Environmental Impact Statement for Barrhaven Conservancy Phase 1

July 11, 2018

Submitted To:

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TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

1.0 INTRODUCTION

This report is an Environmental Impact Statement (EIS) written by Kilgour & Associates Ltd. (KAL) on behalf of Barrhaven Conservancy East Inc. (BCE) in support of their proposed development of Phase I of their property located between Strandherd Road and the Jock River near Borrisokane Road in Ottawa. The Phase I Barrhaven Conservancy development will be located on land parcels at 3285 Borrisokane Road (herein the site). There are several triggers for this EIS including: 1) the presence of potential habitat for species at risk (SAR) including Blanding's Turtle (*Emydoidea blandingii*), Barn Swallow (*Hirundo rustica*), and Bobolink (*Dolichonyx oryzivorus*), and 2) the potential for fish and fish habitat within the drains crossing the site.

The site is composed almost entirely of active agricultural areas partitioned by tree hedgerows. No areas on or adjacent to the Phase 1 area in indicated as potential natural heritage areas within City of Ottawa Schedule L2. This EIS provides information on existing conditions at the site and on adjacent lands. It also includes a tree inventory for the site, providing a Tree Consecration Report (TCR), as a component of study. The presence of the drains on the property, which connect to Jock River to the south, were fully described and evaluated through a Headwater Drainage Features Assessment (HDFA – KAL, 2017) to assess aquatic habitat characteristics and fish communities.

2.0 PROPERTY INFORMATION

The Phase I Barrhaven Conservancy site covers approximately 8.69 ha of the 3285 Borrisokane Road property parcel (Nepean PIN: 045950057; Figure 1). This parcel occurs to the east of Borrisokane between Strandherd Road and the Jock River. It is wholly owned by BCE. The site currently occurs within the Developmental Reserve Zone (DR).

The property has historically been used for agricultural activities as indicted in geoOttawa (Ottawa, 2017a) aerial photography from 1976, and still is used for this purpose. The main channel of the former Fraser-Clarke municipal drain crosses the site. A stormwater management pond is located approximately 50 m to the east of the site, and another drain, the Burnett Drain, is located > 350 m beyond the eastern end of the site.

3.0 SITE AND THE NATURAL ENVIRONMENT

3.1 Methodology and Area of Detailed Assessment

Colour digital aerial photographs from geoOttawa (Ottawa, 2017a) and Google Earth were used to initially identify natural environment features on the broader site through a desktop review. Ontario Base Map (OBM), geoOttawa, and Ottawa OP Schedule L layers (Ottawa, 2007) were used to demarcate surface water, potential wetland areas, and other natural heritage system features and were overlaid on the aerial photographs to aid interpretation.

Additional information on natural heritage features and wildlife species for the site was obtained from online sources, which include but are not limited to:

- Natural Heritage Information Centre (NHIC, 2017);
- Rideau Valley Conservation Authority (RVCA, 2017);
- Species at Risk Public Registry (Canada, 2017);
- Ontario Species at Risk List (MNRF, 2017);
- Breeding Bird Atlas of Ontario (OBBA) (Cadman *et al*. 2007);
- Bat Conservation International species profiles (BCI, 2017); and,
- Reptiles and Amphibians of Ontario (Ontario Nature, 2017).

During numerous field visits, KAL biologists surveyed for potential SAR presence and habitat for SAR to occur on site, and identified and described other natural heritage features.

3.2 Landform, Soils and Geology

The property is located within the Ottawa Valley Clay Plains which are composed of areas of Champlain Sea deposits, glacial deposits and drumlins, glaciofluvial deposits, shallow and exposed bedrock, and peat and muck from wetlands (Schut and Wilson, 1987). On a more local scale, the property occurs within the Piperville, North Gower and Dalhousie associations.

The Piperville association is a group of soils developed in slightly acid to neutral, moderately coarse to medium-textured, marine, estuarine, and fluvial materials, and are composed of Gleyed Melanic Brunisols, Orthic Humic Gleysols, and Rego Gleysols (Schut and Wilson, 1987). These soils are dominantly poorly drained Orthic Humic Gleysols found on level to very gently sloping topography (between 0% to 2%).

The Dalhousie association consists of soils developed in fine-textured, modified marine materials with soils profiles that include Gleyed Orthic Melanic Brunisols, Orthic Humic Gleysols, and Rego Gelysols (Schut and Wilson, 1987). These soils are dominantly poorly drained Orthic Humic Gleysols found on level to very gently sloping topography (between 0% and 2%).

The North Gower association is made up of soils developed in moderately fine-textured, modified marine parent materials, and includes Humic Gleysols, Rego Gleysols, and Gleyed Gray Brown Luvisols soil profiles (Schut and Wilson, 1987). These soils are poorly drained Orthic Humic Gleysols found on level to very gently sloping topography (between 0% and 2%).

The property is mostly flat with a few small lower lying areas throughout, though it generally slopes gently near the Fraser-Clarke Drain to allow sheet flow runoff.

There are no rocky outcrops on the site and no Earth Science Areas or Natural and Scientific Interest as designated by the Ministry of Natural Resources identified in OP Schedule K (Ottawa, 2014).

3.3 Surface Water, Groundwater and Fish Habitat

The site and adjacent lands lie within the Jock River watershed in the Jock River-Barrhaven Catchment subwatershed (SWS) (RVCA, 2010). The Jock River flows eastward to the Rideau River approximately 175 m (at its closest point) south of the property. A former municipal drain – the Fraser-Clarke Drain– occurs on the property that connects to the Jock River. The Fraser-Clarke Drain no longer has status as a municipal

drain under the Drainage Act. It was abandoned by the landowners.:. There is also an agricultural drain on the site.

The Barrhaven Catchment provides fish habitat to 40 fish species (RVCA, 2010). Although, very few of these species are likely to be found within the drains on the property, and only one (Bridle Shiner [*Notropis bifrenatus*]) is designated as SAR in Ontario (Ontario, 2017).

No Provincially Significant Wetlands or undesignated wetlands were indicated on the site by the City, RVCA, or MNRF mapping. A portion of the site occurs within the 100-year floodplain boundary for the Jock River, yet it remained mostly dry this year, despite Ottawa experiencing high amounts of rainfall.

Headwater drainage feature assessment (HDFA) of the site was completed by KAL in 2017 (KAL, 2017, see Appendix C). The HDFA followed the Ontario Stream Assessment Protocol (OSAP) methodologies for descriptions of flow conditions, riparian vegetation and site features that are important components of habitat (headwater sampling protocol OSAP S4.M10), and included an electrofishing survey to describe fish and fish habitat (OSAP S4.M10). OSAP investigations of HDFs were conducted by KAL biologists on April 7, electrofishing surveys were conducted on May 4, and a final survey was performed on July 5, 2017.

The HDFA identified two surface water features on the site. The first is the channel of the former Fraser-Clark drain and the second is a small agricultural drain (listed as features R14 and R16 respectively in the HDFA). These features contained flowing water during the spring and early summer but mostly dry by July.

(Former) Fraser-Clarke Drain

The section of the former Fraser-Clarke Drain that flows eastwards along the southern border of the property is approximately 570 m. The former Fraser-Clarke Drain confluences with the Jock River about 450 m further downstream. Both banks of the reaches flow through cropped land. Instream vegetation consists of grasses and cattails.

The substrate consisted of silt and clay. Woody debris and submergent vegetation are present in patches, especially within the hedgerow in the downstream section of the reach. The reach was flooded in April with slow flow. In May and July, the reach was characterized by interstitial flow. Eleven fish were observed in this reach; eight Common Shiners (*Luxilus cornutus*), two Banded Killifish (*Fundulus diaphanus*), and one Creek Chub (*Semotilus atromaculatus*). American Toads (*Anaxyrus americanus*), Gray Treefrogs (*Hyla versicolor*), Green Frogs (*Rana clamitans*) and Northern Leopard Frogs (*Lithobates pipiens*), and a Snapping Turtle (*Chelydra serpentina*) was observed.

The HDFA provided a management directive of “Protection” for this feature. As such, both the channel and riparian corridor are to be maintained and/or enhanced; they cannot normally be considered for relocation or removal.

Agricultural Drain

A 230 m agricultural drain runs south-east through cropped land on the near the eastern border of the property before its confluence with the former Fraser-Clarke Drain. Instream vegetation consists of grasses and both banks are dominated by grasses with the occasional shrub and tree.

The substrate there consists of silt and clay. Woody debris is somewhat abundant while submergent vegetation is absent. The reach was fast flowing in April, but had only low levels of standing water in May and July. No fish, frogs, or turtles were observed in this reach.

The HDFA provided a management directive of "Mitigation" for this feature. As such, there is requirement for the channel to be to be maintained per se, though its functionality (limited to conveyance and some nutrient input) must be replicated through lot level conveyance measures and/or through constructed wetland features elsewhere in the system as part of the development's overall SWM plan.

3.4 Vegetation and Land Cover

The Barrhaven Catchment SWS land cover is primarily composed of settlements and crop and pasture lands (38% and 22%, respectively) (RVCA 2010). Roads comprise 13% of the area with woodlands (10%), sand and gravel (9%), grassland (5%), water (2%), and wetlands (1%), accounting for the remainder of the area.

The site itself is current composed primarily of agricultural lands. Air photos from 1976 indicate the site was previously used for agricultural activities with narrow bands of hedgerows present between fields in some areas (Ottawa, 2017a). The site appears to have the same composition as today except that the hedgerows now contain more trees than in 1976. These hedgerows are primarily composed of deciduous trees species, including: Butternut (*Juglans cinerea*), Manitoba Maple (*Acer negundo*), Crack Willow (*Salix fragilis*), Green Ash (*Fraxinus pennsylvanica*), Bur Oak (*Quercus macrocarpa*), White Elm (*Ulmus laevis*), and Silver Maple (*Acer saccharinum*).

3.4.1 Site Land Cover

A vegetation community assessment and ELC survey was completed at the site on June 27, 2017. The site consists of cultivated cropland bordered by narrow hedgerows containing drainage channels. Many of the trees within the hedgerows on site were apparent in the 1976 air photos (geoOttawa, 2017), and larger trees are still abundant within these hedgerows today. Site land cover is described here through ELC (Lee et al., 1998).

The most abundant habitat type on site was open agriculture (OAG) (Figure 2). Observed crops on site were primarily corn. The majority of these areas were dry, but a few lowland areas held water during spring freshet and immediately after precipitation events.

The former Fraser-Clarke Drain to the east contains small patches of Ash Mineral Deciduous Swamp (SWD2) and Willow Mineral Deciduous Thicket (SWT2) (Figure 1). The Ash Mineral Deciduous Swamp patches are composed of mainly Green Ash and Manitoba Maple, with subordinate species of Bur Oak, Crack Willow, and Silver Maple. Green Ash, Bur Oak, and Silver Maple were the largest trees observed and were between 70 and 105 cm DBH. Many of the large trees showed dieback and there were many large

Green Ash snags present. The SWT2 patches contained willow shrubs and Manitoba Maple along with grass and forb species. This area also contained a few Butternut saplings (Figure 1).

Two short hedgerows occur near the Fraser Clarke corridor. Hedgerow H11 spans 100 m and consists of three small patches of Manitoba Maple (10-30 cm dbh) with scattered elm and ash saplings (maximum 15cm dbh but mostly <10 cm). Within the Phase 1 area, Hedgerow H12 consists mostly of grasses and tall shrubs, though two treed patches span 50 m just north of the SWD2. The north patch includes 11 small Green Ash (<10-25 cm dbh) with sapling Manitoba Maples in the understory.The south patch also includes eleven small Green Ash (<10-25 cm dbh) with two White Elm (14 and 21 cm dbh) and five Bur Oaks (<10-20 cm dbh).

3.4.2 Site Trees

The tree inventory survey was performed on June 27, 2017, and all trees on site were identified to species and diameter at breast height (DBH) was recorded (Table 1; Figure 1). Habitat classification based on ELC categories was completed on the property (Section 3.4.1) and locations of large potential specimen trees were recorded.

Tree ages were not specifically determined, however, the 1976 geoOttawa air photo shows treed hedgerows and tree patches. However, some of the trees on site were not visible in the 1976 air photo and were less than 40 years old. A few larger and older trees, however, that were part of the hedgerows were also identified on the site. The trees on site generally appeared to be healthy except as otherwise noted within Table 1.

Table 1. Results of tree inventory surveys of Barrhaven Conservancy Phase I in 2017

Tree Number	Common Name	Quantity	Diameter at breast height	Comments	Fate
24	Basswood	1 (MS)	45 - 50	multi-stem	Retained
24	Green Ash	1	73	much dieback	Removed
25	Butternut	4	<10	saplings	Impacted*
26	Butternut	1	<10	sapling	Removed
27	Butternut	1	<10	sapling	Impacted*
28	Green Ash	~60	10 - 50	dieback, many snags @ 50 - 70 cm	Retained
29	Butternut	1	<10	sapling	Impacted*
30	Green Ash	1	~75	much dieback	Retained
31	Bur Oak	1	~70	healthy	Retained
32	Green Ash	1 (DS)	55 - 65	double-stem	Retained
33	Green Ash	1	~65	mostly dead	Retained
34	Green Ash	1	79	mostly dead	Retained
35	Silver Maple	1	105	healthy with cavities	Retained

* Impacted = development will occur within 50 m of the tree (defined as "harm" under the *ESA*), though the tree will not be specifically removed.

Only two trees on site were flagged as being both large (i.e. > 50 cm DBH) and in mostly good health. These trees include a Silver Maple and a Bur Oak. There were also many large Green Ash on the site but most of them showed some signs of dieback suggesting infestation with Emerald Ash Borer (EAB; *Agrilus planipennis*).

