	---	---	S5	5	5	SR
Poaceae	*Elymus repens*	Creeping Wildrye	6	---			●		---	---	SNA	---	3	
Poaceae	*Glyceria striata*	Fowl Mannagrass	---	---			●	●	---	---	S5	3	-5	X
Poaceae	*Leersia oryzoides*	Rice Cutgrass	---	---				●	---	---	S5	3	-5	X
Poaceae	*Phalaris arundinacea*	Reed Canary Grass	9	---		●	●	●	---	---	S5	0	-4	X
Poaceae	*Phleum pratense*	Common Timothy	---	---		●	●		---	---	SNA	---	3	X
Poaceae	*Phragmites australis* ssp. *australis*	European Common Reed	9	---			●		---	---	SNA	---	-4	
Poaceae	*Poa compressa*	Canada Bluegrass	3	---		●			---	---	SNA	0	2	
Iridaceae	*Iris versicolor*	Harlequin Blue Flag	---	---				●	---	---	S5	5	-5	X
Liliaceae	*Allium tricoccum* var. *tricoccum*	Wild Leek	---	---	●				---	---	S4	7	2	
Liliaceae	*Erythronium americanum*	Yellow Trout-lily	---	---	●				---	---	S5	5	5	
Liliaceae	*Maianthemum canadense*	Wild Lily-of-the-valley	---	---	●				---	---	S5	5	0	
Liliaceae	*Maianthemum stellatum*	Star-flowered False Solomon's-seal	---	---	●				---	---	S5	6	1	
Liliaceae	*Trillium grandiflorum*	White Trillium	---	---	●				---	---	S5	5	5	
Smilacaceae	*Smilax herbacea*	Herbaceous Carrionflower	---	---	●				---	---	S4	5	0	

Family[1]	Scientific Name	Common Name	Invasive[2]	Noxious[3]	ELC Habitat Observed In[4]				*SARA*[5]	*ESA*[6]	SRank[7]	CC[8]	CW[9]	Regional
Orchidaceae	*Epipactis helleborine*	Eastern Helleborine	---	---	●				---	---	SNA	---	5	
Sparganiaceae	*Sparganium americanum*	American Burreed	---	---			●		---	---	S4?	6	-5	
Typhaceae	*Typha latifolia*	Broad-leaved Cattail	---	---			●	●	---	---	S5	3	-5	SR
Apiaceae	*Daucus carota*	Wild Carrot	3	---		●			---	---	SNA	---	5	
Apiaceae	*Pastinaca sativa*	Wild Parsnip	9	Y		●			---	---	SNA	---	5	
Apiaceae	*Sium suave*	Hemlock Water-parsnip	---	---				●	---	---	S5	4	-5	X
Aristolochiaceae	*Asarum canadense*	Canada Wild-ginger	---	---	●				---	---	S5	6	5	
Asteraceae	*Ageratina altissima*	White Snakeroot	---	---			●		---	---	S5	5	3	X
Asteraceae	*Antennaria parlinii* ssp. *parlinii*	Parlin's Pussytoes	---	---	●				---	---	SU	2	5	
Asteraceae	*Arctium minus*	Common Burdock	---	---		●			---	---	SNA	---	5	
Asteraceae	*Centaurea nigra*	Black Knapweed	---	Y		●			---	---	SNA	---	5	
Asteraceae	*Cirsium arvense*	Canada Thistle	6	---	●	●			---	---	SNA	---	3	
Asteraceae	*Erigeron philadelphicus*	Philadelphia Fleabane	---	---		●			---	---	S5	1	-3	
Asteraceae	*Eutrochium maculatum* var. *maculatum*	Spotted Joe Pye Weed	---	---				●	---	---	S5	3	-5	X
Asteraceae	*Hieracium pilloseloides*	Smooth Yellow Hawkweed	---	---		●			---	---	SNA	---	5	
Asteraceae	*Leucanthemum vulgare*	Oxeye Daisy	3	---		●			---	---	SNA	---	5	
Asteraceae	*Prenanthes alba*	White Rattlesnake-root	---	---	●				---	---	S5	6	3	
Asteraceae	*Solidago canadensis* var. *canadensis*	Canada Goldenrod	---	---		●			---	---	S5	1	3	
Asteraceae	*Solidago flexicaulis*	Zigzag Goldenrod	---	---	●				---	---	S5	6	3	
Asteraceae	*Taraxacum officinale*	Common Dandelion	---	---		●			---	---	SNA	---	3	
Asteraceae	*Tussilago farfara*	Colt's-foot	4	Y				●	---	---	SNA	---	3	X
Brassicaceae	*Thlaspi arvense*	Field Penny-cress	---	---		●			---	---	SNA	---	5	
Caryophyllaceae	*Silene vulgaris*	Maiden's Tears	---	---		●			---	---	SNA	---	5	
Cornaceae	*Cornus alternifolia*	Alternate-leaved Dogwood	---	---	●	●			---	---	S5	6	5	
Cornaceae	*Cornus obliqua*	Silky Dogwood	---	---				●	---	---	S5	5	-4	X
Cornaceae	*Cornus sericea ssp sericea*	Red-osier Dogwood	---	---		●		●	---	---	S5	2	-3	X
Caprifoliaceae	*Sambucus racemosa* ssp. *Pubens*	Red-berried Elderberry	---	---	●				---	---	S5	5	2	
Caprifoliaceae	*Viburnum lentago*	Nannyberry	---	---			●		---	---	S5	4	-1	X
Caprifoliaceae	*Viburnum opulus* ssp. *trilobum*	Highbush Cranberry	---	---	●				---	---	S5	---	---	
Fabaceae	*Amphicarpaea bracteata*	American Hog-peanut	---	---	●				---	---	S5	4	0	
Fabaceae	*Lotus corniculatus*	Garden Bird's-foot Trefoil	---	---		●			---	---	SNA	---	1	
Fabaceae	*Melilotus albus*	White Sweet-clover	9	---		●			---	---	SNA	---	3	
Fabaceae	*Trifolium pratense*	Red Clover	---	---		●			---	---	SNA	---	2	
Fabaceae	*Vicia cracca*	Tufted Vetch	---	---		●			---	---	SNA	---	5	
Betulaceae	*Betula alleghaniensis*	Yellow Birch	---	---				●	---	---	S5	6	0	SR
Betulaceae	*Ostrya virginiana*	Eastern Hop-hornbeam	---	---	●				---	---	S5	4	4	

Family[1]	Scientific Name	Common Name	Invasive[2]	Noxious[3]	ELC Habitat Observed In[4]				*SARA*[5]	*ESA*[6]	SRank[7]	CC[8]	CW[9]	Regional
Fagaceae	*Fagus grandifolia*	American Beech	---	---	●				---	---	S4	6	3	
Fagaceae	*Quercus rubra*	Northern Red Oak	---	---	●				---	---	S5	6	3	
Apocynaceae	*Apocynum cannabinum*	Hemp Dogbane	---	---		●			---	---	S5	3	0	
Asclepiadaceae	*Asclepias incarnata*	Swamp Milkweed	---	---	●		●	●	---	---	S5	6	-5	X
Asclepiadaceae	*Asclepias syriaca*	Common Milkweed	---	---		●			---	---	S5	0	5	
Asclepiadaceae	*Cynanchum rossicum*	European Swallow-wort	9	Y	●	●			---	---	SNA	---	5	
Balsaminaceae	*Impatiens capensis*	Spotted Jewelweed	---	---	●			●	---	---	S5	4	-3	X
Oxalidaceae	*Oxalis dillenii*	Slender Yellow Wood-sorrel	---	---	●				---	---	S5?	0	3	
Juglandaceae	*Juglans cinerea*	Butternut	---	---	●				END	END	S3?	6	2	
Juglandaceae	*Juglans nigra*	Black Walnut	---	---	●	●			---	---	S4	5	3	
Boraginaceae	*Echium vulgare*	Common Viper's-bugloss	---	---		●			---	---	SNA	---	5	
Lamiaceae	*Lycopus americanus*	American Water-horehound	---	---				●	---	---	S5	4	-5	X
Lamiaceae	*Monarda didyma*	Scarlet Beebalm	---	---		●			---	---	S3	8	3	
Verbenaceae	*Verbena hastata*	Blue Vervain	---	---			●		---	---	S5	4	-4	X
Tiliaceae	*Tilia americana*	American Basswood	---	---	●		●		---	---	S5	4	3	SR
Onagraceae	*Circaea canadensis*	Broad-leaved Enchanter's Nightshade	---	---	●				---	---	S5	3	3	
Onagraceae	*Oenothera biennis*	Common Evening Primrose	---	---		●			---	---	S5	0	3	
Onagraceae	*Oenothera parviflora*	Small-flowered Evening Primrose	---	---		●			---	---	S5	1	3	
Polygonaceae	*Persicaria amphibia* var. *stipulacea*	Flanged Smartweed	---	---			●		---	---	S5?	---	---	SR
Polygonaceae	*Rumex crispus*	Curly Dock	---	---		●			---	---	SNA	---	-1	
Primulaceae	*Lysimachia ciliata*	Fringed Loosestrife	---	---				●	---	---	S5	4	-3	X
Berberidaceae	*Berberis vulgaris*	European Barberry	6	Y				●	---	---	SNA	---	3	
Berberidaceae	*Caulophyllum thalictroides*	Blue Cohosh	---	---	●				---	---	S5	6	5	
Berberidaceae	*Podophyllum peltatum*	May-apple	---	---	●				---	---	S5	5	3	
Ranunculaceae	*Actaea pachypoda*	White Baneberry	---	---	●				---	---	S5	6	5	
Ranunculaceae	*Anemone acutiloba*	Sharp-lobed Hepatica	---	---	●				---	---	S5	6	5	
Ranunculaceae	*Anemone cylindrica*	Long-fruited Anemone	---	---		●			---	---	S4	7	5	
Ranunculaceae	*Caltha palustris*	Yellow Marsh Marigold	---	---				●	---	---	S5	5	-5	X
Ranunculaceae	*Ranunculus abortivus*	Kidney-leaved Buttercup	---	---	●				---	---	S5	2	-2	
Ranunculaceae	*Ranunculus acris*	Tall Buttercup	---	---		●			---	---	SNA	---	-2	
Ranunculaceae	*Thalictrum dioicum*	Early Meadow-rue	---	---	●				---	---	S5	5	2	
Rhamnaceae	*Rhamnus cathartica*	Common Buckthorn	9	Y	●	●	●		---	---	SNA	---	3	X
Vitaceae	*Parthenocissus quinquefolia*	Virginia Creeper	---	---	●				---	---	S4?	6	1	
Vitaceae	*Vitis riparia*	Riverbank Grape	---	---		●	●	●	---	---	S5	0	-2	X
Grossulariaceae	*Ribes cynosbati*	Prickly Gooseberry	---	---	●				---	---	S5	4	5	
Rosaceae	*Agrimonia gryposepala*	Hooked Agrimony	---	---	●	●			---	---	S5	2	2	