Overall, the trees on site are unlikely to provide much wildlife habitat. The linear composition of treed areas on site and lack of diverse foraging habitats make these areas unattractive to most bird and mammal

species. There was also a lack of cavity trees on site for potential bat roosting. The primary function of trees on site was to act as windbreaks between cultivated fields and corridors for agricultural and municipal drains.

Seven butternut saplings were observed in the cultural thicket and near the former Fraser Clarke Drain. These were all marked with white flagging tape and are included in Figure 1.

3.5 Wildlife

Field surveys were completed at the site in 2017 to assess general wildlife and SAR use of the site. These surveys included basking turtle surveys, amphibian calling surveys, and breeding bird surveys (Figure 1).

3.5.1 Amphibians

Methods

Three rounds of amphibian surveys were performed on the site. The surveys followed the protocols set forth by the Marsh Monitoring Program (Bird Studies Canada, 2003). Three surveys were completed to identify early, mid, and, late season breeding amphibian species in April, May, and June; respectfully. Survey were completed on nights of calm weather with temperatures above 5°C, 10°C, and 17°C for each of the three respective survey periods. Surveys began a half hour after sunset and finished by midnight with a five-minute recording period at each survey station. Amphibian species were recorded at each point along with estimated distance from observers, abundance code, estimate of individuals, and estimated direction.

Results

Amphibian surveys were performed on April 26, May 24, and June 28, 2017. Two stations were surveyed in wetland and aquatic habitats (Figure 1). Weather characteristics for the surveys are presented in Table 2. No SAR amphibians were observed on site during the field visits.

Table 2. Results of amphibian surveys of Barrhaven Conservancy Phase I in 2017

Date	Temperature (°C)	Weather conditions	Wind speed (km/hr)
26-Apr-17	13	Clear	16 - 19
24-May-17	18	Mostly cloudy	10 - 13
28-Jun-17	15*	Mostly clear	8 - 9

* Temperatures had been >17°C for several consecutive nights prior to the survey

Small numbers of amphibians were observed at both survey stations (<10 of all a species combined). Both survey stations were in a combination of cultivated cropland and drains. American Toads were heard at both stations, while Green Frogs and Northern Leopard Frogs were heard at one station. Specifically, frogs were found associated with the municipal drains, as indicated in Section 3.3.1.

None of the areas with frogs included sufficient numbers of individuals (i.e. at least 20 of a given species) to constitute Significant Amphibian Breeding Habitat as per the SWH Ecoregion 6E Criterion Schedule.

3.5.2 Turtles

Methods

Five rounds of turtle surveys were performed on the site in May and June, 2017. Specific basking surveys were completed at two survey stations at the site (Figure 1). Basking surveys followed the protocols detailed in the Blanding's Turtle Survey Protocols (MNRF, 2015). Each drain between survey station was slowly walked from shore while scanning ahead with binoculars. Other features that held water at the time of the surveys were also generally walked to search for turtles there.

Surveys were completed on days with little to no cloud cover and temperatures of at least 10°C, and overcast days with temperatures of at least 15°C. These surveys involved stopping at points along wetland and surface water features and scanning with binoculars. All turtles observed on site were recorded including incidental observation while traveling between survey stations and during other field surveys.

Results

Basking surveys were completed on May 10, 16, and 24, and June 1 and 15, 2017. Weather conditions during field surveys are presented in Table 3. All surveys were completed between 10 am and 3 pm. Only Snapping Turtles were observed on the site. No SAR turtles were observed on the site or on adjacent lands during field surveys of the site.

Table 3. Weather conditions during basking turtle surveys at Barrhaven Conservancy Phase I in 2017.

Date	Temperature (°C)	Cloud Cover (%)	Weather Conditions	Wind Speed (km/hr)	Species observed
10-May-17	13	40 – 60	Mostly sunny with some cloud	4 - 9	Snapping Turtle
16-May-17	20	90 – 100	Cloudy	10 - 17	Snapping Turtle
24-May-17	18 - 22	5 – 10	Clear	2 - 12	None
1-Jun-17	14 - 15	60	Mainly Clear	23 - 31	None
15-Jun-17	20 - 22	60 – 80	Clear	5 - 14	None

3.5.3 Birds

Methods

Three rounds of breeding bird surveys were completed on site in 2017. Breeding bird surveys (BBS) followed guidelines from Bird Studies Canada (Bird Studies Canada, 2001). The period for BBS in the Ottawa regions begins on May 24 and ends on July 10, and each BBS round was a minimum of 10 days apart. Typically, only two rounds of BBS are required, but when there is potential for SAR birds to be presence the MNRF requests a third round be completed.

The surveys were conducted on calm weather days with no precipitation from one half hour before sunrise until 10:00 am. Surveys were five minutes in duration with a two-minute habituation period

preceding the surveys. All birds seen and heard were recorded along with their associated breeding codes, and the estimated distance from the observer.

Results

Three rounds of BBS were completed at the site on June 14 and 27, and July 5, 2017. Breeding bird surveys were completed at two survey stations that covered all habitats on site. These were completed on calm weather days with light wind (less than 3 on the Beaufort scale) and no precipitation.

Overall, 18 bird species were observed on site during the three rounds of surveys (Table 4). Red-winged Blackbirds (*Agelaius phoeniceus*) were the most abundant species on site followed by Song Sparrows (*Melospiza melodia*) and Savannah Sparrows (*Passerculus sandwichensis*). One listed species, Barn Swallow (*Hirundo rustica*), is listed as threatened under the *Endangered Species Act* (ESA) (Ontario, 2007) and *Species at Risk Act* (SARA) (Canada, 2002) and was observed around the stormwater management ponds to the north-east of the site during the BBS (i.e. well off the Phase 1 site).

Based on extended walks around the broader vicinity for other projects, Barn Swallow nesting appears to be limited to the 416 overpass located > 2 km to the west, and in buildings > 200 m north of the site. The Borrisokane Road Bridge, located approximately 1 km south-west of the property, provides some nesting potential though no Barn Swallows were observed here. No Barn Swallow nests however, were found anywhere on site. Regulated Barn Swallow habitat extends 200 m from nest locations. The behavior of Barn Swallows noted away from the site, was observed during each survey to note directions towards, or locations to, which food was being carried (i.e. to indicate possible nesting areas). These observations provided no evidence of nesting within 200 m of the Phase 1.

Most of the birds observed on site were common species and have a high likelihood of breeding on site. Birds classified with a moderate likelihood of breeding are common breeders in the area, but only a limited amount of preferred breeding habitat was observed on site. Birds classified with a low likelihood of breeding may breed in the local area but no preferred breeding habitat was observed on site.

Table 4. Breeding Birds Observed during field surveys at Barhaven Conservancy Phase I site, in 2017.

Common Name	Scientific Name	Likelihood of Breeding	Common Name	Scientific Name	Likelihood of Breeding
American Crow	*Corvus brachyrhynchos*	Moderate	Northern Flicker	*Colaptes auratus*	High
American Goldfinch	*Spinus tristis*	High	Red-winged Blackbird	*Agelaius phoeniceus*	High
American Redstart	*Setophaga ruticilla*	Moderate	Ring-billed Gull	*Larus delawarensis*	Low
American Robin	*Turdus migratorius*	High	Savannah Sparrow	*Passerculus sandwichensis*	High
Black-capped Chickadee	*Poecile atricapillus*	High	Swamp Sparrow	*Melospiza georgiana*	High
Chipping Sparrow	*Spizella passerina*	Moderate	Turkey Vulture	*Cathartes aura*	Low
Common Yellowthroat	*Geothlypis trichas*	High	Warbling Vireo	*Vireo gilvus*	Moderate
Gray Catbird	*Dumetella carolinensis*	High	White-breasted Nuthatch	*Sitta carolinensis*	Moderate
Killdeer	*Charadrius vociferus*	High	Yellow Warbler	*Setophaga petechia*	High

3.6 Species at Risk Habitat

At this time, no reply to our SAR information request for the property has been received. Our internal background information review, which relies on information previous stated in Section 3.1, and our experience in identification of SAR habitat and natural heritage features, indicated a potential for 16 SAR listed under *ESA* (Ontario, 2007) and *SARA* (Canada, 2002) to occur on or in proximity to the property.

These SAR include Bank Swallow (*Riparia riparia*), Barn Swallow, Blanding's Turtle (*Emydoidea blandingii*), Bobolink (*Dolichonyx oryzivorus*), Butternut, Eastern Meadowlark (*Sturnella magna*), Bridle Shiner (*Notropis bifrenatus*), Eastern Musk Turtle (*Sternotherus odoratus*), Eastern Wood-pewee (*Contopus virens*), Monarch (*Danaus plexippus*), Snapping Turtle, Little Brown Myotis (*Myotis lucifugus*), Eastern Small-footed Myotis (*Myotis leibii*), Northern Long-eared Myotis (*Myotis septentrionalis*), Tri-colored Bat (*Perimyotis subflavus*), and Wood Thrush (*Hylocichla mustelina*).

For full due diligence, Table 5 indicates the habitat requirements of these SAR plus others SAR potentially present within the broader area and whether the property may provide significant habitat. The list also includes additional entries for species under consideration for listing within the next two years.

Table 5. Species-at-risk with the potential to occur to on the Barrhaven Conservancy site in 2017

Species Name	Provincial (ESA) Status	Habitat Requirement	Habitat on Site	Project Concerns Associated with Habitat on Site
Birds				
Bank Swallow (*Riparia riparia*)	Threatened	Colonial nester; burrows in eroding silt or sand banks, sand pit walls, and other similar habitats	No nesting habitat observed on or adjacent to Site, but may forage in open habitats nearby.	Negligible potential for presence. Not a concern.
Barn Swallow (*Hirundo rustica*)	Threatened	Species prefers to nest on manmade structures such and bridges, barns, and buildings near open terrestrial and aquatic habitats where it forages.	Borrisokane Road Bridge may provide nesting areas, and the mix of agricultural land and surface water provide suitable forage adjacent to the site.	Barn Swallow presence was limited to the SWMP to the north-east. Occasional foraging runs by birds may cross onto the site from peripheral areas, though regulated habitat only extends 200 m from a nest. No nests observed on or near the Phase 1 area.
Bobolink (*Dolichonyx oryzivorus*)	Threatened	Periodically mown, dry meadow for nesting. Habitat (meadow) should be > 10 ha, and preferably > 30 ha before bobolink are attracted to the site. Not near tall trees.	No suitable habitat on site. Potential within the neighbouring agricultural fields if allowed to go fallow, though active agricultural areas do not constitute habitat.	Negligible potential for presence. Not a concern.
Eastern Meadowlark (*Sturnella magna*)	Threatened	Prefers grasslands and pastures >5 ha in area with moderately tall grasses (25 to 50 cm) and abundant litter cover. High proportion of grasses to forbs and shrubs (<35% forbs and shrubs).	No suitable habitat on site. Potential within the neighbouring agricultural fields if allowed to go fallow, though active agricultural areas do not constitute habitat.	Negligible potential for presence. Not a concern.
Eastern Wood-pewee (*Contopus virens*)	Special Concern	Prefers mature and intermediate-aged deciduous and mixed forest with an open understory. Often nests and forages near open areas and forest edges.	Deciduous forest habitat on site is limited to hedgerows. These areas and unlikely to provide preferable nesting habitat to this species.	Negligible potential for presence. Not a concern.
Wood Thrush (*Hylocichla mustelina*)	Special Concern	Moist deciduous hardwood or mixed forests with trees >16 m in height, a closed canopy (>70%), moderate sub-canopy and shrub layer, fairly open forest floor, and moist soil.	Deciduous forest habitat on site is limited to hedgerows. These areas and unlikely to provide preferable nesting habitat to this species.	Negligible potential for presence. Not a concern.
Butterflies				
Monarch (*Danaus plexippus*)	Special Concern*	Caterpillars require Milkweed species and are confined to meadow and open areas where it grows, while adults feed on nectar ins a variety of habitats.	Species may use milkweed species associated the edge of the hedgerows on site for nectaring.	The species is not currently protected under the *ESA.* The agricultural composition of the site is unlikely to provide habitat for Monarchs; therefore, this species is not a concern.
Fish				
Bridle Shiner (*Notropis bifrenatus*)	Special Concern*	Clear warm waters in stream and occasionally lakes with abundant submerged aquatic vegetation and bottom composed of silt and/ or sand.	Likely in the Jock River south of the site and may use drainage channels on site during spring flooding. Was not observed during fish surveys of the site.	The species is not currently protected under the ESA.
Mammals				
Little Brown Myotis (*Myotis lucifuga*)	Endangered	Widespread, roosting in trees and buildings. Hibernate in caves or abandoned mines.	Although there were large snags and cavity trees on site, the linear composition of the treed areas are unlikely to be attractive as roosting areas. No hibernation habitat.	Negligible potential for presence. Not a concern.

Species Name	Provincial (ESA) Status	Habitat Requirement	Habitat on Site	Project Concerns Associated with Habitat on Site
Northern Long-eared Myotis (*Myotis septentrionalis*)	Endangered	Associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. Hibernate in caves or abandoned mines.	No suitable roosting or hibernation habitat was observed on site.	Negligible potential for presence. Not a concern.
Eastern Small-footed Myotis (*Myotis leibii*)	Endangered	Species roosts in a range of habitats including under rocks, rocky outcroppings, buildings, under bridges, caves, mines, and hollow trees. Hibernate in smaller caves subject to air movement.	No suitable roosting or hibernation habitat was observed on site.	Negligible potential for presence. Not a concern.
Tri-colored Bat (*Pipistrellus subflavus*)	Endangered	Prefers to roost in trees on old forests but sometimes uses buildings. Forage over water courses or open fields with large trees nearby. They never forage in deep woods. Hibernate in caves or abandoned mines.	Although there were large trees on site, the linear composition of the treed areas is unlikely to be attractive as roosting areas. No hibernation habitat.	Negligible potential for presence. Not a concern.
Turtles				
Blanding's Turtle (*Emydoidea blandingii*)	Threatened	Species prefers shallow water usually in large wetlands or shallow lakes with high abundance of emergent vegetation.	The drains on site do not present suitable habitat for this species, but species may occur on site due to proximately to Jock River.	Low potential for presence. The nearest nesting site was recorded at over 2 km from the site. No turtles were observed within any of the headwater features, but the Jock River does provide potential habitat.
Eastern Musk turtle (Sternotherus odoratus)	Special Concern*	Lakes, Rivers, and ponds with slow-moving water and soft mud bottoms. Often inhabits shallow water.	No overwintering habitat is found on site. Species is likely to be found in Jock River, but rarely travels more than 45 m from water for nesting.	Negligible potential for presence. Not a concern.
Snapping Turtle (*Chelydra serpentina*)	Special Concern*	Freshwater habitat characterized by slow-moving water with a soft mud bottom and dense aquatic vegetation.	Species may use drainage channels on the site for travel and nesting. Was observed on site in Fraser-Clarke channel during surveys.	Species was observed within the Fraser-Clarke channel during field surveys. The species is not afforded habitat protection under the ESA.
Vascular Plants				
Butternut (*Juglans cinerea*)	Endangered	Variable but typically on well-drained soils.	The majority of the site is cultivated land, but suitable habitat may be present along the unnamed drainage channels on the site.	Seven saplings were observed on site along the hedgerows. These few trees are too small to constitute "archivable" trees and can and will therefore be handled through a site registration process if a BHA finds them to be retainable.

* Species status is, or will soon be, under review and thus may change in the near future.
Species occurring or potentially having habitat on site.

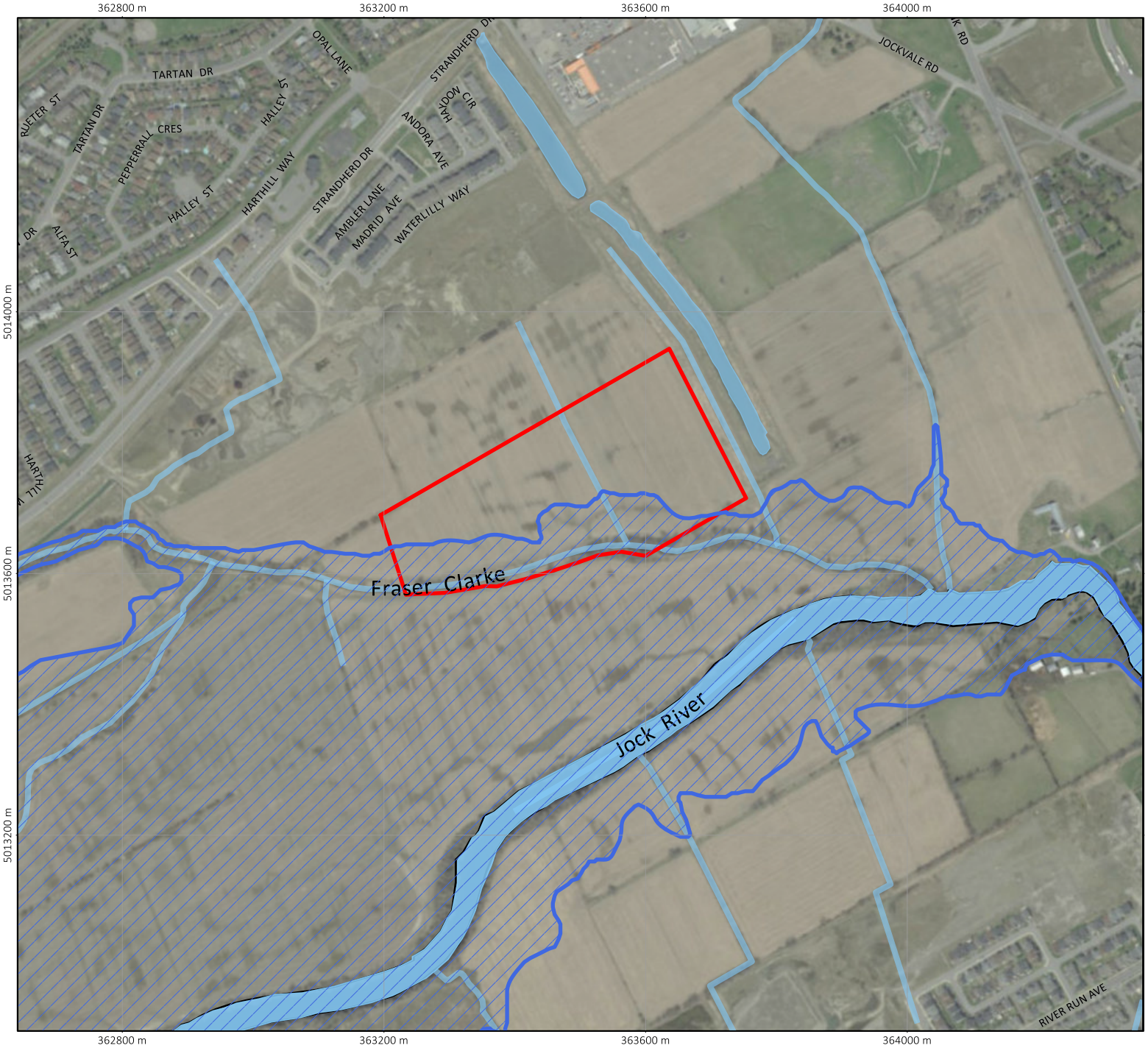

Figure 1: Site context.

Legend

Phase 1 Area

Floodplain

N

0 200 m

Project: CAIV 626 ELC
Created By: AF
MTM Zone 9
(NAD 83)
Printed on: 2018-06-01

KILGOUR & Associates

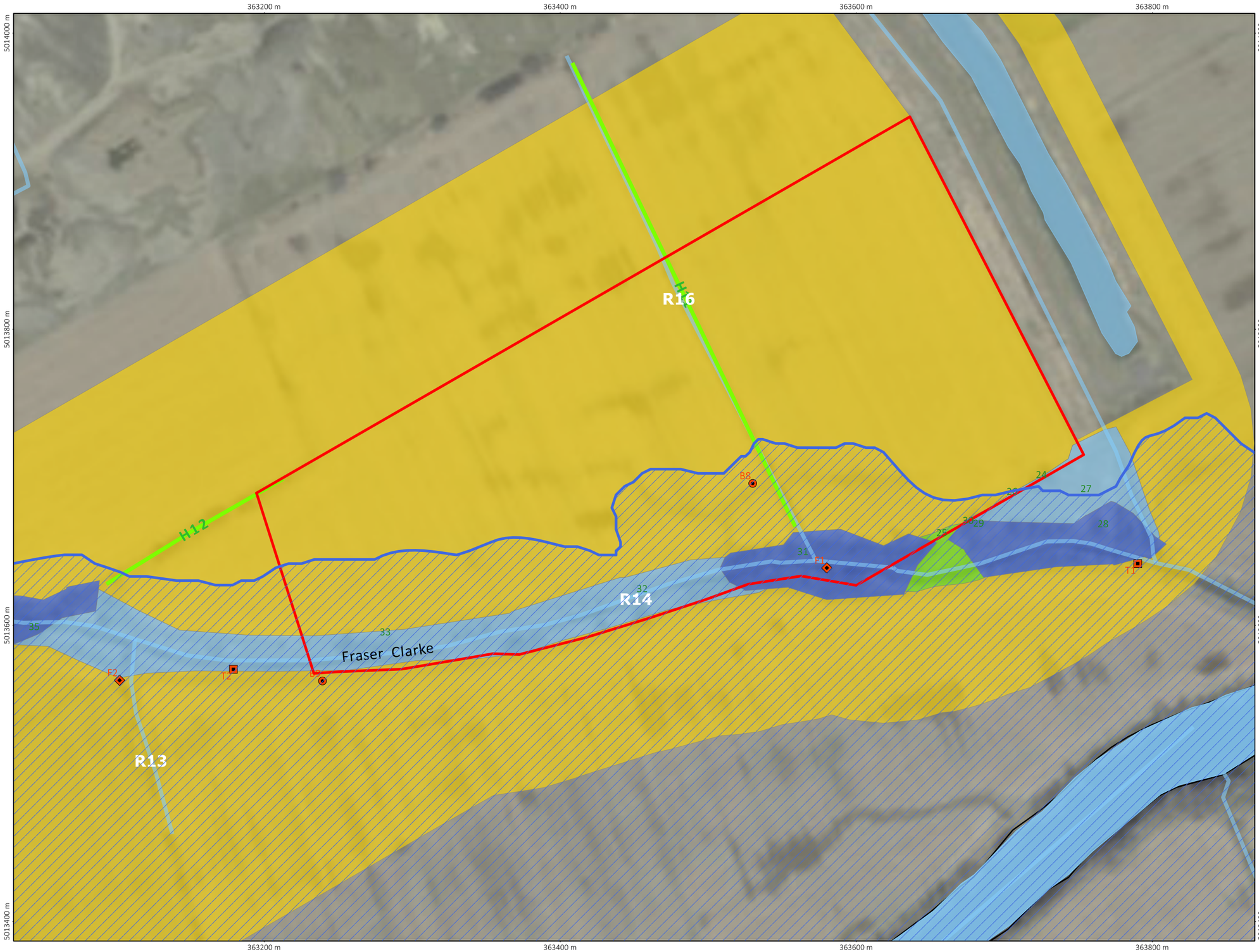

Figure 2 Existing site conditions

Legend

Phase 1 Area

Floodplain

ELC
- CUT1
- FOD3
- Farmyard
- MAM2
- OAG
- SWD2
- SWT2

Trees
- # Tree Number
- Hedgerow

Wildlife Surveys
- Bird Staion
- Frog Station
- Turtle Station

N

0 100 m

Project: CAIV626-Full_Set v2
Created By: AF/TH
Checked By: AF
MTM Zone 9
(NAD 83)
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3.7 Other Natural Heritage Features

There are no Provincially or Locally Significant Wetlands, "wetlands found in association with Significant Woodlands", Significant Valleylands, Significant Wildlife Habitats or Life Science Areas of Natural and Scientific Interest on or adjacent to the site (Figure 1, 2). The nearest Provincially Significant Wetland is over 3 km to the northwest and is part of the Stoney Swamp Wetland Complex. Small Significant Woodland patches may exist along the Jock River corridor adjacent to the site, but are > 120 m from the site property line.

4.0 PROJECT DESCRIPTION

The Phase I development will be entirely residential with a mix of single family detached homes, townhomes, and medium density residential, including 0.47 ha of park space and a ~ 65 m wide corridor (channel width plus 30 m riparian buffer on each side) along the channel of the former Fraser-Clarke Drain (Figure 3).

All land development will occur within areas currently covered by active agricultural lands (including the small agricultural drain, which will be removed). The small, non-agricultural ecosites (SWT2, SWD2 and MAM2) within the development area are tightly associated with the Fraser-Clark channel. These features will be fully captured within the reserved corridor along the channel and will be preserved there as such. Note that on the Phase 1 side of the channel, the natural ecosites only extend 7 - 17 m beyond the channel. The corridor thus also captures an additional 13 - 23 m of current agricultural lands. This broad additional fringe will be planted with native vegetation providing an overall increase in natural land-cover along the channel (detailed landscape plans are still to e developed).

The Phase 1 development will be carried out in two sub-phases. Topsoil stripping and underground construction activities will be carried out for the entire Phase 1 development (i.e. outside of the reserved Fraser Clark corridor) beginning in late 2018. This work does include areas within the existing floodplain in anticipation of its eventual removal through other projects in the broader vicinity. The proposed works however, will result only in a net removal of material there, and thus will not reduce floodplain capacity in any way.

Phase 1A above ground works (filling, road construction, home construction, etc.) will begin in early 2019 in areas outside of the current floodplain limit. The remainder of the Phase 1 above ground construction (Phase 1 B) will only take place once the floodplain boundary is revised, permitting fill in this area.