Family[1]	Scientific Name	Common Name	Invasive[2]	Noxious[3]	ELC Habitat Observed In[4]				*SARA*[5]	*ESA*[6]	SRank[7]	CC[8]	CW[9]	Regional
Rosaceae	*Amelanchier spicata*	Running Serviceberry	---	---	●				---	---	S4?	7	3	
Rosaceae	*Fragaria virginiana*	Wild Strawberry	---	---		●			---	---	S5	2	1	
Rosaceae	*Geum canadense*	White Avens	---	---	●				---	---	S5	3	0	
Rosaceae	*Malus baccata*	Siberian Crabapple	---	---		●			---	---	SNA	---	---	
Rosaceae	*Malus pumila*	Common Apple	---	---					---	---	SNA	---	5	
Rosaceae	*Potentilla recta*	Sulphur Cinquefoil	---	---		●			---	---	SNA	---	5	
Rosaceae	*Prunus serotina*	Wild Black Cherry	---	---		●			---	---	S5	3	3	
Rosaceae	*Prunus virginiana*	Choke Cherry	---	---	●				---	---	S5	2	1	
Rosaceae	*Rubus allegheniensis*	Alleghany Blackberry	---	---		●			---	---	S5	2	2	
Rosaceae	*Rubus idaeus* ssp. *idaeus*	Common Red Raspberry	---	---	●				---	---	SNA	---	5	
Rosaceae	*Rubus odoratus*	Purple-flowering Raspberry	---	---	●				---	---	S5	3	5	
Rosaceae	*Spiraea alba*	White Meadowsweet	---	---			●		---	---	S5	3	-4	X
Rubiaceae	*Galium aparine*	Cleavers	---	---	●				---	---	S5	4	3	
Rubiaceae	*Sherardia arvensis*	Blue Field Madder	---	---		●			---	---	SNA	---	---	
Salicaceae	*Populus balsamifera*	Balsam Poplar	---	---			●		---	---	S5	4	-3	X
Salicaceae	*Populus grandidentata*	Large-tooth Aspen	---	---				●	---	---	S5	5	3	X
Salicaceae	*Populus tremuloides*	Trembling Aspen	---	---	●			●	---	---	S5	2	0	X
Salicaceae	*Salix alba*	White Willow	3	---					---	---	SNA	---	-3	
Salicaceae	*Salix discolor*	Pussy Willow	---	---		●	●		---	---	S5	3	-3	X
Salicaceae	*Salix eriocephala*	Heart-leaved Willow	---	---			●		---	---	S5	4	-3	X
Salicaceae	*Salix fragilis*	Crack Willow	3	---				●	---	---	S4?	---	-1	SR
Aceraceae	*Acer negundo*	Manitoba Maple	4	---				●	---	---	S5	0	-2	SR
Aceraceae	*Acer saccharinum*	Silver Maple	---	---				●	---	---	S5	5	-3	SR
Aceraceae	*Acer saccharum*	Sugar Maple	---	---	●				---	---	S5	4	3	
Aceraceae	*Acer x freemanii*	Freeman's Maple	---	---			●	●	---	---	SNA	---	---	SR
Anacardiaceae	*Rhus typhina*	Staghorn Sumac	---	---	●	●			---	---	S5	1	5	
Anacardiaceae	*Toxicodendron radicans*	Climbing Poison Ivy	---	Y	●				---	---	S5	5	-1	
Oleaceae	*Fraxinus americana*	White Ash	---	---	●	●			---	---	S4	4	3	
Oleaceae	*Fraxinus nigra*	Black Ash	---	---				●	---	---	S4	7	-4	X
Oleaceae	*Fraxinus pennsylvanica*	Green Ash	---	---	●			●	---	---	S4	3	-3	X
Oleaceae	*Syringa vulgaris*	Common Lilac	4	---				●	---	---	SNA	---	5	
Scrophulariaceae	*Mimulus ringens*	Square-stemmed Monkeyflower	---	---			●		---	---	S5	6	-5	X
Scrophulariaceae	*Verbascum thapsus*	Common Mullein	---	---		●			---	---	SNA	---	5	
Solanaceae	*Solanum dulcamara*	Bittersweet Nightshade	4	---				●	---	---	SNA	---	0	X
Ulmaceae	*Ulmus americana*	American Elm	---	---	●	●		●	---	---	S5	3	-2	X
Urticaceae	*Boehmeria cylindrica*	False Nettle	---	---				●	---	---	S5	4	-5	X

Family[1]	Scientific Name	Common Name	Invasive[2]	Noxious[3]	ELC Habitat Observed In[4]				*SARA*[5]	*ESA*[6]	SRank[7]	CC[8]	CW[9]	Regional
Urticaceae	*Laportea canadensis*	Wood Nettle	---	---				●	---	---	S5	6	-3	X
Violaceae	*Viola pubescens* var. *pubescens*	Downy Yellow Violet	---	---	●				---	---	S5	5	4	
Violaceae	*Viola sororia*	Woolly Blue Violet	---	---		●			---	---	S5	4	1	
Violaceae	*Viola striata*	Striped Cream Violet	---	---	●				---	---	S3	8	-3	

1 – Species are listed by commonly accepted taxonomic hierarchy; 2 – Invasive Ranking as determined by the *Invasive Exotic Plant Species Rankings for Southern Ontario (Draft - Urban Forest Associates/MNRF, 2014),* species that are designated as 4,5,6 are more locally invasive and tend to be naturalized whereas 7,8,9 are highly invasive often forming monocultures; 3 – Noxious designation as determined by the Schedule of Noxious Weeds under the Ontario Weed Control Act, RSO 1990; 4 – based on the ELC communities documented by Dillon Consulting Limited; 5 – as designated under Schedule 1 of the federal *Species at Risk Act*, 2002; 6 – as designated under the provincial *Endangered Species Act*, 2007; 7 – provincial conservation rankings as determined by the NHIC , S1 - Extremely rare in Ontario; usually 5 or fewer occurrences in the province, or only a couple remaining hectares , S2 - Very rare in Ontario; usually between 6 and 20 occurrences in the province, or only a few remaining hectares, S3 - Rare to uncommon in Ontario; usually between 21 and 80 occurrences in the province; may have fewer occurrences, but with some extensive examples remaining , S4 - Considered to be common in Ontario. It denotes a species that is apparently secure, with over 80 occurrences in the province, S5 - Indicates that a species is widespread in Ontario. It is demonstrably secure in the province,? - A question mark following the rank indicates that there is some uncertainty with the classification due to insufficient information. These provincial ranks may further be modified, S2S3 - Indicates that an element is rare, but insufficient information exists to accurately assign a single rank, SNR - Unranked — conservation status Not Ranked, SNA - Not Applicable – a conservation status rank is not applicable because the species is not a suitable target for conservation activities, SX - Indicates that an element is extirpated from the province, SU - Indicates that the status is uncertain due to insufficient information, SE - Exotic species, non-native to Ontario; 8 - Coefficient of Conservatism (CC) as determined by the NHIC's Floristic Quality Assessment System for Southern Ontario (1995); 9 - Coefficient of Wetness (CW) as determined by the NHIC's Floristic Quality Assessment System for Southern Ontario (1995); 10 – Regional Rarity in Peterborough, Northumberland, Durham and the former Victoria County as determined in the *Distribution and Status of the Vascular Plants of Central Region* (Riley, 1989), X = native species present and all introduced species, R = native species and provincially rare, SR = site record only

Appendix H

Wetland Evaluation

MEMO

TO: MNRF Peterborough District
FROM: Jonathan Harris, Biologist/Wetland Evaluator - Dillon Consulting Limited, Toronto
cc: Whitney Moore, Project Manager - Dillon Consulting Limited, Ottawa
DATE: October 24, 2017
SUBJECT: Towerhill Developments – OWES Evaluation (Baxter Creek Headwaters)
OUR FILE: 16-4800

1.0 INTRODUCTION

Dillon Consulting Limited (Dillon) was retained by Towerhill Developments Inc. to complete an independent Ontario Wetland Evaluation System (OWES) assessment of the unevaluated wetlands located on their property northwest of the Town of Millbrook. Allowing Dillon biologist's access throughout the natural area, this assessment of the unevaluated wetlands was able to confirm and/or revise the wetland boundaries based on field studies carried out over three seasons (spring/summer/fall) in 2017. Data collected by Dillon staff was compiled and used to calculate the evaluation score to determine if unevaluated wetland units meet the criteria for provincial significance. The proposed name for the assessment wetlands is the Baxter Creek Headwaters Wetland Complex.

2.0 STUDY AREA

The Study Area, which covers part of Lot 11 and Lot 12, Concession 6 in the Township of Cavan-Monaghan, is located northwest of the Town of Millbrook. Due to the irregular shape of the property, the Study Area is roughly bound by Larmer Line to the north, Highway 115 to the west, Fallis Line to the south, and Peterborough County Road 10 to the east. The property is privately owned with the majority of the area comprised of agriculture (row crops) as well as a vacant farmyard, watercourse, hedgerows, meadow, an abandoned railway, forest, and the unevaluated wetlands.

3.0 METHODS

The 2017 field investigations used a combination of the protocols outlined under the *Ecological Land Classification (ELC) System for Southern Ontario* (Lee *et al.,* 1998) and *Ontario Wetland Evaluation System – Southern Manual, 3rd Edition, Version 3.3* (MNR, 2014) for characterizing vegetation communities and wetland boundaries. Other field investigations were undertaken in support of an Environmental Impact Study report currently being prepared by Dillon which included breeding bird surveys and amphibian surveys. The results of these other surveys helped to supplement the OWES assessment.

Where present, vegetation community boundaries were determined through the review of aerial photography, and then further refined through on-site vegetation studies. Vegetation studies involved identifying the dominant species in each vegetation cover type based on visual estimates of species abundances and biomass. Vegetation communities were mapped on aerial photography according to ELC nomenclature to graphically represent the specific spatial pattern in the vegetation cover according to species composition, physiognomy, and physical site characteristics. Boundaries of wetland vegetation communities were delineated by using the >50% rule outlined in the OWES Southern manual, and where required, the moisture regime was determined based on vegetation to assist in refining the boundaries. Other physical traits such as topography and slope aspect were also noted within each community.

4.0 RESULTS

Dillon's Biologists/OWES Certified Wetland Evaluators completed field investigations at the Study Area over a three season period, including amphibian call monitoring, bird surveys, botanical inventories, ELC and wetland boundary delineation. Over the three season period, staff devoted approximately 20 person hours, which included visits on the following days:

- April 21, May 18, June 29 (amphibians);
- May 18, June 21, July 28 (vegetation/ELC/wetland boundaries);
- June 8 and June 21 (birds); and,
- June 20 (aquatics).

For an evaluated wetland to obtain a PSW designation it must score either a total combination of $\geq$600 or over 200 in either the biological or special features components of the evaluation. Although the Baxter Creek Headwaters Wetland Complex is unique in the landscape due to the potential association with glacial activity, through examination of the OWES scoring criteria, especially the biological and special features components (i.e., number of significant species observed), resulted in the wetland not meeting the PSW designation. The wetland complex only achieved a total score of 468.3 with the biological (107.5) and special features (173.8) components both under 200.

5.0 SUMMARY

Studies carried out in 2017 found that the Baxter Creek Headwaters Wetland Complex did not meet the required scores for designation as a Provincially Significant Wetland though it may still warrant consideration as locally significant due to the uniqueness in the landscape. This designation of not provincially significant is similar to neighbouring wetland complexes, Tapley South and Millbrook Northeast, which also are evaluated as not provincially significant.

WETLAND EVALUATION DATA AND SCORING RECORD

i) Wetland Name: Unnamed (proposed name - Baxter Creek Headwaters)

ii) MNR Administrative Region: Southern
MNR District: Peterborough
MNR Area Office: Peterborough

iii) Conservation Authority Jurisdiction: Otonabee Region

iv) County of Regional Municipality: Peterborough

v) Township/Geographic Twp and/or Local Municipality: TOWNSHIP OF CAVAN-MONAGHAN

vi) Lots and Concessions: part of Lot 11 and Lot 12, Concession 6

vii) Ecodistrict/Ecoregion: 6E-8 (Peterborough)

viii) Map and Air Photo References:

a) Latitude: 44.164844° Longitude: -78.465770°

b) UTM grid reference:
Zone: 17 Block: T E: 702647.63 N: 4893325.18

c) National Topographic Series:
Map name(s): Peterborough

Map number(s): 031D01

Edition:
Scale: 1:50,000

d) Aerial photographs:
Date(s) photo taken: 1954, 2011-2017 Scale: 20 cm
Flight & plate numbers: aerial imagery available through Google Earth (2011-2016) (CNES/Airbus, DigitalGlobe,

e) Ontario Base Map numbers & scale:
~~1017700048900 (Scale 1:10,000)~~

ix) Wetland Size
(circle appropriate category, a or b)

a) Single contiguous wetland area

Total wetland size = _____ hectares

b) Wetland complexed comprised of 2 individual wetlands:

Wetland Unit No. 1 = 1.41 hectares
Wetland Unit No. 2 = 14.25 hectares
Wetland Unit No. 3 = _____ hectares
Wetland Unit No. 4 = _____ hectares
Wetland Unit No. 5 = _____ hectares
Wetland Unit No. 6 = _____ hectares
Wetland Unit No. 7 = _____ hectares
Wetland Unit No. 8 = _____ hectares
Wetland Unit No. 9 = _____ hectares
Wetland Unit No.10 = _____ hectares

(Attach additional sheet if necessary)

Total wetland size = 15.66 hectares *(add together size of each unit)*

Documentation requirements for evaluated wetland complexes (attach additional sheet if necessary):

- a statement of rationale for identifying a wetland complex;
- a statement of rationale for identifying any wetland complex less than 2 ha in total size;
- a statement of rationale for any vegetation community less than 0.5 ha in size;
- adherence to the wetland complexing rules (750 m; "watershed rule"; lacustrine wetlands); and
- written documentation of the reasons for including wetland units smaller than 2 ha.

see attached statement of rationale

Vegetation Form	FA
h	0.9
c	
dh	
dc	
ts	
ls	
ds	
gc	
m	
ne	
be	
re	0.1
ff	
f	
su	
u	

1.0 BIOLOGICAL COMPONENT

1.1 PRODUCTIVITY

1.1.1 Growing Degree-Days/Soils *(max: 30 pts)*

Refer to page 43 of manual for further explanation.

1. Determine the correct GDD value for your wetland (use Figure 5).
2. Circle the appropriate GDD value from the evaluation table below.
3. Determine the Fractional Area (FA) of the wetland for each soil type.
4. Multiply the fractional area of each soil type by the applicable score-factor in the evaluation table.
5. Sum the scores for each soil type to obtain the final score (maximum score is 30 points).

NOTE: *In wetland complexes the evaluator should aim at determining the fractional area occupied by the categories for the complex as a whole.*

Growing Degree-Days	Clay-Loam	Silt-Marl	Lime-stone	Sand	Humic-Mesic	Fibric	Granite
<2800	15	13	11	9	8	7	5
2800-3200	18	15	13	11	9	8	7
3200-3600	22	18	15	13	11	9	7
3600-4000	26	21	18	15	13	10	8
>4000	30	25	20	18	15	12	8

Soil Type	FA of wetland in soil type	Enter appropriate score-factor from above table	
Clay/Loam	1	X 22	= 22
Silt/Marl:		X	=
Limestone:		X	=
Sand:		X	=
Humic/Mesic:		X	=
Fibric:		X	=
Granite:		X	=
Total			22

GDD/Soils Score *(maximum 30 points)* 22

1.1.2 Wetland Type

(Fractional Areas = area of wetland type/total wetland area)

	Fractional Area		Score
Bog		x 3 =	
Fen		x 6 =	
Swamp	0.90	x 8 =	7.2
Marsh	0.10	x 15 =	1.5
Total		=	8.7

Wetland Type Score *(maximum 15 points)* 9

1.1.3 Site Type

(Fractional Area = area of site type/total wetland area)

	Fractional Area		Score
Isolated		x 1 =	
Palustrine (permanent or intermittent flow)	1	x 2 =	2
Riverine		x 4 =	
Riverine (at rivermouth)		x 5 =	
Lacustrine (at rivermouth)		x 5 =	
Lacustrine (with barrier beach)		x 3 =	
Lacustrine (exposed to lake)		x 2 =	
Total		=	

Site Type Score *(maximum 5 points)* 2

1.2 BIODIVERSITY

1.2.1 Number of Wetland Types

(Check only one)

☐	One	=	9 points
☒	Two	=	13
☐	Three	=	20
☐	Four	=	30

Number of Wetland Types Score
(maximum 30 points) 13

1.2.2. Vegetation Communities

Use the data sheet provided in Appendix 4 to record and score vegetation communities (the completed form must be attached to this data record)

Scoring *(circle only one option for each of the columns below):*

Total # of communities with **1-3 forms**	
1 =	1.5 pts
2 =	2.5
3 =	3.5
4 =	4.5
5 =	5
6 =	5.5
7 =	6
8 =	6.5
9 =	7
10 =	7.5
11 =	8
+ 0.5 *for each additional community*	
=	

Total # of communities with **4-5 forms**	
1 =	2 pts
2 =	3.5
3 =	5
4 =	6.5
5 =	7.5
6 =	8.5
7 =	9.5
8 =	10.5
9 =	11.5
10 =	12.5
11 =	13
+ 0.5 *for each additional community*	
= 3.5	

Total # of communities with **6 or more forms**	
1 =	3 pts
2 =	5
3 =	7
4 =	9
5 =	10.5
6 =	12
7 =	13.5
8 =	15
9 =	16.5
10 =	18
11 =	19
+ 1.0 *for each additional community*	
=	

Vegetation Communities Score
(maximum 45 points) 3.5

1.2.3 Diversity of Surrounding Habitat

Check all appropriate items. Only habitat within 1.5 km of the wetland boundary and at least 0.5 ha in size are to be scored.