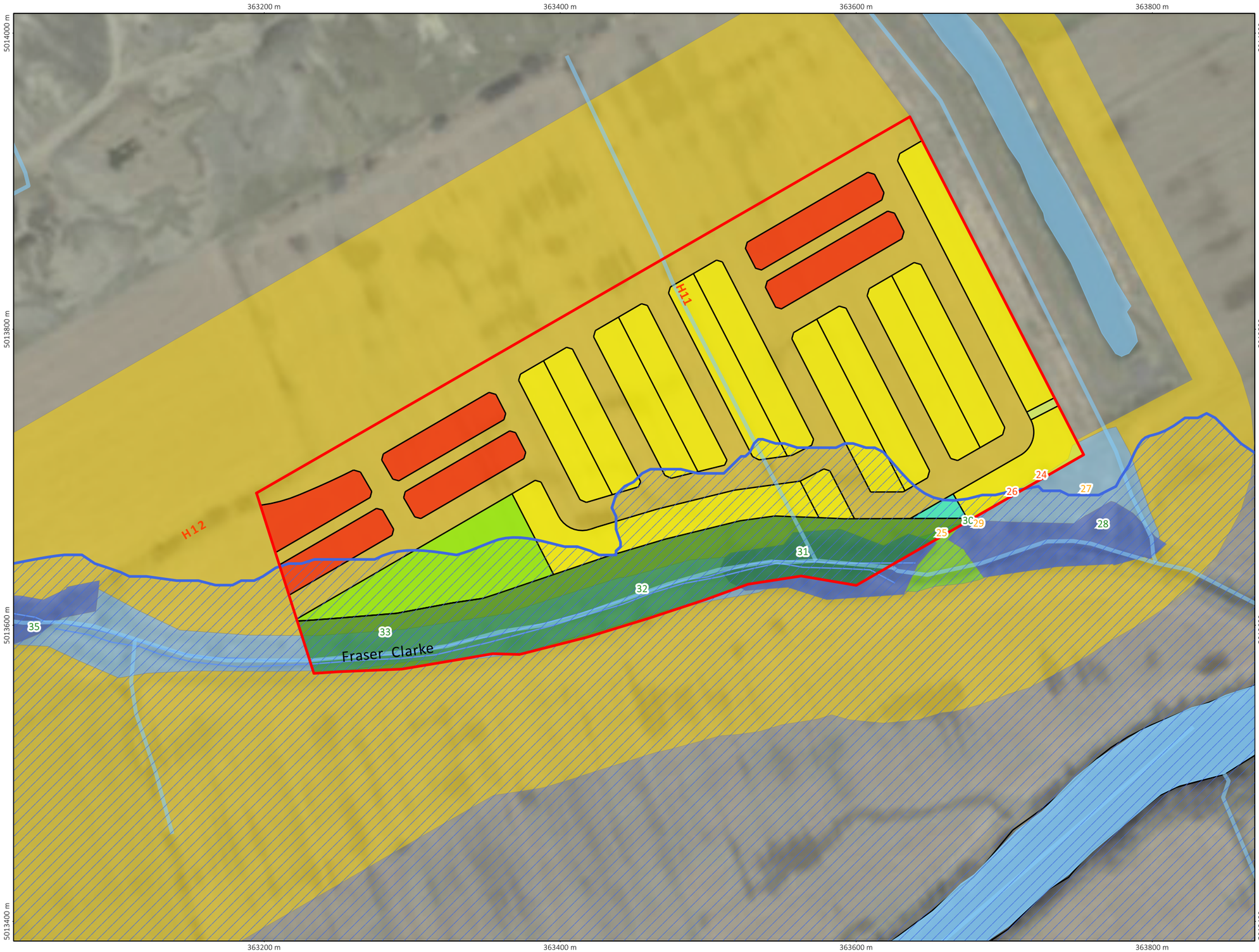

Figure 3 Proposed development

Legend

Phase 1 Area

Floodplain

CDP (180620)

- Natural Heritage System
- Park
- Walkway
- SWM
- Single Detached
- Rear Lane Townhome

ELC

- CUT1
- FOD3
- Farmyard
- MAM2
- OAG
- SWD2
- SWT2

Trees

- # Retained
- # Removed
- # Impacted BN

N

0 100 m

Project: CAIV626-Full_Set v2
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MTM Zone 9
(NAD 83)
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5.0 IMPACT ASSESSMENT

5.1 Impacts to Surface Water Features

The former Fraser-Clarke Drain will be protected within a corridor maintaining setback distances of 30 m from high water mark to development areas. The 30 m swath on either side of the channel is intended to protect the existing channel and to provide some ecological functionality in its own right (e.g. wildlife corridor, direct provision of habitat etc.). No lands within the corridor are proposed to be filled at any time. Active agricultural lands within that reserved area however, will be revegetated with natural land-cover providing an overall net benefit to the feature.

The remaining small agricultural drain will be removed, though its functionality will be incorporated into the stormwater management plan for the site as per the recommendations of the HDFA. We do not predict any impacts to surface water features during site development.

5.2 Impacts to Trees/ Significant Woodlands

Trees on site are located along the drains and in hedgerows. Trees along the municipal drain will be retained within the 30 m buffer that surrounds these features. The remaining hedgerows, however, will be removed during site development. Riparian forest areas along the Jock River are not predicted to be impacted by the project given the large separation of these features from development areas.

No unique treed habitats or tree species were observed on site. All trees present on site are represented throughout the Ottawa region and in adjacent habitats. Many of the largest trees on site were showing dieback (Green Ash).

Trees within hedgerows on the site outside the municipal drain corridors will be removed during project development to accommodate site grading. A tree planting plan, however, will be created as part of the landscape plan for the area, ensuring a net increase in the number trees on site (the vast majority of the site is currently treeless). Additional mitigation measures to protect retained trees will be implemented on site during project development (as per Section 6.2).

5.2.1 Tree Removals

As per Table 1 and as indicated above, two individual trees and two hedgerows have specifically been planned for removal from the site as they occur within areas that will be regraded and built upon. These are:

- Tree #24 (Green Ash)
- Tree #26 (Butternut)
- Hedgerow H11 (mix of small Manitoba Maple, American Elm and Green Ash)
- Hedgerow H12 (mix of small Manitoba Maple, American Elm, Green Ash and Bur Oak)

Green Ash trees that occur within the Fraser-Clarke corridor are not specifically required to be removed to accommodate community development. However, as these trees are already in generally poor condition due to EAB, they will be re-evaluated when other site trees are scheduled for removal. Any ash

trees that are dead at that time, or are likely to soon become hazardous, will also be removed as part of the broader land clearing for safety considerations.

5.3 Impacts to Species at Risk

Three SAR were observed on or adjacent to the site during field surveys in 2017: Barn Swallow, Butternut, and Snapping Turtle. Barn Swallow were only using the stormwater management pond to the north-east of the site as a foraging area and were not observed nesting on site. The MNRF General Habitat Guidelines for Barn Swallow (MNRF, 2015) protects three categories of habitat for the species.

- Category one – nest or nesting colony has low tolerance to alteration.
- Category two – the areas within 5 m of the nest and has a moderate tolerance to alteration.
- Category three – the area between 5 m and 200 m and has the highest tolerance to alteration.

Areas beyond 200 from nesting sites are not protected under the *ESA*. The nesting sites for Barn Swallow include the Highway 416 overpass to the west, and various commercial and industrial buildings to the north that are > 200 m from the site. The Borrisokane Road Bridge could potentially support Barn Swallows, but this bridge is about 1 km away from the site and none were found to occur. Therefore, we predict no impacts to Barn Swallow from site development.

A total of seven Butternuts were observed on site within the shrubland habitat along the former Fraser-Clarke Drain. Those seven trees are currently protected as SAR. All land located within 50 m of the Butternuts is currently deemed to constitute the SAR habitat and similarly legally protected from damage or harm under the *ESA*. Importantly however, as there are fewer than 10 trees on site, and all of them are less than 10 cm DBH, none of Butternuts on site can possibly be deemed archivable under Ontario Regulation 242/08. There are thus no conditions on site that could disallow a site registration for the species and no further oversite from the MNFR is required to complete the process. The site therefore can, and will, be registered with the MNFR by July 15, 2018. Upon completion of the site registration, neither the trees, nor their surrounding habitat will be protected by the ESA. As all trees are less than 10 cm dbh, they can be removed without any tree clearing permit from the City. Trees directly on BCE property will be removed accordingly by July 16, 2018. Trees on the neighbouring property cannot be removed directly, but are sufficiently close to the development areas such that BCE cannot guarantee their safety during site development. As such, these trees will also be listed within the site registration for removal (as opposed to harm). A “harm” registration would permit land alteration with 25 m, but would still prohibit killing the tree (accidentally or otherwise).

Site registration will oblige the BCE to provide compensation through the planting of new Butternuts. The planting program is provided under O. Reg. 242/08 and is designed to ensure a net benefit to the species. As such, we predict no impacts to these species from site development.

The primary habitat of Snapping Turtle is the Jock River to the south, though they use the municipal drainage channel crossing the property to move between the Jock River and other areas upstream. The development of the site is not predicted to alter the municipal drainage channel on site in which Snapping

Turtles were observed. A 30 m habitat buffer will be applied to this drain that will allow for continued use by this species. Therefore, we predict no impacts to Snapping Turtle from site development.

5.4 Impacts to Wildlife

The agricultural composition of the site makes it unlikely to support a large and diverse wildlife community. Moreover, the linear nature of the hedgerow does not provide cover for most wildlife species. The only areas on site providing potentially significant frog habitats is the former Fraser-Clark drain, which is being fully retained within corridors of sufficient width to maintain frog breeding space.

Wildlife species common to the Ottawa area were observed on site during the field surveys. These species are likely to use the adjacent site to the same extent and will likely remain on site in the habitat buffer along the municipal drain. The riparian forest along the Jock River acts as a wildlife corridor, and this area will remain in place during and after site development. Mitigation measures will be implemented to protect wildlife species during site development, and therefore we predict no impacts to wildlife species during site development.

6.0 MITIGATIONS

6.1 Mitigations for Surface Water Features

To ensure no flood damage generally to development either here or elsewhere in catchment, no fill or structural development will occur within any areas designated as floodplain, until such time as that designation is removed. No lands within 30 m of the Fraser-Clarke channel are to be filled at any time. A detailed landscape plan must be developed indicating how active agricultural lands within the 30 m reserved corridor along that will be revegetated with native natural land-cover.

Erosion Sediment Control (ESC) measures will be installed along the site boundary where surface water runoff could have the potential to impact this either the Fraser-Clark channel or the Jock River. Silt curtains will also be installed where there is potential for surface water runoff to leave the site. Lastly, surface water runoff and sediment flows from the site will be monitoring during project development until site contouring and stormwater management features are completed and fully functional.

6.2 Mitigations for Trees

Please note that this report does not constitute permission to remove any trees from the site. Removal of trees can only be undertaken upon the issuance of a tree removal permit from the City of Ottawa. This report may be used to support the application for that permit and to advise mitigation measures imposed by the permit. Accordingly, to minimize impact to the remaining trees on the property, the following protection measures are indicated as necessary during construction:

- Tree removal on site should be limited to that which is necessary to accommodate site construction.

- To minimize impact to remaining trees during future site development:

  - Erect a fence beyond the critical root zone (CRZ, i.e. 10 x the trunk diameter) of trees. The fence should be highly visible (e.g. orange construction fence) and paired with erosion control fencing. Pruning of branches is recommended in areas of potential conflict with construction equipment;
  - Do not place any material or equipment within the CRZ of the tree;
  - Do not attach any signs, notices or posters to any tree;
  - Do not raise or lower the existing grade within the CRZ without approval;
  - Tunnel or bore when digging within the CRZ of a tree;
  - Do not damage the root system, trunk or branches of any tree; and
  - Ensure that exhaust fumes from all equipment are NOT directed towards any tree's canopy.

- The *Migratory Bird Convention Act* (Canada, 1994) protects the nests and young of migratory breeding birds in Canada. The City of Ottawa guidelines require no clearing of trees or vegetation between April 1 and August 15, unless a qualified biologist has determined that no nesting is occurring within 5 days prior to the clearing (Ottawa, 2017c).

As part of the Community Development Plan for the project a full landscape plan will be created for the area, which will include a tree planting plan. This will suggest the number of trees to be planted on site and the preferred species. This will also include setback distances for trees from residential properties, streets, sidewalks, and other infrastructure. The landscape plan must call for residential areas to be planted with a tree density equivalent to at least one tree per lot using appropriate native tree species as per City guidelines. Trees however, may be located along streets rather than necessarily planting on each lot directly. Additional trees are to be planted around the new storm water management ponds. Further tree planting is also likely within the landscaping plans for the future school, apartment and commercial blocks, though these are not included in Phase I and specific planting details are beyond BCE's purview as these areas will be developed by and to the specifications of the future land owners.

Where planting along wet areas (i.e. along drain corridors) is required, tree species a such as Silver or Red Maple (*Acer rubrum*) are recommenced over the current mix of trees (primarily ash and elm species, which are rapidly diminishing in health due to Emerald Ash Borer [EAB] and Dutch Elm's Disease [DED]). Burr Oak could be considered where spacing allows for future showcase trees.

6.3 Mitigations for Species at Risk

Barn Swallows and Snapping Turtles are not predicted to be impacted by site development and general wildlife mitigation measures will be sufficient to protect these species. A Butternut Health Assessment (BHA) for the area will be submitted to the MNRF prior to commencing any work potentially impacting those trees on site. The MNRF reserves a period of 30 days to review the BHA, after which the site will be registered. With fewer than 10 Butternuts on site and no possibility of archivable trees (all are too small), no level of permitting can be required by the MNFR beyond site registration. Upon site registration, Butternut will no longer be subject to the ESA and will not be considered a SAR.

For Butternuts subject to impact or removal under this project, a Butternut Health Assessment (BHA) will be completed by a certified Butternut Health Assessor by June 8, 2018. Any trees found to be non-

retainable will no longer be subject to protection under the *ESA.* Any trees found to be retainable, must be included in a site registration. Findings of the BHA are reserved for a 30-day period, after which they become official. The BHA cannot deem any of the trees to be archivable, as none are over 20 cm DBH. Site registration can be completed immediately following the 30-day waiting period and will be completed before July 15, 2018. Registration will oblige BCE to plant 35 new Butternut saplings with 35 companion trees at either another location on the site or off-site within the region within one year, as well as to implement and follow a detailed tending program for those trees for two years, and to submit records of the trees and their care to the MNRF annually for that same period. For this project, Butternut compensation will be contracted out to the Rideau Valley Conservation Foundation, which manages and runs such programs on mass.

6.4 Mitigations for Wildlife

There are no Significant Wildlife Habitats on site. Common wildlife species however, were observed on site during the field visit. The following mitigation measures shall be implemented during construction of the project on site:

- Areas shall not be cleared during sensitive time of the year for wildlife, unless mitigation measures are implemented and/or the habitat has been inspected by a qualified biologist.
- Site clearing should begin at the north (i.e. from the direction of Strandherd Drive) and proceed southward to drive any wildlife towards available habitat.
- Do not harm, feed, or unnecessarily harass wildlife.
- Food wastes and other garbage – effective mitigation measures include waste control (prevent littering); keeping all trash secured in wildlife-proof containers, and prompt removal from the site (especially in warm weather).
- Drive slowly and avoid hitting wildlife where possible.
- Shelter – effective mitigation measures include covering or containing piles of soil, fill, brush, rocks and other loose materials; capping ends of pipes where necessary to keep wildlife out; ensuring that trailers, bins, boxes, and vacant buildings are secured at the end of each work day to prevent access by wildlife.
- Check the work site (including previously cleared areas) for wildlife, prior to beginning work each day. In addition to daily sweeps of the work site, all on site staff should be aware of what species at risk have the potential to enter the work site, identification and handling procedures;
- Inspect protective fencing or other installed measures daily and after each rain event to ensure their integrity and continued function; and,
- Monitor construction activities to ensure compliance with the project-specific protocol (where applicable) or any other requirements.

7.0 SUMMARY AND RECOMMENDATIONS

It is our professional opinion that there will be no impacts to natural heritage features or wildlife species from the proposed project. Three species at risk were observed on or adjacent to the site during field surveys in 2017, but no impacts are anticipated to Barn Swallows or Snapping Turtles under the project. Seven Butternut were observed on site, but all of them were less than 10 cm in diameter and they are therefore not archivable. Site registration and planting of compensation Butternut will be undertaken to replace these trees. Mitigation measures shall be implemented on site to protect surface water features, retained trees and area wildlife generally.

Regards,
KILGOUR & ASSOCIATES LTD.

Terry Hams, MSc.	Anthony Francis, PhD.
Ecologist	Senior Ecologist/Project Manager

Appendix A
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Appendix B
Qualifications of Report Author

Anthony Francis, PhD

Dr. Francis is an ecologist with over 18 years of experience in both terrestrial and aquatic projects. His doctoral thesis work on global plant diversity patterns included conducting tree surveys across North America. As a consulting ecologist he has worked on diverse ecological projects including literature reviews of forestry management and species-at-risk; environmental studies of contaminants (metals and suspended particulates); geomatic and statistical analyses for federal and provincial ministries as well as for private industry; and aquatic and terrestrial species inventories. He has contributed to environmental impact statements and federal environmental screening assessments for creek realignments and other infrastructure projects across Ontario.

Terry Hams M.Sc.

Terry is a terrestrial ecologist with over 10 years of experience in terrestrial field work and five years of experience in ecological consulting. He has worked on various projects across the United States and Canada surveying for terrestrial plants and wildlife. Terry has worked on Environmental Assessments for potash mines, Environmental Impact Statements, Constraints Assessments, and Species at Risk Assessments. He has experience preforming of Species at Risk surveys across Canada and has extensive knowledge of terrestrial plant and wildlife species.

Appendix C
HDFA Report

Headwater Drainage Feature Assessment
Barrhaven Conservancy

September 8, 2017

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TABLE OF CONTENTS

List of Tables

List of Figures

1.0 INTRODUCTION

This report is a Headwater Drainage Feature Assessment written by Kilgour & Associates Ltd. (KAL) on behalf of Barrhaven Conservancy East Inc. (BCE) in support of their eventual development of their property located between Strandherd Road and the Jock River along Borrisokane Road in Ottawa, Ontario. The report provides a detailed description of the headwater drainage features (HDFs) crossing the property following the field methodologies identified with the *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (CVC & TCRA, 2013), herein the HDF Guidelines.

2.0 HEADWATER DRAINAGE FEATURES

2.1 Overview

This study identifies and describes 16 channels that are located on four contiguous property parcels - 3285, 3288, and 3300 Borrisokane Road and 4305 McKenna Casey Drive (Nepean PINs: 045951742, 045950023, 045950057, and 045950025). These parcels occur to the west and east of Borrisokane between Strandherd Road and the Jock River.

Most of the lands to the west of Borrisokane Rd. were completely flooded during the initial April survey period (over 50 cm deep in some places). The nine headwater drainage features (HDFs) identified there are municipal, agricultural, or roadside drainage ditches flowing in a generally southerly direction until their confluences with the Jock River to the south of the property. This portion of the property is composed of mainly cropped lands with wood/shrubland in the south and a Stormwater Management Pond (SWMP) to the north. The lands to the east of Borrisokane Rd have five HDFs that all join the Fraser-Clarke Drain, which flows eastwards into the Jock River. This portion of the property is comprised almost entirely of cropped land.

A brief visual inspection of the site on September 17, 2015, coupled with the close proximity to the Jock River, suggested the possibility of fish being present in many of the Reaches on site, though water levels in most were found likely to be intermittent. The channel form was clearly well defined in many Reaches, apparently having been dug as linear drainage channels. During a spring site visit on April 7, 2017, all of the reaches were in freshet conditions with obvious surface flow. Reaches closer to the Jock River (i.e., the southside of the western portion of the property) were completely flooded due to unusually high flood waters from the Jock River. Other reaches, Reaches 7 and 13, for example, were considered, even at that time, to likely be ephemeral. Accordingly, the HDF Guidelines require a “Standard” level survey type of the area.

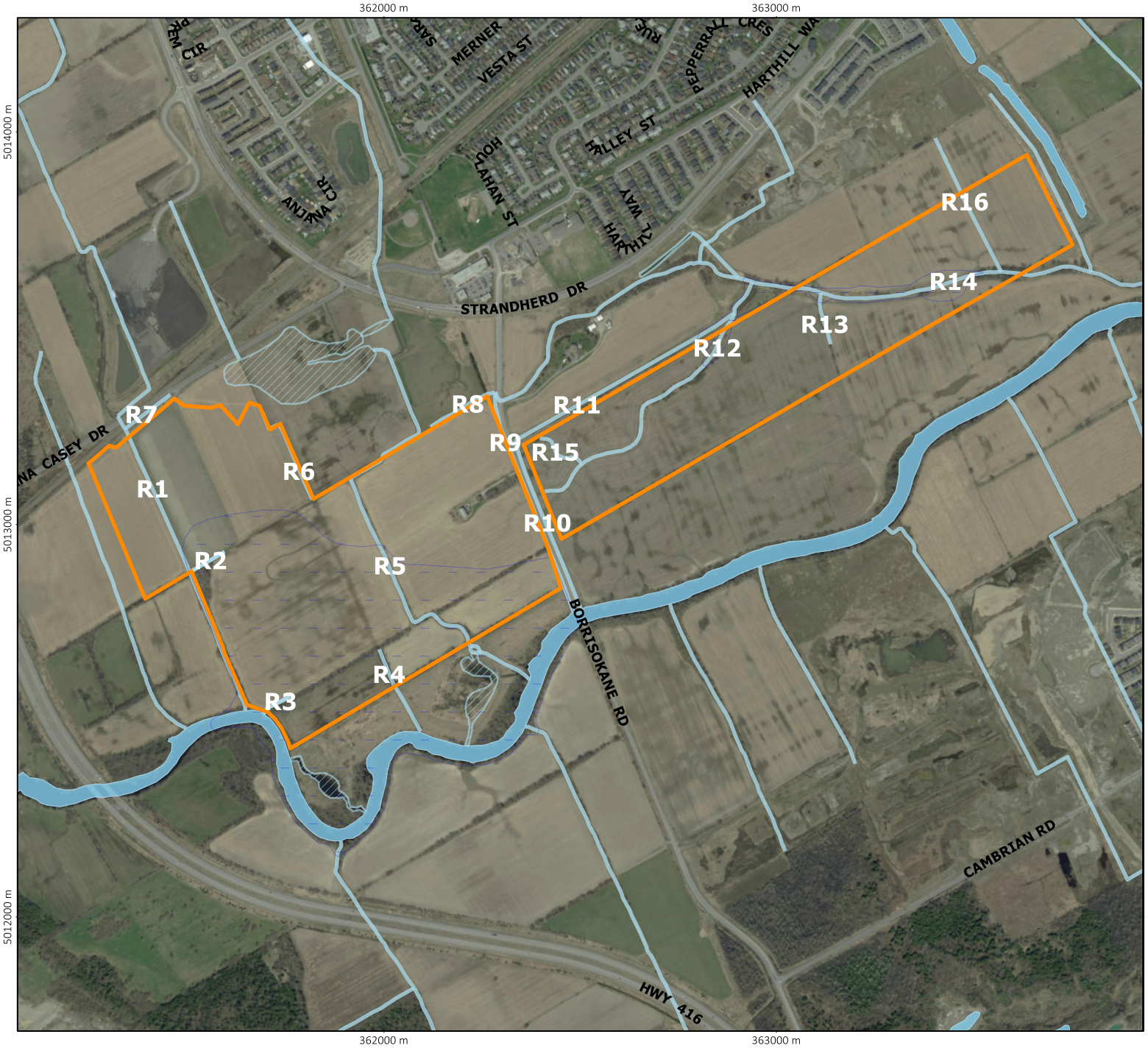

Figure 1 Headwater drainage features on/adjacent to the site

Legend

Property Boundary

Water Features

- Headwater Channel
- Wet Area
- Early Spring Flooding

N

0 500 m

Project: CAIV 626
Created By: RB
Checked By: AF
MTM Zone 9
(NAD 83)
Printed on: 2017-09-08

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2.2 Assessment Methodology

The Standard level of assessment follows Ontario Stream Assessment Protocol (OSAP) methodologies for descriptions of flow conditions, riparian vegetation and site features that are important components of habitat (headwater sampling protocol OSAP S4.M10), and includes an electrofishing survey to describe fish and fish habitat (OSAP S4.M10). Additionally, an ecological land classification (ELC) is applied to the riparian zone of each segment as a means of documenting community type and an assessment of amphibian breeding should be conducted following the Marsh Monitoring Protocol (MMP). A turtle survey was also completed according to the Ministry of Natural Resources and Forestry's (MNRF) protocol.

Initial OSAP investigations of HDFs were conducted on April 7, 2017 by KAL biologists Ross Breckels and Terry Hams, and follow-up electrofishing surveys were conducted on May 4, 2017 by KAL biologists Ross Breckels and Liza Hamilton. General ELC descriptions were provided by Terry Hams based on a broader vegetation survey of the property on June 27 and July 5, 2017. Each of the three assessments of amphibian breeding, following the MMP, was conducted by two of KAL biologists Ross Breckels, Anthony Francis, Liza Hamilton, and Catherine Proulx on April 26, May 24, and June 28, 2017, and turtle surveys were conducted, following the MNRF protocol, by KAL biologists Ross Breckels or Rob Hallett on May 11, 16, and 24, and June 1 and 17, 2017. A final site-visit by Terry Hams on July 5, 2017 looked at early summer water levels in the reaches and whether any seeps were evident within the HDFs.

2.3 General Reach Descriptions

Images of the Reaches 1 through 16 are available in Appendix A.

2.3.1 West Side

Reach 1

The 770 m portion of Reach 1, a Municipal Drain (O'Keefe Drain), flows southeast along the entire western border of property into the Jock River. Both banks of Reach 1 run along cropped land. Instream vegetation consists of mainly grasses. Both banks are covered with grasses in the upstream section, and a mixture of grasses, shrubs, and trees in the downstream section.

The substrate consisted of a mixture of clay and silt, with some sand and gravel in the upstream section. Woody debris was present in the downstream section while submergent vegetation was common in the upstream section. During the spring freshet survey in April, this reach was flooded, very deep (too deep to measure), and fast flowing. By May and July, the reach had shrunk considerably but was still fast flowing. A total of 30 fish were observed in this reach: seven Common Shiners (*Luxilus cornutus*), six Longnose Dace (*Rhinichthys cataractae*), five Creek Chub (*Semotilus atromaculatus*), four Mottled Sculpin (*Cottus bairdii*), three Banded Killifish (*Fundulus diaphanus*), three Pumpkinseed Sunfish (*Lepomis gibbosus*), and two Fathead Minnows (*Pimephales promelas*). No frogs and one Snapping Turtle (*Chelydra serpentina*) was observed in this reach.

Reaches 2 and 3

Reaches 2 and 3 are small agricultural drainage ditches, 100 and 80 m respectively, that flow south-west to the western border of the property until their confluences with Reach 1 and the Jock River, respectively. Reach 2 runs through cropped land, while Reach 3 runs through cropped land to the north and scrubland to the south. The north bank of Reach 2 is dominated with grasses whereas the south bank is dominated by trees. Both banks of Reach 3 are dominated by trees. Instream vegetation consists is not common, but consists of grasses where it is present.

The substrate consisted of a mixture of clay and silt. Woody debris was abundant Reach 3 but less so in Reach 2. Submergent vegetation was not present in either reach. Both reaches were flooded but with no detectable flow during the April survey period. In May and July, both reaches were dry. No fish, frogs, or turtles were observed either in either of these reaches.

Reach 4

The portion of Reach 4 that is located on the property is a 100 m wetted depression that flows southeast through the south-centre of the western portion of the property, then another 135 m into the Jock River. The east 'bank' runs along cropped land and the west 'bank' runs through scrubland. Instream vegetation consists is largely absent, with the occasional shrub or tree.

The substrate consisted of a mixture of clay and silt. Woody debris was highly abundant but submergent vegetation was absent. Reach 4 was completely flooded due to the high waters of the Jock River during the April survey period. In May, however, this reach consisted of standing water, being blocked by several woody barriers downstream. In July, this reach was characterized by remaining damp areas though likely due to ongoing rains rather than seeps. No fish, frogs, or turtles were observed in Reach 4.