X	row crop
X	pasture
	abandoned agricultural land
X	deciduous forest
	coniferous forest
X	mixed forest*
	abandoned pits and quarries
	open lake or deep river
X	fence rows with deep cover, or shelterbelts
	terrain appreciably undulating, hilly or with ravines
X	creek flood plain

* *"Mixed forest" is defined as either 25% coniferous trees distributed singly or in clumps in deciduous forest, or 25% deciduous trees distributed singly or in clumps in coniferous forest. Note that Forest Resource Inventory (FRI) maps can be misleading since 25% conifer within a unit could be entirely concentrated around a lake.*

Score 1 point for each feature checked, up to a maximum of 7 points.

Diversity of Surrounding Habitat Score
(maximum 7 points) 6

1.2.4 Proximity to Other Wetlands

Check highest appropriate category. (Note: if the wetland is lacustrine, score option #1 at 8 points).

✓		Points
	Hydrologically connected by surface water to other wetlands (different dominant wetland type), or to open lake or deep river within 1.5 km	8
X	Hydrologically connected by surface water to other wetlands (same dominant wetland type) within 0.5 km	8
	Hydrologically connected by surface water to other wetlands (different dominant wetland type), or to open lake or deep river from 1.5 to 4 km away	5
	Hydrologically connected by surface water to other wetlands (same dominant wetland type) from 0.5 to 1.5 km away	5
	Within 0.75 km of other wetlands (different dominant wetland type) or open water body, but not hydrologically connected by surface water	5
	Within 1 km of other wetlands, but not hydrologically connected by surface water	2
	No wetland within 1 km	0

Name and distance (from wetland) of wetlands/waterbodies scored above:
Unevaluated and unnamed - connected by headwaters of Baxter Creek to the west

Proximity to other Wetlands Score
(maximum 8 points) 8

1.2.5 Interspersion

Number of Intersections = 369

✓	Number of Intersections *(Check one only)*	Points
	26 or less	= 3
	27 to 40	= 6
	41 to 60	= 9
	61 to 80	= 12
	81 to 100	= 15
	101 to 125	= 18
	126 to 150	= 21
	151 to 175	= 24
	176 to 200	= 27
X	>200	= 30

Interspersion Score *(maximum 30 points)* 30

1.2.6 Open Water Types

NOTE: *this attribute is only to be scored for permanently flooded open water within the wetland (adjacent lakes do not count). Check one option only.*

✓	Open Water Type	Characteristic	Points
	Type 1	Open water occupies < 5 % of wetland area	= 8
	Type 2	Open water occupies 5-25% of wetland (occurring in central area)	= 8
	Type 3	Open water occupies 5-25% (occurring in various-sized ponds, dense patches of vegetation or vegetation in diffuse stands)	= 14
	Type 4	Open water occupies 26-75% of wetland (occurring in a central area)	= 20
X	Type 5	Open water occupies 26-75% of wetlands (small ponds and embayments are common)	= 30
	Type 6	Open water occupies 76%-95% of wetland (occurring in large central area; vegetation is peripheral)	= 8
	Type 7	Open water occupies 76-95% of wetland (vegetation in patches or diffuse open stands)	= 14
	Type 8	Open water occupies more than 95% of wetland area	= 3
	No open water		= 0

Open Water Type Score *(maximum 30 points)* 30

1.3 SIZE (BIOLOGICAL COMPONENT)

Total Size of Wetland = 15.66 ha

Sum of scores from Biodiversity Subcomponent
1.2.1
+ 1.2.2
+ 1.2.3
+ 1.2.4
+ 1.2.5
+ 1.2.6

Circle the appropriate score from the table below.

Wetland size (ha)	Total Score for Biodiversity Subcomponent									
	<37	37-47	48-60	61-72	73-84	85-96	97-108	109-120	121-132	>132
<20 ha	1	5	7	8	9	17	25	34	43	50
20-40	5	7	8	9	10	19	28	37	46	50
41-60	6	8	9	10	11	21	31	40	49	50
61-80	7	9	10	11	13	23	34	43	50	50
81-100	8	10	11	13	15	25	37	46	50	50
101-120	9	11	13	15	18	28	40	49	50	50
121-140	10	13	15	17	21	31	43	50	50	50
141-160	11	15	17	19	23	34	46	50	50	50
161-180	13	17	19	21	25	37	49	50	50	50
181-200	15	19	21	23	28	40	50	50	50	50
201-400	17	21	23	25	31	43	50	50	50	50
401-600	19	23	25	28	34	46	50	50	50	50
601-800	21	25	28	31	37	49	50	50	50	50
801-1000	23	28	31	34	40	50	50	50	50	50
1001-1200	25	31	34	37	43	50	50	50	50	50
1201-1400	28	34	37	40	46	50	50	50	50	50
1401-1600	31	37	40	43	49	50	50	50	50	50
1601-1800	34	40	43	46	50	50	50	50	50	50
1801-2000	37	43	47	49	50	50	50	50	50	50
>2000	40	46	50	50	50	50	50	50	50	50

Size Score (Biological Component)
(maximum 50 points) 17

2.0 SOCIAL COMPONENT

2.1 ECONOMICALLY VALUABLE PRODUCTS

2.1.1 Wood Products

Check the option that best reflects the total area (ha) of forested wetland (i.e., areas where the dominant vegetation form is h or c). Note that this is the area of all the forested vegetation communities, not total wetland size. Do not include areas where harvest is not permitted. Check only one option.

Area of wetland used for scoring 2.1.1: 14.25

☐	< 5 ha	=	0 pts
☒	5 - 25 ha	=	3
☐	26 – 50 ha	=	6
☐	51 – 100 ha	=	9
☐	101 – 200 ha	=	12
☐	> 200 ha	=	18

Source of information:
Field studies in 2017 and local tree removal by-laws

Wood Products Score *(maximum 18 points)* 3

2.1.2 Wild Rice

Check only one.

☐	Present (min. size 0.5 ha)	=	6 pts
☒	Absent	=	0
☐	Harvest not permitted	=	0

Source of information:
Field studies in 2017

Wild Rice Score *(maximum 6 points)* 0

2.1.3 Commercial Baitfish

Check only one.

☐	Present	=	12 pts
☒	Absent	=	0
☐	Fishing not permitted	=	0

Source of information:
Field studies, MNRF baitfish license mapping

Commercial Fish Score *(maximum 12 points)* 0

2.1.4 Furbearers

Only species recognized as furbearers under the Fish & Wildlife Conservation Act may be scored here. Score 3 *points for each furbearer species listed, up to a maximum of 12 points. Score 0 points if trapping is prohibited.*

	Name of furbearer	Source of information
1.	Beaver	Field studies 2017
2.		
3.		
4.		
5.		
6.		

Furbearer Score *(maximum 12 points)* 3

2.2 RECREATIONAL ACTIVITIES

Sources of information and reasons for scoring a wetland under high or moderate use below, must be included below.

Circle one score for each of the activities listed. Score is cumulative – add score for hunting, nature enjoyment and fishing together for final score.

Intensity of Use	Type of Wetland-Associated Use: Hunting	Nature Enjoyment/ Ecosystem Study	Fishing
High	40 points	40 points	40 points
Moderate	20	20	20
Low	8	8	8
Not Possible/ No evidence	0	0	0

Sources of information (include evidence/criteria forming basis for score and any relevant reference used to obtain that information):
- e.g., Hunting scored at 20 points: 5 hunting blinds observed; hunters using area frequently monitored for compliance (source: D. Black, MNR Conservation Officer)

Hunting: One hunting blind observed (source: field studies 2017)

Nature: No evidence observed of nature enjoyment (private lands)

Fishing: No evidence observed of fishing in wetland

Recreational Activities Score
(maximum 80 points) 8

2.3 LANDSCAPE AESTHETICS

2.3.1 Distinctness

Check only one.

[X]	Clearly Distinct	=	3 pts
[ ]	Indistinct	=	0

Landscape Distinctness Score
(maximum 3 points) 3

2.3.2 Absence of Human Disturbance

Check only one.

[ ]	Human disturbances absent or nearly so	=	7 pts
[X]	One or several localized disturbances	=	4
[ ]	Moderate disturbance; localized water pollution	=	2
[ ]	Wetland intact but impairment of ecosystem quality intense in some areas	=	1
[ ]	Extreme ecological degradation, or water pollution severe and widespread	=	0

Details regarding type, extent and location of disturbance scored:
Evidence of rubbish around edges of wetlands; planting of crops right up to edges of reM1

Source of information:
Field studies 2017

Absence of Human Disturbance Score
(maximum 7 points) 4

2.4 EDUCATION AND PUBLIC AWARENESS

2.4.1 Educational Uses

Check highest appropriate category.

[ ]	Frequent	=	20 pts
[ ]	Infrequent	=	12
[x]	No visits	=	0

Details regarding the type and frequency of education uses scored above:

No evidence of educational use; private lands

Source of information:

Field studies in 2017

Educational Uses Score *(maximum 20 points)* 0

2.4.2 Facilities and Programs

Check all appropriate options, score highest category checked.