Reach 5

The 560 m portion of the Foster Drain (Municipal Drain) that flows generally south through the centre of the western portion of property along cropped land from the SWMP to the north of the property into the Jock River to the south. Both banks of Reach 5 are dominated by grasses, with shrubs and trees becoming more prevalent downstream. Instream vegetation consists of grasses.

The substrate consisted of a mixture of clay and silt. Woody debris and submergent vegetation are abundant in Reach 5. During the April survey, Reach 5 was flooded by the high water levels in the Jock River. In May and July, the reach was significantly lower, yet was still too deep to fish during the fishing survey. The fish community in this reach was, however, assessed by in August 2009 (Muncaster 2009) as part of the Foster and Kennedy Burnett Stormwater Project. The authors found a limited and common fish community, albeit, still relatively diverse, including Banded Killifish (*Fundulus diaphanus*), Blacknose Dace (*Rhinichthys atractulus*), Blacknose Shiner (*Notropis heterolepis*), Bluntnose Minnow (*Pimephales notatus*), Brook Stickleback (*Culaea inconstans*), Central Mudminnow (*Umbra limi*), Common Shiner (*Luxilus cornutus*), Creek Chub (*Semotilus atromaculatus*), Fathead Minnow (*P. promelas*), Mottled Sculpin (*Cottus bairdii*), Pumpkinseed Sunfish (*Lepomis gibbosus*), Rock Bass (*Ambloplites rupestris*), and White Sucker (*Catostomus commersonii*). American Toads (*Anaxyrus americanus*), Gray Treefrogs (*Hyla versicolor*), and Northern Leopard Frogs (*Lithobates pipiens*) were heard calling in the vicinity, and one Snapping Turtle was observed in Reach 5.

Reach 6

Reach 6 is a 280 m long, isolated, remnant agricultural drainage ditch. It appears, based on older City maps to have once been part of a longer channel connecting flows from north of McKenna Casey Drive to Reach 4. That channel however, has since been cut off at both ends, i.e. by the new SWMP facility to the north of the property and by regrading in the farm field to the south. Both banks of Reach 6 are covered by a mixture of grasses and shrubs, with shrubs becoming more dominant downstream. Instream vegetation consists of grasses.

The substrate in this reach consists of a mixture of clay and silt. Woody debris was highly abundant downstream. Submergent vegetation was not present. Reach 6 maintained some standing water through April, May and July, through a combination of spring runoff, heavy rains and poor drainage/infiltration. No fish or turtles were observed in this reach. No frogs were heard here either, though American Toads and Gray Treefrogs were heard calling from the SWM pond to the north.

Reach 7

Reach 7 is a 145 m roadside ditch that runs parallel with McKenna Casey Drive, just off the northwestern corner of the property. The reach runs along McKenna Casey Drive to the north and a farm road to the south. Instream vegetation is highly abundant, consisting of grasses. Both banks are covered in grasses.

The substrate consisted of a mixture of clay and silt. Woody debris and submergent vegetation was absent. Reach 7 consisted of standing water in April, May, and July, being blocked by higher ground downstream. No fish, frogs, or turtles were observed in this reach.

Reach 8

Reach 8 is the upstream-most section of the Fraser Clarke Municipal Drain. Reach 8 is a 165 m channel running just beyond the north edge of the property to Borrisokane Rd. The channel then passes under Borrisokane through a culvert, and crosses neighbouring properties to the north before reaching the east-side development area (Reach 14 there). The substrate consisted of silt and clay. It was flooded in April with slow flow. In May and July, Reach 8 contained small amounts of standing water. No fish, frogs or turtles were observed there.

2.3.2 Borrisokane Road

Reaches 9 and 10

Reaches 9 and 10 are 598 and 464 m roadside ditches located on the west and east of Borrisokane Road, respectively. Both reaches have Borrisokane Road on one side and cropped land on the other. Instream vegetation and both banks are covered with grasses. Both reaches connect directly to the Jock River at their south ends, but flow into other channels (Reach 9 to Reach 8 and Reach 10 to Reach 11) at their north ends, suggesting high points somewhere midway along the length of each. Both reaches though were characterized by standing water during the April survey with small, disparate, pools of standing water (presumably rain water) in May and July, preventing the determination of the specific location of those high points.

The substrates both reaches consisted of silt and clay. Woody debris and submergent vegetation are absent. In Reach 9, two fish were observed; one Creek Chub and one undetermined fish (fish was observed but was not captured). No fish were observed in Reach 10 and no frogs or turtles were observed in either reach.

2.3.3 East Side

Reach 11

Reach 11 is a 647 m agricultural drainage ditch that conveys flow north-east along the northern border of the eastern property parcel from Borrisokane Road to Reach 12. This reach runs along cropped land on both sides. Instream vegetation is dominated by grasses with some heavy patches of cattails. Both banks consist grasses with some shrubs.

The substrate consisted of silt and clay. Woody debris and submergent vegetation are absent. Reach 11 had negligible flow in April with some standing water in May and July. No fish or turtles were observed in this reach. A few American Toads, Gray Treefrogs, and Northern Leopard frogs were heard calling from scattered points along Reach 11.

Reach 12

Reach 12 is an 814 m swale conveying spring freshet flows north-east though the eastern farm fields to Reach 12. The feature may have once began on the west side of Borrisokane Rd. but no longer does. It is a poorly defined swale for most its length, but does develop some bank structure after the confluence of Reach 11 to its confluence with Reach 14. The reach runs along cropped land to the north and south. Instream vegetation is dominated by grasses with the occasional cattail. Both banks are dominated by grasses, with some shrubs and trees.

The substrate consisted of silt and clay. Woody debris and submergent vegetation is mostly absent from this reach. In April, this reach was characterized by barely detectable flow. There were limited patches of standing water in May and July. No fish, frogs, or turtles were observed in this reach.

Reach 13

Reach 13 is a 135 m wetted depression between two corn fields on the eastern portion of the property. Instream vegetation and both banks are covered in grasses, with the occasional shrub.

The substrate consisted of clay. Woody debris and submergent vegetation was absent. Reach 13 was characterized by standing water in April and was completely dry by May. In July, this reach had regained small areas of pooled water after high levels of rainfall. No fish, frogs, or turtles were observed in this reach.

Reach 14

Reaches 14 is the main channel of the Fraser Clarke Municipal Drain where it crosses the eastern development area. The reach, from the confluence of Reach 12 to the south property boundary, runs 700

m, then continues on into the Jock River. Both banks of both reaches flow through cropped land. Instream vegetation consists of grasses; some small patches of swampy riparian vegetation occur along the upper portions of the reach. The substrate consisted of silt and clay. Woody debris and submergent vegetation are present in patches.

The reach was very wide and flooded in April with slow flow. Through May and July, the reach reduced to a wetted width of 1 m or less along much of its length with undetectable levels of flow. Eleven fish were observed in Reach 14; eight Common Shiners, two Banded Killifish, and one Creek Chub. American Toads, Gray Treefrogs, Green Frogs (*Rana clamitans*) and Northern Leopard Frogs were heard calling in the vicinity of Reach 14, and a Snapping Turtle was observed.

Reach 15

Reach 15 is a very shallow, 115 m agricultural swale that runs south-east through a corn field on the eastern portion of the property before its confluence with Reach 12. There was no instream vegetation and both banks were bare earth in spring, though crops had begun to cover the feature by July (i.e. it had been planted and not treated as any sort of HDF.

The substrate consisted of clay. Woody debris and submergent vegetation was absent. Reach 13 was characterized by standing water in April and was completely dry in May and July. No fish, frogs, or turtles were observed in this reach.

Reach 16

The portion of Reach 16 is a 230 m agricultural drainage ditch that runs south-east through cropped land on the near the eastern border of the property before its confluence with Reach 14. Instream vegetation consists of grasses and both banks are dominated by grasses with the occasional shrub and tree.

The substrate consisted of silt and clay. Woody debris was somewhat abundant while submergent vegetation was absent. Reach 16 was fast flowing in April but only low levels of standing water in May and July. No fish, frogs, or turtles were observed in this reach.

2.4 Component Classifications

The following tables summarize the functions provided by the 16 reaches.

Table 1. Hydrology Classification, 2017

Drainage Feature	Hydrology Classification				
	Assessment Period	Flow Conditions	Flow Classification	Modifiers	Hydrological Function
Reach 1	April 7 May 4 July 5	Surface flow Surface flow Surface flow	Perennial		**Important Functions**
Reach 2	April 7 May 4 July 5	Surface flow - negligible Dry Dry	Ephemeral	No source other than spring run-off and after heavy rainfall.	**Contributing Functions**
Reach 3	April 7 May 4 July 5	Surface flow - negligible Dry Dry	Ephemeral	No source other than spring run-off and after heavy rainfall.	**Contributing Functions**
Reach 4	April 7 May 4 July 5	Surface flow - negligible Standing water Nearly dry	Ephemeral	Water only remained in this reach due to temporary blockages and heavier than average rainfalls.	**Contributing Functions**
Reach 5	April 7 May 4 July 5	Surface flow Surface flow Surface flow	Perennial		**Important Functions**
Reach 6	April 7 May 4 July 5	Standing water Standing water Standing water	Standing Water	No source other than spring run-off and after heavy rainfall. Low apparent infiltration.	**Limited Functions**
Reach 7	April 7 May 4 July 5	Standing water Dry Dry	Ephemeral	No source other than spring run-off and after heavy rainfall.	**Contributing Functions**
Reach 8	April 7 May 4 July 5	Surface flow Standing water Standing water	Intermittent	Water was likely higher here than usual due to heavier than average rainfalls in 2017.	**Valued Functions**
Reach 9	April 7 May 4 July 5	Surface flow - negligible Standing water Standing water	Intermittent	Spring freshet water with road runoff subsequently.	**Contributing Functions**
Reach 10	April 7 May 4 July 5	Surface flow - negligible Standing water Standing water	Intermittent	Spring freshet water with road runoff subsequently.	**Contributing Functions**
Reach 11	April 7 May 4 July 5	Surface flow Standing water Standing water	Intermittent	Water was likely higher here than usual due to heavier than average rainfalls in 2017.	**Valued Functions**
Reach 12	April 7 May 4 July 5	Surface flow - negligible Standing water Standing water	Intermittent	Water was likely higher here than usual due to heavier than average rainfalls in 2017.	**Valued Functions**
Reach 13	April 7 May 4 July 5	Standing water Dry Disparate areas of standing water	Ephemeral	No source other than spring run-off; some rainwater briefly held in July.	**Contributing Functions**
Reach 14	April 7 May 4 July 5	Surface flow Surface flow - negligible Surface flow - negligible	Permanent		**Valued Functions**
Reach 15	April 7 May 4 July 5	Standing water (no apparent flow) Dry Dry	Ephemeral	No source other than spring run-off.	**Contributing Functions**

Drainage Feature	Hydrology Classification				
	Assessment Period	Flow Conditions	Flow Classification	Modifiers	Hydrological Function
Reach 16	April 7 May 4 July 5	Surface flow Standing water Standing water	Intermittent	Water was likely higher here than usual due to heavier than average rainfalls in 2017.	**Valued Functions**

Table 2. Riparian Classification

Drainage Feature	Riparian Classification			
	OSAP Descriptions	OSAP Riparian Codes	ELC Codes	Riparian Conditions
Reach 1	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 2	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 3	RUB – Scrubland LUB – Cropped land	RUB – 5 LUB – 3	CUT OAG	**Important Functions**
Reach 4	RUB – Cropped land LUB – Scrubland	RUB – 3 LUB – 5	OAG CUT	**Important Functions**
Reach 5	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 6	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 7	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 8	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 9	RUB – None (Borrisokane Rd) LUB – Cropped land	RUB – 1 LUB – 3	Road OAG	**Limited Functions**
Reach 10	RUB – Cropped land LUB – None (Borrisokane Rd)	RUB – 3 LUB – 1	OAG Road	**Limited Functions**
Reach 11	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 12	RUB – Cropped land/Meadow Marsh LUB – Cropped land/Meadow Marsh	RUB – 3 LUB – 3	OAG/MAM OAG/MAM	**Import Functions**
Reach 13	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 14	RUB – Cropped land/Swamp LUB – Cropped land/Swamp	RUB – 3 LUB – 3	OAG/SWD/MAM OAG/SWD/MAM	**Important Functions**
Reach 15	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**
Reach 16	RUB – Cropped land LUB – Cropped land	RUB – 3 LUB – 3	OAG OAG	**Limited Functions**