[ ]	Staffed interpretation centre	=	8 pts
[ ]	No interpretation centre or staff, but a system of self-guiding trails or brochures available	=	4
[ ]	Facilities such as maintained paths (e.g., woodchips), boardwalks, boat launches or observation towers, but no brochures or other interpretation	=	2
[x]	No facilities or programs	=	0

Additional Notes/Comments:

Source of information:

Field studies 2017

Facilities and Programs Score *(maximum 8 points)* 0

2.4.3 Research and Studies

Check all that apply; score highest category checked.

☐	Long term research has been done	=	12 pts
☐	Research papers published in refereed scientific journal or as a thesis	=	10
☐	One or more (non-research) reports have been written on some aspect of the wetland's flora, fauna, hydrology, etc.	=	5
☒	No research or reports	=	0

List of reports, publications, research studies etc. scored above:

~~No research or reports specific to this site.~~

Research and Studies Score
(maximum 12 points) 0

2.5 PROXIMITY TO AREAS OF HUMAN SETTLEMENT

Name of Settlement: Millbrook

Distance of wetland from settlement: 60 m

Population of settlement: 1,695 (Source: 2016 census)

Circle only the highest score applicable

Distance of wetland to settlement	population >10,000	population 2,500-10,000	population <2,500 or cottage community
within or adjoining settlement	40 points	26 points	16 points
0.5 to 10 km from settlement	26	16	10
10 to 60 km from settlement	12	8	4
>60 km from nearest settlement	5	2	0

Proximity to Human Settlement Score
(maximum 40 points) 16

2.6 OWNERSHIP

FA of wetland held by or held under a legal contract by a conservation body (as defined by the *Conservation Land Act*) for wetland protection	_____ x 10 = _____
FA of wetland occurring in provincially or nationally protected areas (e.g., parks and conservation reserves)	_____ x 10 = _____
FA of wetland area in Crown/public ownership, not as above	_____ x 8 = _____
FA of wetland area in private ownership, not as above	1 x 4 = 4

Source of information:
Geowarehouse parcel data

Ownership Score *(maximum 10 points)* 4

2.7 SIZE (SOCIAL COMPONENT)

Total Size of Wetland = 15.66 ha Sum of scores from Subcomponents 2.1, 2.2, and 2.5 = 30

Circle the appropriate score from the table below.

	Total for Size Dependent Social Features									
	<31	31-45	46-60	61-75	76-90	91-105	106-120	121-135	136-150	>150
<2 ha	1	2	4	8	10	12	14	14	14	15
2-4	1	2	4	8	12	13	14	14	15	16
5-8	2	2	5	9	13	14	15	15	16	16
9-12	3	3	6	10	14	15	15	16	17	17
13-17	3	4	7	10	14	15	16	16	17	17
18-28	4	5	8	11	15	16	16	17	17	18
29-37	5	7	10	13	16	17	18	18	19	19
38-49	5	7	10	13	16	17	18	18	19	20
50-62	5	8	11	14	17	17	18	19	20	20
63-81	5	8	11	15	17	18	19	20	20	20
82-105	6	9	11	15	18	18	19	20	20	20
106-137	6	9	12	16	18	19	20	20	20	20
138-178	6	9	13	16	18	19	20	20	20	20
179-233	6	9	13	16	18	20	20	20	20	20
234-302	7	9	13	16	18	20	20	20	20	20
303-393	7	9	14	17	18	20	20	20	20	20
394-511	7	10	14	17	18	20	20	20	20	20
512-665	7	10	14	17	18	20	20	20	20	20
666-863	7	10	14	17	19	20	20	20	20	20
864-1123	8	12	15	17	19	20	20	20	20	20
1124-1460	8	12	15	17	19	20	20	20	20	20
1461-1898	8	13	15	18	19	20	20	20	20	20
1899-2467	8	14	16	18	20	20	20	20	20	20
>2467	8	14	16	18	20	20	20	20	20	20

Total Size Score (Social Component) 3

2.8 ABORIGINAL VALUES AND CULTURAL HERITAGE

Either or both Aboriginal or Cultural Values may be scored. However, the maximum score permitted for 2.8 is 30 points.

Full documentation of sources must be attached to the data record.

2.8.1 Aboriginal Values

☐	Significant	=	30 pts
☐	Not Significant	=	0
☒	Unknown	=	0

Additional Comments/Notes:

No known value to indigenous peoples

2.8.2 Cultural Heritage

☐	Significant	=	30 pts
☐	Not Significant	=	0
☒	Unknown	=	0

Additional Comments/Notes:

No known value to cultural heritage

Aboriginal Values/Cultural Heritage Score
(maximum 30 points) 0

3.0 HYDROLOGICAL COMPONENT

3.1 FLOOD ATTENUATION

Check one of the following four options.

- [ ] If wetland is a single contiguous coastal wetland, ➡ score 0 points for this section.
- [ ] If all wetland units of a wetland complex are coastal wetland units, ➡ score 0 points for this section.
- [ ] If wetland or wetland complex is entirely isolated in site type, ➡ score 100 points automatically.
- [x] Wetland not as above – proceed through 'steps' A through L below.

(A) Total wetland area = 15.66 ha

(B) Size of wetland's catchment = 1181 ha

(C) Size of other detention areas in catchment = 80.04 ha

(D) Size of 'isolated' portions of wetland = 0 ha (FA = 0)

(E) Size of coastal units of wetland complex = 0 ha (FA = 0)

Points for Isolated Portion of Wetland (If not applicable, enter '0'):
(F) (FA of D) x 100 pts = 0 pts

Points for Coastal Portion(s) of Wetland (if not applicable, enter '0')
(G) (FA of E) x 100 pts = 0 pts

(H) Size of wetland minus the isolated and coastal portions = {A – D – E} = 15.66 ha

(I) Number of points available to score 'rest' of wetland = {100 – F – G} = 100 pts

(J) Total area of upstream detention areas = {A + C } = 95.7 ha

(K) Upstream Detention Factor = {(H/J) x 2} = 0.33 (maximum 1.0)

(L) Attenuation Factor = {(H/B) x 10} = 0.13 (maximum 1.0)

Flood Attenuation Final Score = {[((K + L) /2) x I] + F} = 23

Flood Attenuation Score *(maximum 100 points)* 23

3.2 WATER QUALITY IMPROVEMENT

3.2.1 Short Term Water Quality Improvement

Step 1: Determination of maximum initial score

[ ]	Wetland on one of the 5 defined large lakes or 5 major rivers (Go to Step 5A)
[X]	All other wetlands (Go through Steps 2, 3, 4, and 5B)

Step 2: Determination of Watershed Improvement Factor (WIF)

Calculation of WIF is based on the fractional area (FA) of each site type that makes up the total area of the wetland.

(FA = area of site type/total area of wetland)

FA of isolated wetland	=	x 0.5 =	
FA of riverine wetland	=	x 1.0 =	
FA of palustrine wetland with no inflow	=	x 0.7 =	
FA of palustrine wetland with inflows	= 1	x 1.0 =	1
FA of lacustrine on lake shoreline	=	x 0.2 =	
FA of lacustrine at lake inflow or outflow	=	x 1.0 =	

Sum (*WIF cannot exceed 1.0*) 1

Step 3: Determination of Catchment Land Use Factor (LUF)

(Choose the first category that fits upstream land use in the catchment.)

[X]	Over 50% agricultural and/or urban	=	1.0
[ ]	Between 30 and 50% agricultural and/or urban	=	0.8
[ ]	Over 50% forested or other natural vegetation	=	0.6

LUF *(maximum 1.0)* 1

Step 4: Determination of Pollutant Uptake Factor (PUF)

Calculation of PUF is based on the fractional area (FA) of each vegetation type that makes up the total area of the wetland. Base assessment on the dominant vegetation form for each community except where dead trees or shrubs dominate. In that case base assessment on the dominant live vegetation type.

(FA = area of vegetation type/total area of wetland)

FA of wetland with live trees, shrubs, herbs or mosses (c, h, ts, ls, gc, m)	= x 0.75 =	0.70
FA of wetland with emergent, submergent or floating vegetation (re, be, ne, su, f, ff)	= x 1.0 =	0.10
FA of wetland with little or no vegetation (u)	= x 0.5 =	

Sum *(PUF cannot exceed 1.0)* 0.80

Step 5: Calculation of final score

☐	Wetland on defined 5 major lakes or 5 major rivers	0
☒	All other wetlands – calculate as follows	
	Initial score	60
	Watershed Improvement Factor (WIF)	1
	Land Use Factor (LUF)	1
	Pollutant Uptake Factor (PUF)	0.80
	Final score: 60 x WIF x LUF x PUF =	48

Short Term Water Quality Improvement Score
(maximum 60 points) 48

3.2.2 Long Term Nutrient Trap

Step 1:

☐ Wetland on defined 5 major lakes or 5 major rivers = 0 points
☒ All other wetlands (Proceed to Step 2)

Step 2: Choose only one of the following settings that best describes the wetland being evaluated

☐	Wetland located in a river mouth	=	10 pts
☐	Wetland is a bog, fen, or swamp with more than 50% of the wetland being covered with organic soil	=	10
☒	Wetland is a bog, fen, or swamp with less than 50% of the wetland being covered with organic soil	=	3
☐	Wetland is a marsh with more than 50% of the wetland covered with organic soil	=	3
☐	None of the above	=	0

Long Term Nutrient Trap Score
(maximum 10 points) 3

3.2.3 Groundwater Discharge

Circle the characteristics that best describe the wetland being evaluated and then sum the scores. If the sum exceeds 30 points, assign the maximum score of 30). Note: for wetland type, wetland type scored does not have to the dominant type in the wetland.

Wetland Characteristics	Potential for Discharge		
	None to Little	Some	High
Wetland type	Bog = 0	Swamp/Marsh = 2	Fen = 5
Topography	Flat/rolling = 0	Hilly = 2	Steep = 5
Wetland area: Upslope catchment area	Large (>50%) = 0	Moderate (5-50%) = 2	Small (<5%) = 5
Lagg development	None found = 0	Minor = 2	Extensive = 5
Seeps	None = 0	≤ 3 seeps = 2	> 3 seeps = 5
Surface marl deposits	None = 0	≤ 3 sites = 2	> 3 sites = 5
Iron precipitates	None = 0	≤ 3 sites = 2	> 3 sites = 5
Located within 1 km of a major aquifer	N/A = 0	N/A = 0	Yes = 10 No = 0

Additional Comments/Notes:

Groundwater Discharge Score
(maximum 30 points) 14

3.3 CARBON SINK

Check only one of the following:

[ ]	Bog, fen or swamp with more than 50% coverage by organic soil	=	5 pts
[ ]	Bog, fen or swamp with between 10 to 50% coverage by organic soil	=	2
[ ]	Marsh with more than 50% coverage by organic soil	=	3
[x]	Wetlands not in one of the above categories	=	0

Source of information:

Field studies carried out in 2017 as well as Ontario soil mapping

Carbon Sink Score
(maximum 5 points) 0

3.4 SHORELINE EROSION CONTROL

From the wetland vegetation map determine the dominant vegetatino type within the erosion zone for lacustrine and riverine site type areas only. Score according to the factors listed below.

Step 1:

[x]	Wetland entirely isolated or palustrine	=	0 pts
[ ]	Any part of the wetland is riverine or lacustrine	=	Go to step 2

Step 2: *Choose the one characteristic that best describes the shoreline vegetation (see page 109 for description of "shoreline".)*

[ ]	Trees and shrubs	=	15 pts
[ ]	Emergent vegetation	=	8
[ ]	Submergent vegetation	=	6
[ ]	Other shoreline vegetation	=	3
[ ]	No vegetation	=	0

Shoreline Erosion Control Score
(maximum 15 points) 0

3.5 GROUNDWATER RECHARGE

3.5.1 Site Type

Wetland > 50% lacustrine (by area) or located on one of the five major rivers		= 0 pts	
Wetland not as above. Calculate final score as follows:			
■ FA of isolated or palustrine wetland	= 1	x 50 =	50
■ FA of riverine wetland	=	x 20 =	
■ FA of lacustrine wetland (not dominant site type)	=	x 0 =	

Groundwater Recharge/Wetland Site Type Score *(maximum 50 points)* 50

3.5.2 Soil Recharge Potential

*Circle only one choice that **best** describes the soils in **the area surrounding the wetland** being evaluated (the soils within the wetland are not scored here).*

Dominant Wetland Type	Group A, B, C (sands, gravels, loams)	Group D (clays, substrates in high water tables, shallow substrates over impervious materials such as bedrock)
Lacustrine or major river	0	0
Isolated	10	5
Palustrine	7	4
Riverine (not on a major river)	5	2

Groundwater Recharge/Wetland Soil Recharge Potential Score *(maximum 10 points)* 7

4.0 SPECIAL FEATURES COMPONENT

4.1 RARITY

4.1.1 Wetland Types

Ecodistrict	Rarity within the Landscape (4.1.1.1)	Rarity of Wetland Type (4.1.1.2)			
		Marsh	Swamp	Fen	Bog
6E-1	60	40	0	80	80
6E -2	60	40	0	80	80
6E-4	60	40	0	80	80
6E-5	20	40	0	80	80
6E-6	40	20	0	80	80
6E-7	60	10	0	80	80
6E-8	20	20	0	80	80
6E-9	0	20	0	80	80
6E-10	20	0	20	80	80
6E-11	0	30	0	80	80
6E-12	0	30	0	60	80
6E-13	60	10	0	80	80
6E-14	40	20	0	40	80
6E-15	40	0	0	80	80
6E-16	60	20	0	80	60
6E-17	40	10	0	30	80
7E-1	60	0	60	80	80
7E-2	60	0	0	80	80
7E-3	60	00	0	80	80
7E-4	80	0	0	80	80
7E-5	60	20	0	80	80
7E-6	80	30	0	80	80

4.1.1.1 Rarity within the Landscape

Choose appropriate score from 2nd column above.

Score *(maximum 80 points)* 20

4.1.1.2 Rarity of Wetland Type

Score is cumulative, based on presence/absence. Circle all appropriate scores from above table and sum.

Score *(maximum 80 points)* 20

4.1.2 Species

4.1.2.1 Reproductive Habitat for an Endangered or Threatened Species

Under the "Activity" column, when scoring animal species, record what the animal was doing when observed (e.g., nesting, courtship, singing, etc).

Common Name	Scientific Name	Activity	Date Observed	Info Source

For each species score 250 points. (Score is cumulative, no maximum score)

Additional Notes/Comments:

~~None observed during studies of breeding birds, amphibians and ecological land classification.~~

Reproductive Habitat for Endangered or Threatened Species *(no maximum)* 0

4.1.2.2 Traditional Migration or Feeding Habitat for an Endangered or Threatened Species

Under the "Activity" column, when scoring animal species, record what the animal was doing when observed (e.g., nesting, courtship, singing, feeding, resting etc). Dates that species has been recorded using the wetland must be included in the table below.

Common Name	Scientific Name	Activity	Dates Observed	Info Source

For one species score 150 points; for each additional species score 75 points. (Score is cumulative)

Additional Notes/Comments:

None known to have traditional migration or feeding habitat in wetland

Traditional Habitat for Endangered or Threatened Species *(no maximum)* 0

4.1.2.3 Provincially Significant Animal Species

Common Name	Scientific Name	Activity	Dates Observed	Info Source
Canada Warbler	Cardellina canadensis	Singing Male	June.8.2017	Bird Survey
Golden-winged Warbler	Vermivora chrysoptera	Singing Male	June.8.2017	Bird Survey
Wood Thrush	Hylocichla mustelina	Singing Male	June.8.2017	Bird Survey
Eastern Wood-pewee	Contopus virens	Singing Male	June.8.2017	Bird Survey

Additional Notes/Comments:

Bird species tracked by the NHIC. All are also listed as Special Concern under the Endangered Species Act, 2007. The four species observed are common over larger woodland interior habitat and shrub thicket (Golden-winged) and may have been migrating through at the time of the survey on June 8 as only Eastern Wood-pewee was observed during a second survey on June.21.2017.

One species = 50 pts	9 species = 140 pts	17 species = 160 pts
2 species = 80	10 species = 143	18 species = 162
3 species = 95	11 species = 146	19 species = 164
4 species = 105	12 species = 149	20 species = 166
5 species = 115	13 species = 152	21 species = 168
6 species = 125	14 species = 154	22 species = 170
7 species = 130	15 species = 156	23 species = 172
8 species = 135	16 species = 158	24 species = 174
		25 species = 176

Add one point for every species past 25 (for example, 26 species = 177 points, 27 species = 178 points etc.)

Provincially Significant Animal Species
(no maximum) 105

4.1.2.4 Provincially Significant Plant Species

Common Name	Scientific Name	Activity	Dates Observed	Info Source

Additional Notes/Comments:

Upland communities contained three significant species, Striped Cream Violet (Viola striata) (S3), Scarlet Beebalm (Monarda didyma) (S3) and Butternut (Juglans cinerea) (S3?) though none of these were observed directly in the wetland or dependent on wetland habitat to survive.

One species	= 50 pts	9 species	= 140 pts	17 species	= 160 pts
2 species	= 80	10 species	= 143	18 species	= 162
3 species	= 95	11 species	= 146	19 species	= 164
4 species	= 105	12 species	= 149	20 species	= 166
5 species	= 115	13 species	= 152	21 species	= 168
6 species	= 125	14 species	= 154	22 species	= 170
7 species	= 130	15 species	= 156	23 species	= 172
8 species	= 135	16 species	= 158	24 species	= 174
				25 species	= 176

Add one point for every species past 25 (for example, 26 species = 177 points, 27 species = 178 points etc.)

Provincially Significant Plant Species
(no maximum) 0

4.1.2.5 Regionally Significant Species

Common Name	Scientific Name	Activity	Dates Observed	Info Source

One species= 20 pts	4 species = 45 pts	7 species = 58 pts
2 species = 30	5 species = 50	8 species = 61
3 species = 40	6 species = 55	9 species = 64
		10 species = 67

For each significant species over 10 in wetland, add 1 point.

Riley.1989 reviewed. No flora species designated as regionally significant

Regionally Significant Species Score
(no maximum score) 0

4.1.2.6 Locally Significant Species

Common Name	Scientific Name	Activity	Dates Observed	Info Source

One species= 10 pts	4 species = 31 pts	7 species = 43 pts
2 species = 17	5 species = 38	8 species = 45
3 species = 24	6 species = 41	9 species = 47
		10 species = 49

For each significant species over 10 in wetland, add 1 point.

No documents known to designate local significance for Peterborough County.