RUB – right upstream bank
LUB – left upstream bank

Table 3. Fish and Fish Habitat Classification, May 4, 2017

Drainage Feature	Riparian Classification		
	Fish Observation • **Fishing effort**	**Fish and Fish Habitat Designation***	**Modifiers**
Reach 1	Fish present, no SAR present. • 400 SS = 8.00 s/m^2	**Important Functions**	A total of 30 fish (7 Common Shiners, 6 Longnose Dace, 5 Creek Chub, 4 Mottled Sculpins, 3 Banded Killifish, 3 Pumpkinseed Sunfish, and 2 Fathead Minnows) were observed. All these fish species are very common and highly tolerant. Conductivity in the reach was 1263 µS/cm, suggesting high levels of contamination through agricultural practices.
Reach 2	No fish present, no SAR present. • Dry	**Limited Functions**	Conductivity in the reach was 1160 µS/cm, suggesting high levels of contamination through agricultural practices.
Reach 3	No fish present, no SAR present. • Dry	**Contributing Functions**	Several woody debris piles downstream act as fish barriers.
Reach 4	No fish present, no SAR present. • Woody debris acting as a fish barrier downstream	**Contributing Functions**	Several woody debris piles downstream act as fish barriers.
Reach 5	Fish present, no SAR present. • Too deep to fish at time of survey. Fish catch data was reviewed from a previous report (Muncaster 2009).	**Important Functions**	Muncaster (2009) found a limited and common fish community, albeit, still relatively diverse, including Banded Killifish, Blacknose Dace, Blacknose Shiner, Bluntnose Minnow, Brook Stickleback, Central Mudminnow, Common Shiner, Creek Chub, Fathead Minnow, Mottled Sculpin, Pumpkinseed Sunfish, Rock Bass, and White Sucker. All these species are common and generally have high tolerances. Conductivity in the reach was 1039 µS/cm, suggesting high levels of contamination through road run-off and upstream agricultural practices.
Reach 6	No fish present, no SAR present. • 96 SS = 1.28 s/m^2 (mostly spot shocking where possible through dense vegetation)	**Limited Functions**	This reach is not connected upstream or downstream. Dissolved oxygen in the reach was 2.0 mg/L, suggesting there is not enough oxygen to support fish.
Reach 7	No fish present, no SAR present. • Dry	**Limited Functions**	Conductivity in the reach was 2774 µS/cm, suggesting high levels of contamination through road run-off.
Reach 8	No fish present, no SAR present. • No way too fish as reach was inundated with cattails and grasses	**Contributing Functions**	The reach was inundated with cattails and grasses providing no areas of open water for fish habitat. Conductivity in the reach was 725 µS/cm, suggesting contamination through road run-off and upstream agricultural practices.
Reach 9	Fish present, no SAR present. • 309 SS = 5.15 s/m^2	**Contributing Functions**	A total of 2 fish (1 Creek Chub and 1 unidentified fish) were observed. Creek Chub are very common and highly tolerant. Conductivity in the reach was 1487 µS/cm, suggesting high levels of contamination through road run-off.
Reach 10	No fish present, no SAR present. • 96 SS = 6.40 s/m^2	**Contributing Functions**	Conductivity in the reach was 1783 µS/cm, suggesting high levels of contamination through road run-off. Dissolved oxygen in the reach was 5.0 mg/L, suggesting there is not enough oxygen to support fish.
Reach 11	No fish present, no SAR present. • 204 SS = 1.36 s/m^2 (mostly spot shocking where possible through dense vegetation)	**Contributing Functions**	Dissolved oxygen in the reach was 3.5 mg/L, suggesting there is not enough oxygen to support fish.
Reach 12	No fish present, no SAR present.	**Contributing Functions**	The reach was inundated with cattails and grasses providing no areas of open water for fish habitat.

Drainage Feature	Riparian Classification		
	Fish Observation • **Fishing effort**	**Fish and Fish Habitat Designation***	**Modifiers**
	• No way too fish as reach was inundated with cattails and grasses		
Reach 13	No fish present, no SAR present. • Dry	**Limited Functions**	
Reach 14	Fish present, no SAR present. • 431 SS = 1.44 s/m^2	**Valued Functions**	A total of 11 fish (8 Common Shiners, 2 Banded Killifish, and 1 Creek Chub) were observed. These species are all very common and highly tolerant. Conductivity in the reach was 1001 µS/cm, suggesting high levels of contamination through agricultural practices.
Reach 15	No fish present, no SAR present. • Dry	**Contributing Functions**	
Reach 16	No fish present, no SAR present. • Sheet flow downstream with the reach's confluence with Reach 14 provided a barrier to fish	**Contributing Functions**	Presence of a barrier (sheet flow over a steep gradient) prevented fish movement upstream.

*Fish and Fish Habitat Designation is constrained by the HDF Guidelines definitions. "Modifiers" provides significant caveats to those designations.
SS = shocking seconds

Table 4. Terrestrial habitat classification

Drainage Feature	Description	Amphibians	Terrestrial Classification
Reach 1	Connects directly to the Jock River; riparian zone (though very limited) likely provides an important corridor function.	No frogs were observed in the vicinity of the feature.	**Valued Functions**
Reach 2	No adjacent wetland areas. No upstream forest or wetland features thus the riparian zone does not provide a corridor connection.	No frogs were observed in the vicinity of the feature.	**Limited Functions**
Reach 3	No adjacent wetland areas. No upstream forest or wetland features thus the riparian zone does not provide a corridor connection. Right upstream bank runs along scrubland thus the riparian zone could provide some marginal habitat space.	No frogs were observed in the vicinity of the feature.	**Contributing Functions**
Reach 4	Connects directly to the Jock River but is very short and does no lead to any upstream forest or wetland features; corridor potential is very limited. Right upstream bank runs along scrubland thus the riparian zone could provide limited area of marginal habitat space.	No frogs were observed in the vicinity of the feature.	**Contributing Functions**
Reach 5	Connects directly to the Jock River; riparian zone (though very limited) likely provides an important corridor function.	American Toads, Gray Treefrogs, and Northern Leopard Frogs were observed in the feature.	**Valued Functions**
Reach 6	A SWMP is situated just north of the feature, but is not connected, and natural areas are absent from the southern end. The riparian zone does provide a corridor connection.	American Toads and Gray Treefrogs were observed in the SWMP to the north of the feature.	**Limited Functions**
Reach 7	Roadside ditch. No adjacent wetland areas. There are no upstream forest or wetland features thus the riparian zone does not provide a corridor connection. Roadside ditch.	No frogs were observed in the vicinity of the feature.	**Limited Functions**
Reach 8	No adjacent wetland areas. There are no upstream forest or wetland features thus the riparian zone does not provide a corridor connection.	No frogs were observed in the vicinity of the feature.	**Limited Functions**
Reach 9	Roadside ditch. No adjacent wetland areas. There are no upstream forest or wetland features thus the riparian zone does not provide a corridor connection. Roadside ditch.	No frogs were observed in the vicinity of the feature.	**Limited Functions**
Reach 10	Roadside ditch. No adjacent wetland areas. There are no upstream forest or wetland features thus the riparian zone does not provide a corridor connection. Roadside ditch.	No frogs were observed in the vicinity of the feature.	**Limited Functions**
Reach 11	There are no upstream forest features but the narrow riparian edges of some portions of the reach provide a thin band of wetland-like habitat.	Very small numbers (3 of fewer each) of American Toads, Gray Treefrogs, and Northern Leopard Frogs were observed in the feature. Not considered a breeding area.	**Valued Functions**

Drainage Feature	Description	Amphibians	Terrestrial Classification
Reach 12	There are no upstream forest features but the narrow riparian edges of some portions of the reach provide a thin band of wetland-like habitat. That habitat was not used by amphibians.	No frogs were observed in the vicinity of the feature.	**Valued Functions**
Reach 13	No adjacent wetland areas. There are no upstream forest or wetland features but the HDF connects directly to the Jock river. The riparian zone may provide a corridor connection.	No frogs were observed in the vicinity of the feature.	**Limited Functions**
Reach 14	Connects directly to the Jock River but leads to primarily to developed urban areas. The riparian zone along the upper end of the however, likely provides some (limited) wetland habitat.	American Toads, Gray Treefrogs, Green Frogs, and Northern Leopard Frogs were observed in the vicinity of the feature.	**Important Functions**
Reach 15	No adjacent wetland areas. There are no upstream forest or wetland features thus the riparian zone does not provide a corridor connection.	No frogs were observed in the vicinity of the feature.	**Limited Functions**
Reach 16	No adjacent wetland areas. There are no upstream forest or wetland features thus the riparian zone does not provide a corridor connection.	No frogs were observed in the vicinity of the feature.	**Limited Functions**

2.5 Reach Summary

Dimensions of the HDF reaches are summarized in Table 5.

Table 5. Reach dimensions, April 7, 2017

Drainage Feature	Length (m)	Mean Bankfull Width (m)	Mean Wetted Width (m)	Mean Depth (m)
Reach 1	770	5.00	4.50	Indeterminate
Reach 2	100	0.80	~400	0.23
Reach 3	80	1.25	1.15	0.07
Reach 4	100	Indeterminate	~100	Indeterminate
Reach 5	560	Indeterminate	~100	Indeterminate
Reach 6	280	2.00	2.35	0.18
Reach 7	145	3.00	1.90	0.06
Reach 8	165	Indeterminate	10.0	Indeterminate
Reach 9	598	2.50	1.80	0.20
Reach 10	464	1.20	0.65	0.10
Reach 11	647	Indeterminate	7.00	0.29
Reach 12	814	Indeterminate	26.3	0.50
Reach 13	135	Indeterminate	6.40	0.09
Reach 14	700	Indeterminate	~30	Indeterminate
Reach 15	115	6.80	6.80	0.11
Reach 16	230	2.10	0.85	0.13

3.0 MANAGEMENT RECOMMENDATIONS

The classification categories identified in Section 2 provide the basis of the management recommendations provided here. The following flow chart (Figure 2) combines and translates the classification results to management recommendations.

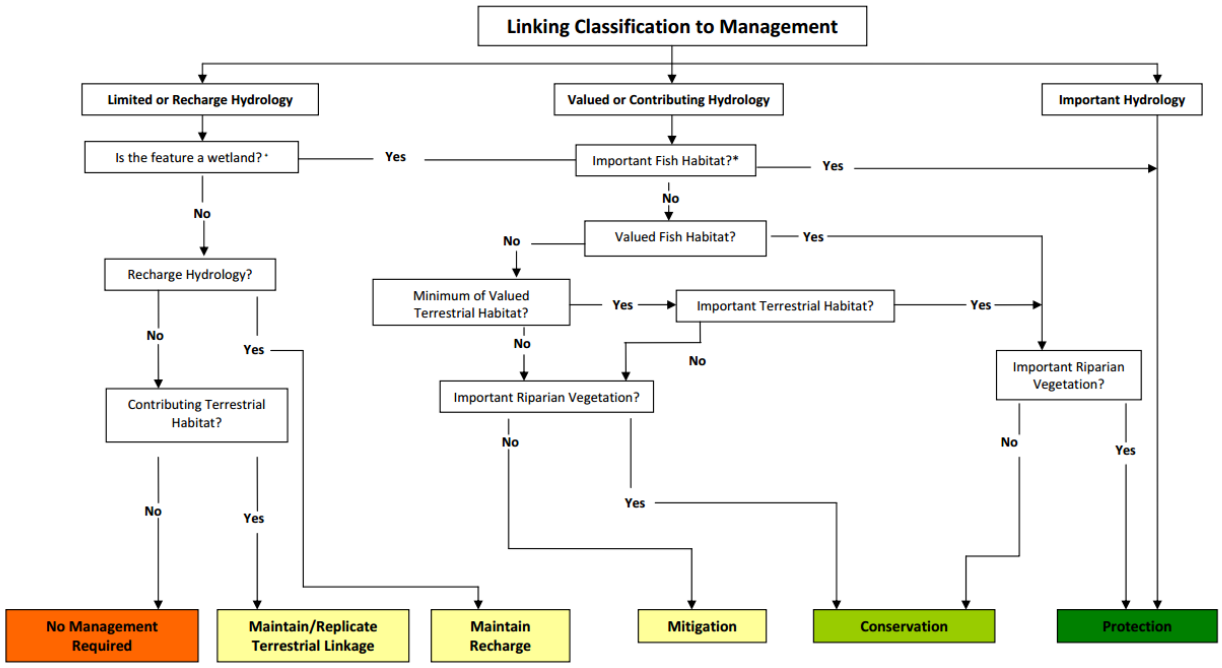


Figure 2. Headwater Drainage Feature Assessment (HDFA) flow chart providing direction on management options

3.1 Reaches Warranting Protection

Reaches 1, 5 and 14 are all municipal drains. These features all have perennial flow and provide direct fish habitat. The lands surrounding these features are entirely under active agriculture, with ploughed fields generally extending to within a few metres or less of the tops of bank. As such, these features provide limited riparian or terrestrial habitat space (though Reach 14 has some limited wetland patches towards its upstream end). Following the HDFA Guide flow chart linking component classification to management directives (Figure 2), these reaches:

1. Provide *Important* Hydrology.

This single factor leads to a management directive to **Protection**, though the directive is further reinforced by the presence of "important" -level fish habitat. These reaches may be maintained and/or enhanced, but cannot generally be relocated. The HDF channels must be protected and their riparian zone corridors should be enhanced where feasible. The hydro-period should be maintained with incorporation of shallow groundwater and base flow protection techniques such as infiltration treatment. Use natural channel design techniques or wetland design to restore and enhance existing habitat features where needed.

Stormwater management systems must be designed to avoid impacts (i.e. sediment, temperature) to the headwater channels.

3.2 Reaches with No Management Required

Reach 6 has no flow as it is an isolated, remnant channel effectively serving as a trough, filled only during the spring freshet. The clay soils there appear to retain water for an extend period, very much limiting infiltration capacity, suggesting the feature plays an, at most, negligible role in groundwater recharge. No turtles or frogs were found to use the feature as habitat and it is surrounded by cropped fields and areas of bare earth. Following the HDFA Guide flow chart linking component classification to management directives (Figure 2), this reach:

1. Provides *Limited* Hydrology;
2. Is not a wetland;
3. Is unlikely to provide recharge hydrology (poorly drained clay soils); and
4. Does not provide *Contributing* Terrestrial Habitat.

This chain of classification descriptors leads to a management directive of **No Management Required.** There is no requirement to maintain or replace the current form of this feature.