Locally Significant Species Score
(no maximum score) 0

4.2 SIGNIFICANT FEATURES AND HABITATS

4.2.1 Colonial Waterbirds

Record all available information. Score the highest applicable category. Include additional information as possible (e.g., nest locations, etc).

Activity	Species	Info Source	Points
Currently nesting			= 50
Known to have nested within the past 5 years			= 25
Active feeding area (great blue heron excluded)			= 15
None known			= 0

Additional Notes/Comments:

No evidence of current or past nesting of colonial waterbirds.

Colonial Waterbird Nesting Score
(maximum 50 points) 0

4.2.2 Winter Cover for Wildlife

Score highest appropriate category. Include rationale/sources of information.

☐	Provincially significant	=	100 pts
☐	Significant in Ecoregion	=	50
☐	Significant in Ecodistrict	=	25
☐	Locally significant	=	10
☒	Little or poor winter cover	=	0

Species/habitat/vegetation community scored *(e.g., winter deer cover in hemlock swamp, S3 and S4b)*:

Source of information:

Winter Cover for Wildlife Score
(maximum 100 points) 0

4.2.3 Waterfowl Staging and/or Moulting Areas

Check highest level of significance for both staging and moulting; add scores for staging and for moulting together for final score. However, maximum score for evaluation under this section is 150 points.

	Staging		Moulting	
Nationally/internationally significant		= 150 pts		= 150 pts
Provincially significant		= 100		= 100
Significant in the Ecoregion		= 50		= 50
Significant in Ecodistrict		= 25		= 25
Known to occur		= 10		= 10
Not possible/Unknown	X	= 0	X	= 0

Species/habitat/vegetation community scored *(e.g., approx 20 mallards in W3)*:
very few occurrences of waterfowl during field studies

Source of information:

Waterfowl Staging/Moulting Score
(maximum 150 points) 0

4.2.4 Waterfowl Breeding

Check highest level of significance.

	Nationally/internationally significant	= 150 pts
	Provincially significant	= 100
	Significant in the Ecoregion	= 50
	Significant in Ecodistrict	= 25
X	Habitat Suitable	= 10
	Habitat not suitable	= 0

Species/habitat/vegetation community scored *(e.g., mallard in W3)*:
Mallards and Wood Duck observed during breeding bird surveys exhibiting probable breeding.

Source of information:
Breeding Bird Surveys in June 2017

Waterfowl Breeding Score
(maximum 150 points) 10

4.2.5 Migratory Passerine, Shorebird or Raptor Stopover Area

Check highest level of significance.

	Nationally / internationally significant	= 150 pts
	Provincially significant	= 100
	Significant in Ecoregion	= 50
	Significant in Ecodistrict	= 25
X	Known to occur	= 10
	Not possible / Unknown	= 0

Species/habitat/vegetation community scored:
Some passerine species observed during surveys were only observed during the first in early June which may be an indication of migratory stopover

Source of information:
Breeding Bird Surveys in June 2017

Passerine, Shorebird or Raptor Stopover Score
(maximum 100 points) 10

4.2.6 Fish Habitat

4.2.6.1 Spawning and Nursery Habitat

Area Factors for Low Marsh, High Marsh and Swamp Communities.

No. of ha of Fish Habitat	Area Factor
< 0.5 ha	0.1
0.5 – 4.9	0.2
5.0 – 9.9	0.4
10.0 – 14.9	0.6
15.0 – 19.9	0.8
20.0 +	1.0

Step 1:

☐ Fish habitat is not present within the wetland	Go to Step 7, Score 0 points
☒ Fish habitat is present within the wetland	Go to Step 2

Step 2: *Choose only one option*

☐ Significance of the spawning and nursery habitat within the wetland is known	Go to Step 3
☒ Significance of the spawning and nursery habitat within the wetland is not known	Go through Steps 4, 5 and 6

Step 3: *Select the highest appropriate category below, attach documentation:*

☐ Significant in Ecoregion	Go to Step 7, Score 100 points
☐ Significant in Ecodistrict	Go to Step 7, Score 50 points
☐ Locally Significant Habitat (5.0+ ha)	Go to Step 7, Score 25 points
☐ Locally Significant Habitat (<5.0 ha)	Go to Step 7, Score 15 points

Source of information:

Step 4: Low Marsh = the '**permanent**' marsh area, from the existing water line out to the outer boundary of the wetland.

☒ Low marsh not present	Go to Step 5
☐ Low marsh present	Continue through Step 4, scoring as noted below

Scoring of Low Marsh:

1. Check the appropriate **Vegetation Group** (see Appendix 7) for each Low Marsh community. (Based on the one most clearly dominant plant species of the dominant form in each Low Marsh vegetation community.)
2. Sum the areas (ha) of the vegetation communities assigned to each **Vegetation Group**.
3. Use these areas to assign an **Area Factor** for each checked **Vegetation Group**.
4. Multiply the **Area Factor** by the **Multiplication Factor** for each row to calculate **Score**.
5. Sum all numbers in Score column to get **Total Score for Low Marsh**.

Scoring for Presence of Key Vegetation Groups – Low Marsh

Vegetation Group Number	Vegetation Group Name	Present as a Dominant Form (check)	Total Area (ha)	Area Factor (from Table 8)	Multiplication Factor	Score
1	Tallgrass				6	
2	Shortgrass-Sedge				11	
3	Cattail-Bulrush-Burreed				5	
4	Arrowhead-Pickerelweed				5	
5	Duckweed				2	
6	Smartweed-Waterwillow				6	
7	Waterlily-Lotus				11	
8	Waterweed-Watercress				9	
9	Ribbongrass				10	
10	Coontail-Naiad-Watermilfoil				13	
11	Narrowleaf Pondweed				5	
12	Broadleaf Pondweed				8	

Total Score for Low Marsh (*maximum 75 points*)

Continue to Step 5

Step 5: High Marsh = the 'seasonal' marsh area, from the water line to the inland boundary of marsh wetland type. This is essentially what is commonly referred to as a wet meadow, in that there is insufficient standing water to provide fisheries habitat except during flood or high water conditions.

☒	High marsh not present	Go to Step 6
☐	High marsh present	Continue through Step 5, scoring as noted below

Scoring of High Marsh:

1. Check the appropriate **Vegetation Group** (see Appendix 7) for each High Marsh community. (Based on the one most clearly dominant plant species of the dominant form in each High Marsh vegetation community.)
2. Sum the areas (ha) of the vegetation communities assigned to each **Vegetation Group**.
3. Use these areas to assign an **Area Factor** (from Table 8) for each checked **Vegetation Group**.
4. Multiply the **Area Factor** by the **Multiplication Factor** for each row to calculate **Score**.
5. Sum all numbers in Score column to get **Total Score for High Marsh**.

Scoring for Presence of Key Vegetation Groups – High Marsh

Vegetation Group Number	Vegetation Group Name	Present as a Dominant Form (check)	Total Area (ha)	Area Factor (from Table 8)	Multiplication Factor	Score
1	Tallgrass	☐			6	
2	Shortgrass-Sedge	☐			11	
3	Cattail-Bulrush-Burreed	☐			5	
4	Arrowhead-Pickerelweed	☐			5	
	Total Score for High Marsh (*maximum 25 points*)					

Continue to Step 6

Step 6:

☐	Swamp containing fish habitat not present	Go to Step 7
☒	Swamp containing fish habitat present	Continue through Step 6, scoring as follows

Scoring of Swamp:

1. Determine the total area (ha) of seasonally flooded swamp communities within the wetland containing fish habitat and record below.
2. Determine the total area (ha) of permanently flooded swamp communities within the wetland containing fish habitat and record below.
3. Use these areas to assign an **Area Factor** (from Table 8).
4. Multiply the Area Factor by the **Multiplication Factor** for each row to calculate **Score**.
5. Sum all numbers in Score column to get **Total Score for Swamp**.

Scoring Swamps for Fish Habitat (Seasonally flooded; Permanently flooded)

Swamp Containing Fish Habitat	Present (check)	Total Area (ha)	Area Factor (from Table 8)	Multiplication Factor	Score
Seasonally Flooded Swamp	☐			10	
Permanently Flooded Swamp	☒	14.2	0.6	10	6
		Total Score for Swamp (*maximum 20 points*)			6

Continue to Step 7

Step 7: CALCULATION OF FINAL SCORE

NOTE: Scores for Steps 4, 5 and 6 are only recorded if Steps 1 and 3 have not been scored.

A. Score from Step 1 (fish habitat not present) = _____
B. Score from Step 3 (significance known) = _____
C. Score from Step 4 (Low Marsh) = _____
D. Score from Step 5 (High Marsh) = _____
E. Score from Step 6 (Swamp) = 6

Calculation of Final Score for Spawning and Nursery Habitat = A or B or Sum of C, D, and E

Score for Spawning and Nursery Habitat
(maximum 100 points) 6

4.2.6.2 Migration and Staging Habitat

Step 1:

[X]	Staging or Migration Habitat is not present in the wetland	Go to Step 4, Score 0 points
[ ]	Staging or Migration Habitat is present in the wetland, significance of the habitat is known	Go to Step 2
[ ]	Staging or Migration Habitat is present in the wetland, significance of the habitat is not known	Go to Step 3

Step 2: Select the highest appropriate category below. Ensure that documentation is attached to the data record.

[ ]	Significant in Ecoregion	Score 25 points in Step 4
[ ]	Significant in Ecodistrict	Score 15 points in Step 4
[ ]	Locally Significant	Score 10 points in Step 4
[ ]	Fish staging and/or migration habitat present, but not as above	Score 5 points in Step 4

Source of information:
Field studies in 2017

Step 3: Select the highest appropriate category below based on presence of the designated site type (i.e. does not have to be the dominant site type). Refer to Site Types recorded earlier (section 1.1.3). Attach documentation.

[ ]	Wetland is riverine at rivermouth or lacustrine at rivermouth	Score 25 points in Step 4
[ ]	Wetland is riverine, within 0.75 km of rivermouth	Score 15 points in Step 4
[ ]	Wetland is lacustrine, within 0.75 km of rivermouth	Score 10 points in Step 4
[ ]	Fish staging and/or migration habitat present, but not as above	Score 5 points in Step 4

Step 4: Enter a score from only one of the three above Steps.

Score for Staging and Migration Habitat
(maximum 25 points) 0

4.3 ECOSYSTEM AGE

		Fractional Area		Score
Bog	=		x 25 =	
Fen, on deeper soils; floating mats or marl	=		x 20 =	
Fen, on limestone rock	=		x 5 =	
Swamp	=	.90	x 3 =	2.7
Marsh	=	.10	x 0 =	.10
		Total	=	2.80

Ecosystem Age Score *(maximum 25 points)* 2.8

4.4 GREAT LAKES COASTAL WETLANDS

Choose one only. Only coastal wetland units may be scored.

☐	Wetland < 10 ha	=	10 pts
☐	Wetland 10-50 ha	=	25
☐	Wetland 51-100 ha	=	50
☐	Wetland > 100 ha	=	75

If the wetland is a complex, identify which wetlands units or wetland communities are being scored as coastal:

Not a coastal wetland unit.

Great Lakes Coastal Wetland Score
(maximum 75 points) 0

5.0 DOCUMENTATION OF WETLAND FEATURES NOT INCLUDED IN THE EVALUATION

5.1 INVASIVE SPECIES

Attach documentation of invasive species found in wetland (include location information and a coarse estimate of abundance [F = few, C = fairly common, A = abundant]):

A number of invasive species were observed during 2017 studies within and adjacent to the wetland units and include:
Common Buckthorn, Creeping Wildrye, Reed Canary Grass (non-native), European Common Reed, Manitoba Maple (introduced to Ecoregion 6E), Common Lilac, European Barberry, Crack Willow, Bittersweet Nightshade, Colt's-foot

5.2 VERNAL POOLS

Documentation of information on vernal pools encountered during the wetland evaluation but not included as part of the evaluated wetland.

5.3 SPECIES OF SPECIAL INTEREST

5.3.1 Osprey

Check all that apply:

- [ ] Present and nesting
- [ ] Known to have nested in last 5 years
- [ ] Feeding area for Osprey
- [x] Not as above

5.3.2 Common Loon

Check all that apply:

- [ ] Nesting in wetland
- [ ] Feeding at edge of wetland
- [ ] Observed or heard on lake or river adjoining the wetland
- [x] Not as above

5.4 IMPORTANT DRINKING WATER AREA

Wetland located within:
(check all that apply)

- [ ] Wellhead Protection Area
- [x] Intake Protection Zone
- [ ] Significant Recharge Area
- [x] Vulnerable Aquifer Area

Source of information:
Ontario Ministry of Agriculture, Food and Rural Affairs (AgMaps)

Additional Comments:
Wetland overlaps Intake Protection Zone 3 and Highly Vulnerable Aquifer (Queens Printer for Ontario, 2017)

5.5 AREA OF WETLAND RESTORATION POTENTIAL

Check all that apply. Attach additional pages if necessary.

- ☐ Area of wetland restoration potential adjacent to evaluated wetland unit(s)
- ☐ Area of wetland restoration potential within 750m of evaluated wetland unit(s), but not adjacent
- ☐ Area of wetland restoration potential encountered elsewhere
- ☐ Area currently functioning as wetland (e.g., showing signs of degradation but still mapped as wetland).
- ☐ Adjacent Wetland Unit (if applicable): _____
- ☐ GPS Coordinates of Site: _____

Description of site (e.g., current land use, wetland characteristics of site, etc) and why it is identified as an area of restoration potential:

Additional Notes/Comments (e.g., adjacent lands, etc)

General Information

Wetland Evaluator(s)

Name: Jonathan Harris (OWES certified) Affiliation: Dillon Consulting Limited

Name: Dayna LeClair (birds) Affiliation: Dillon Consulting Limited

Name: Ryan Godfrey (vegetation/amphibians) Affiliation: Dillon Consulting Limited

Name: Kate Roper (amphibians) Affiliation: Dillon Consulting Limited

Name: Cale Hartin (aquatics/) Affiliation: Dillon Consulting Limited

Date(s) wetland visited (in field): All in 2017 - April 21, May 18, June 8, June 20, June 21, June 29, July 28,

Date evaluation completed: October 24, 2017

Estimated time devoted to completing the field survey in person hours: 20 hours

Weather Conditions

i) at time of field work: range of 6 C to high 20s, generally sunny, clear skies

ii) summer conditions in general: higher than average precipitation (505 mm between March and August)

WETLAND EVALUATION SCORING RECORD

WETLAND NAME: Baxter Creek Headwaters Wetland Complex

1.0 BIOLOGICAL COMPONENT

	1.1 PRODUCTIVITY
22	1.1.1 Growing Degree-Days/Soils
9	1.1.2 Wetland Type
2	1.1.3 Site Type
33	
	1.2 BIODIVERSITY
13	1.2.1 Number of Wetland Types
3.5	1.2.2 Vegetation Communities
6	1.2.3 Diversity of Surrounding Habitat
8	1.2.4 Proximity to Other Wetlands
30	1.2.5 Interspersion
30	1.2.6 Open Water Type
90.5	
17	1.3 SIZE (Biological Component)
107.5	TOTAL (Biological Component)

2.0 SOCIAL COMPONENT

	2.1 ECONOMICALLY VALUABLE PRODUCTS
3	2.1.1 Wood Products
0	2.1.2 Wild Rice
0	2.1.3 Commerical Baitfish
3	2.1.4 Furbearers
6	Total for Economically Valuable Products
8	2.2 RECREATIONAL ACTIVITIES
	2.3 LANDSCAPE AESTHETICS
3	2.3.1 Distinctness
4	2.3.2 Absence of Human Disturbance
7	Total for Landscape Aesthetics
	2.4 EDUCATION AND PUBLIC AWARENESS
0	2.4.1 Educational Uses
0	2.4.2 Facilities and Programs
0	2.4.3 Research and Studies
0	Total for Education and Public Awareness
16	2.5 PROXIMITY TO AREAS OF HUMAN SETTLEMENT
4	2.6 OWNERSHIP
3	2.7 SIZE (Social Component)
	2.8 ABORIGINAL VALUES AND CULTURAL HERITAGE
0	2.8.1 Aboriginal Values
0	2.8.2 Cultural Heritage
41	TOTAL (Social Component)

3.0 HYDROLOGICAL COMPONENT

23	3.1 FLOOD ATTENUATION
	3.2 WATER QUALITY IMPROVEMENT
48	3.2.1 Short Term Water Quality Improvement
3	3.2.2 Long Term Nutrient Trap
14	3.2.3 Groundwater Discharge
66	Total for Water Quality Improvement
0	3.3 CARBON SINK
0	3.4 SHORELINE EROSION CONTROL
	3.5 GROUNDWATER RECHARGE
50	3.5.1 Site Type
7	3.5.2 Soil Recharge Potential
57	Total for Groundwater Recharge
146	TOTAL (Hydrological Component)

4.0 SPECIAL FEATURES COMPONENT

4.1 RARITY

4.1.1 Wetlands

20	4.1.1.1 Rarity within the Landscape
20	4.1.1.2 Rarity of Wetland Type
40	Total for Wetland Rarity

4.1.2 Species

0	4.1.2.1 Reproductive Habitat for an Endangered or Threatened Species
0	4.1.2.2 Traditional Migration or Feeding Habitat for an Endangered or Threatened Species
105	4.1.2.3 Provincially Significant Animal Species
0	4.1.2.4 Provincially Significant Plant Species
0	4.1.2.5 Regionally Significant Species
0	4.1.2.6 Locally Significant Species
105	Total for Species Rarity

4.2 SIGNIFICANT FEATURES AND HABITATS

0	4.2.1 Colonial Waterbirds
0	4.2.2 Winter Cover for Wildlife
0	4.2.3 Waterfowl Staging and/or Moulting Areas
10	4.2.4 Waterfowl Breeding
10	4.2.5 Migratory Passerine, Shorebird or Raptor Stopover Area
	4.2.6 Fish Habitat
6	4.2.6.1 Spawning and Nursery Habitat
0	4.2.6.2 Migration and Staging Habitat
26	Total for Significant Features and Habitats

2.8	4.3 ECOSYSTEM AGE
0	4.4 GREAT LAKES COASTAL WETLANDS
174.8	TOTAL FOR SPECIAL FEATURES COMPONENT (*not to exceed 250*)

SUMMARY OF EVALUATION RESULT

Wetland Baxter Creek Headwaters Wetland Complex

107.5 1.0 TOTAL FOR BIOLOGICAL COMPONENT

41 2.0 TOTAL FOR SOCIAL COMPONENT

146 3.0 TOTAL FOR HYDROLOGICAL COMPONENT

173.8 4.0 TOTAL FOR SPECIAL FEATURES COMPONENT

468.3 TOTAL WETLAND SCORE

FOR MNR USE ONLY

MNR Reviewer (Name & Position) _____

Reviewer Comments _____

MNR Approver (Name & Position) _____

Approval Date _____

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