3.3 Reaches Warranting Mitigation or Protection

The remainder of the reaches on sites are a mix of small agricultural drains, roadside ditches, or swales through farm fields. Following the HDFA Guide flow chart linking component classification to management directives (Figure 2), these reaches:

1. Provide *Valued* or *Contributing* Hydrology; but
2. Do not provide either *Important* or *Valued* Fish Habitat.

Reaches 11 and 12 include small bands of meadow marsh habitat along their fringes though these areas do no support breeding frog populations. As such, they:

3a. Provide *Valued* but not *Important* Terrestrial Habitat; and
4a. Provide *Important* Riparian Vegetation.

This chain of classification descriptors leads to a management directive of **Conservation** for these reaches. These features may be maintained or, if necessary relocated, using natural channel design techniques to maintain or enhance overall productivity of the reach. In either case, riparian corridors must be maintained or enhanced. If catchment drainage will be removed due to diversion of stormwater flows, lost functions should be restored through enhanced lot level controls (e.g. restore original catchment using clean roof drainage). External flows must be maintained or replaced and the drainage feature must (re)connect to downstream features.

Reaches 2, 3, 4, 7, 8, 9, 10, 13, 15 and 16:

3a. Provide only *Contributing* or *Limited* Terrestrial Habitat (i.e. not *Valued*); and

4a. Provide *Limited* Riparian Vegetation.

This chain of classification descriptors leads to a management directive to **Mitigation** for these reaches. These features are not required to be maintained per se, but their functionality must be replicated or enhanced through lot level conveyance measures, such as well-vegetated swales (herbaceous, shrub and tree material) to mimic online wet vegetation pockets, or be replicated through constructed wetland features connected to downstream of the site. The stormwater plan for site development must replicate on-site flow and outlet flows at the top end of system. If catchment drainage has been previously removed due to diversion of stormwater flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage). Lot level conveyance measures (e.g. vegetated swales) connected to the natural heritage system, and/or Low Impact Development (LID) options are the preferred approaches for stormwater plan to the extent that they can be implemented.

4.0 CLOSURE

This report provides detailed descriptions and ecological valuations of the HDFs crossing the BCE property. Points of clarification can be addressed to the undersigned.

Anthony Francis, PhD
KILGOUR & ASSOCIATES LTD.

5.0 REFERENCES

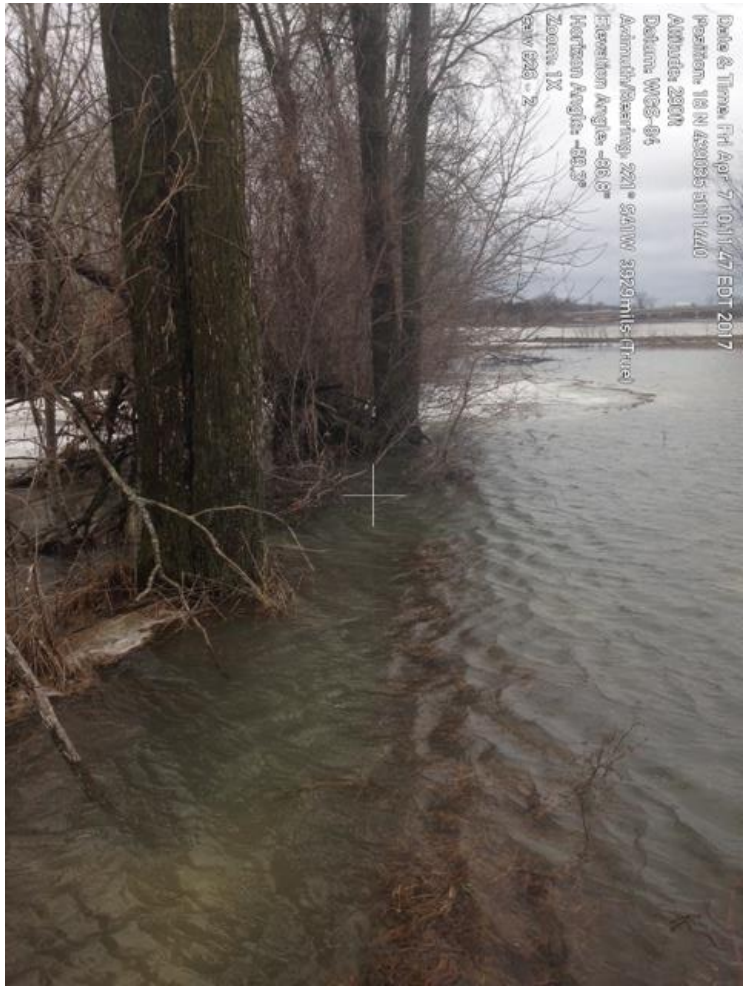
Muncaster (Muncaster Environmental Planning Inc.). 2009. Foster and Kennedy Burnett Stormwater Project – Fish and Fish Habitat Assessments – Foster and Fraser Clarke Drains, Barrhaven, City of Ottawa.

APPENDIX A: SITE PHOTOS

Reach 1

Reach 2


Date & Time: Fri Apr 7 10:11:30 EDT 2017
Position: 18 N 439038 5011454
Altitude: 353ft
Datum: WGS-84
Azimuth/Bearing: 047° N47E 0836mils (True)
Elevation Angle: -87.1°
Horizon Angle: -89.2°
Zoom: 1X
caiv 626 - 2


Date & Time: Fri Apr 7 10:11:47 EDT 2017
Altitude: 290ft
Datum: WGS-84
Azimuth/Bearing: 221° SW 3929mils (True)
Elevation Angle: -88.6°
Horizon Angle: -89.3°
Zoom: 1X
caiv 626 - 2

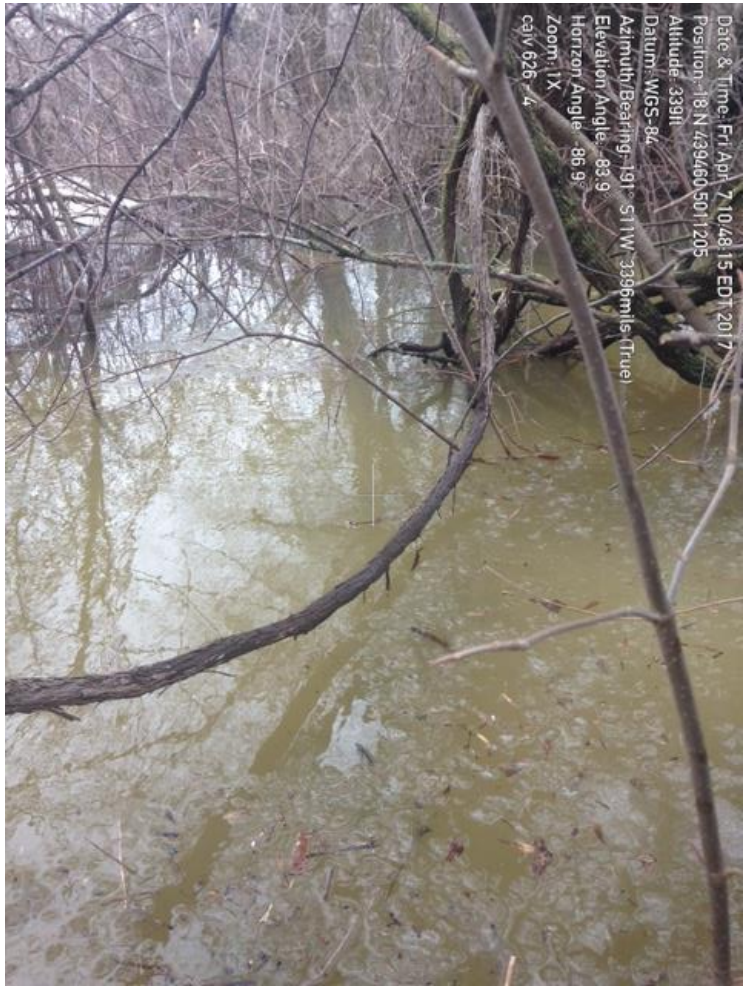
Reach 3


Date & Time: Fri Apr 7 10:29:13 EDT 2017
Position: 18 N 439194 5011081
Altitude: 339ft
Datum: WGS-84
Azimuth/Bearing: 066° N66E 1173mils (True)
Elevation Angle: -89.0°
Horizon Angle: 89.5°
Zoom: 1X
caiv 626 - 3


Date & Time: Fri Apr 7 10:28:25 EDT 2017
Position: 18 N 439191 5011061
Altitude: 306ft
Datum: WGS-84
Azimuth/Bearing: 230° S50W 4089mils (True)
Elevation Angle: 86°
Horizon Angle: 88°
Zoom: 1X
caiv 626 - 3

Reach 4


Date & Time: Fri Apr 7 10:47:57 EDT 2017
Position: 18 N 439460 5011205
Altitude: 351ft
Datum: WGS-84
Azimuth/Bearing: 359° N01W 6382mils (True)
Elevation Angle: -77.6°
Horizon Angle: -84.8°
Zoom: 1X
caiv 626 - 7


Date & Time: Fri Apr 7 10:48:15 EDT 2017
Position: 18 N 439460 5011205
Altitude: 339ft
Datum: WGS-84
Azimuth/Bearing: 191° S11W 3396mils (True)
Elevation Angle: -83.9°
Horizon Angle: -86.9°
Zoom: 1X
caiv 626 - 4

Reach 5

***These pictures are of Reach 5, not Reach 4 which is displayed in the text photograph.**

Reach 6


Date & Time: Fri Apr 7 11:15:00 EDT 2017
Position: 16 N 4[illegible] 5011626
Altitude: 271 m
Datum: WGS-84
Azimuth: 81.6° (Mag) 90° 5.0W 3378 mils (True)
Elevation Angle: 8°
Horizontal Distance: 6222 miles
Zoom: 1x
caiv626 6


Date & Time: Fri Apr 7 11:15:16 EDT 2017
Position: 16 N 4[illegible] 5011629
Altitude: 320 m
Datum: WGS-84
Azimuth: 81.6° (Mag) 90° 5.0W 3378 mils (True)
Elevation Angle: 8°
Horizontal Distance: 6222 miles
Zoom: 1x
caiv626 16

Reach 7


Date & Time: Fri Apr 7 11:26:49 EDT 2017
Position: 18 N 441046 5012890
Altitude: 389ft
Datum: WGS-84
Azimuth/Bearing: 045° N45E 0800mils (True)
Elevation Angle: 81.7°
Horizon Angle: -87.0°
Zoom: 1X
caiv 626 - 7


Date & Time: Fri Apr 7 11:27:02 EDT 2017
Position: 18 N 443934 5011856
Altitude: 289ft
Datum: WGS-84
Azimuth/Bearing: 242° S52W 4124mils (True)
Elevation Angle: -85.4°
Horizon Angle: -88.6°
Zoom: 1X
caiv 626 - 7

Reach 8


Date & Time: Fri Apr 7 12:18:05 EDT 2017
Position: 18 N 439741 5011850
Altitude: 326ft
Datum: WGS-84
Azimuth/Bearing: 247° S67W 4391 mils (True)
Elevation Angle: -83.7°
Horizon Angle: -87.8°
Zoom: 1X
caiv 626 - 8


Date & Time: Fri Apr 7 12:18:36 EDT 2017
Position: 18 N 439743 5011851
Altitude: 340ft
Datum: WGS-84
Azimuth/Bearing: 066° N66E 1173 mils (True)
Elevation Angle: -88.3°
Horizon Angle: -89.4°
Zoom: 1X
caiv 626 - 8

Reach 9


Date & Time: Fri Apr 7 12:25:25 EDT 2017
Position: 18 N 439780 5011783
Altitude: 90.0ft
Datum: WGS-84
Azimuth/Bearing: 355° N05W 6311mils (True)
Elevation Angle: -88.6°
Horizon Angle: -89.5°
Zoom: 1X
caiv 626 - 9


Date & Time: Fri Apr 7 12:25:36 EDT 2017
Position: 18 N 439793 5011782
Altitude: 90.0ft
Datum: WGS-84
Azimuth/Bearing: 175° S05E 3111mils (True)
Elevation Angle: -89.2°
Horizon Angle: -89.8°
Zoom: 1X
caiv 626 - 9

Reach 10


Date & Time: Fri Apr 7 12:47:45 EDT 2017
Position: 18 N 459827 5011693
Altitude: 88ft
Datum: WGS-84
Azimuth/Bearing: 351° N09W 6240mils (True)
Elevation Angle: -88.4°
Horizon Angle: -89.4°
Zoom: 1X
caiv 626 - 10


Date & Time: Fri Apr 7 12:47:56 EDT 2017
Position: 18 N 459845 5011653
Altitude: 297ft
Datum: WGS-84
Azimuth/Bearing: 174° S06E 3093mils (True)
Elevation Angle: -86.6°
Horizon Angle: -89.0°
Zoom: 1X
caiv 626 - 10

Reach 11


Date & Time: Fri Apr 7 12:55:24 EDT 2017
Position: 18 N 450740 5012091
Altitude: 300m
Datum: WGS-84
Azimuth/Bearing: 225° SASW 4000mils (True)
Elevation Angle: -85.1°
Horizon Angle: -88.0°
Zoom: 1X

Reach 12


UTC: 2017.04.07T16:57:07Z
Lat, Lon: 45.257395, -75.766304
Azimuth and Bearing
241° S61W
0°
-2.1°
-5°
-15°
-4.3°
0°
+15°
SW
W


Azimuth and Bearing
25° N25E
+5°
0°
.0°
-15°
-3.7°
0°
+15°
N
NE

Reach 15


Azimuth and Bearing
347° N77W
0°
-1.3°
-5°
-30°
-15°
-10.1°
0°
NW
N
NE


Azimuth and Bearing
131° S40E
0°
-.7°
-5°
-15°
-5.7°
0°
+15°
E
SE
S