

**Claridge Homes
2559 Mer Bleue Road
Subdivision**

Headwaters Report

Prepared for:

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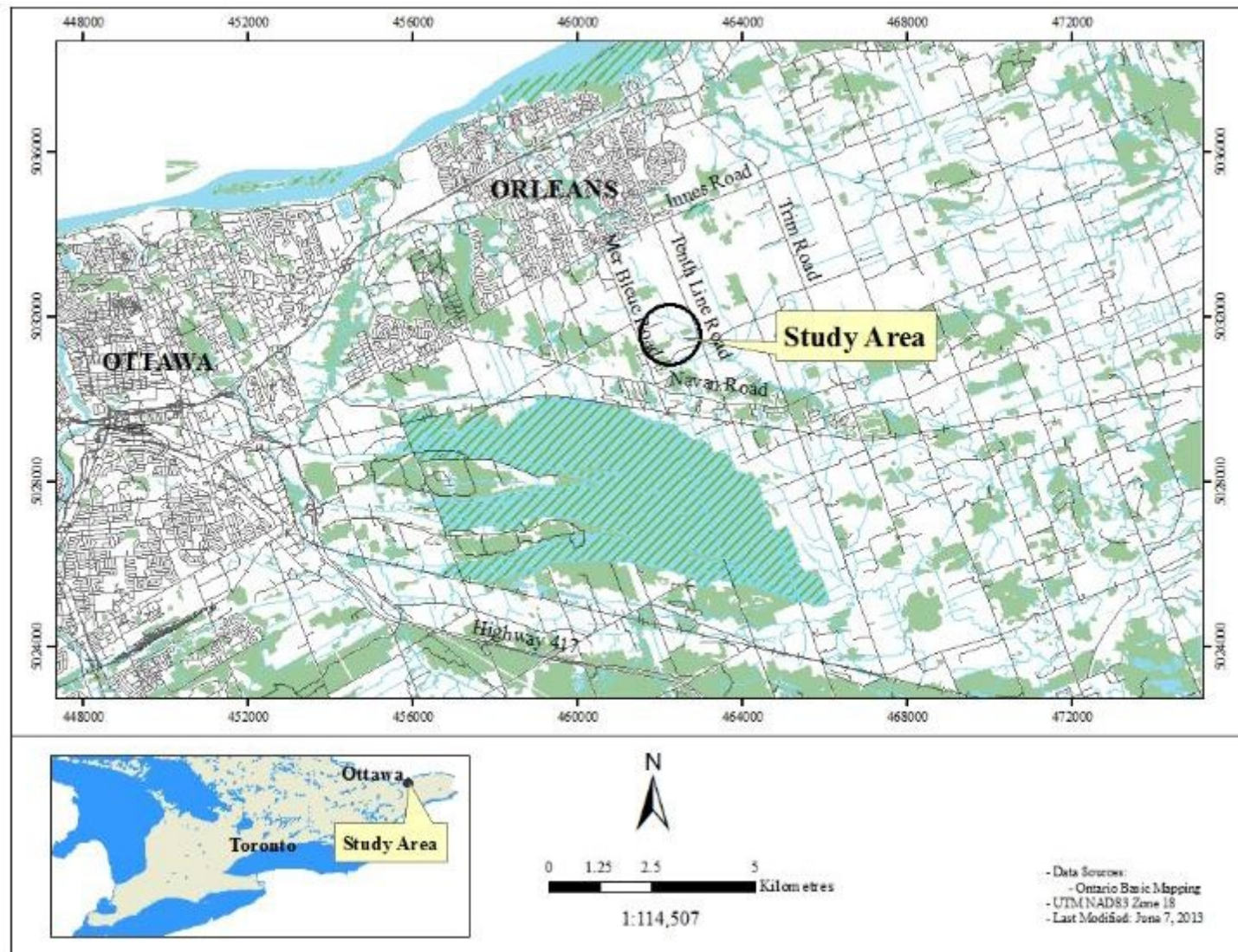
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1.0 INTRODUCTION

In 2016, Muncaster Environmental Planning (MEP) and Bowfin Environmental Consulting (Bowfin) prepared a Headwater Drainage Feature Assessment Report on behalf of the Mer Bleue Expansion Area Community Design Plan for the Mer Bleue Area 10 Urban Expansion Area (UEA). The UEA is 219 ha of former rural land bounded by Tenth Line Road on the east; Wall Road and approximately the south limit of Lot 6/Concession 11 on the south; Mer Bleue Road on the west and, approximately the north limit of Lot 4/Concession 11 on the north (Figure 1). The headwater features all flow into McKinnon's Creek (Figure 2). Claridge Homes, one of the participants in that stage, requested a copy of the Headwater Report, one that focused on their lands. Drains 6-13 from the 2016 report are situated within the Claridge Homes project area. Apart from a single visit to confirm that the headwater features remained and were similar to that described in the 2016, no new field work has been undertaken. All remained in similar state as witness during the previous work.

This report provides a summary of the findings along with an evaluation of the headwaters as per the *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* created by Credit Valley Conservation and Toronto Region Conservation (July 2013, updated January 2014).

Figure 1: Location of Study Area



2.0 METHODOLOGY

The following provides a summary of work which was completed between 2013 and 2019 on the relevant drains to Claridge Homes (Drains 6-14). The habitat in the Urban Expansion Area was described on September 6th, 2013 and sampled on April 28th and July 17th, 2014. Headwater features were described on April 14th and 28th, and August 9, 2016. The features within Claridge's lands were verified December 10th, 2019.

2.1 Review of Background Information

The review of background information was conducted in order to identify potential environmental concerns and to augment the data collected during the site visit. Background information regarding fish species was obtained with a request for information to South Nation Conservation (SNC) and a search of the Natural Heritage Information Centre (NHIC) databases.

2.2 Habitat Description

The fish habitat features within the study area was described based on the MTO *Environmental Guide for Fish and Fish Habitat October 2006* and the *Ontario Stream Assessment Protocol*. Information on the channel morphology was collected (channel width, wetted width, bankfull and wetted depths, cover type and abundance, and substrate type). The location of specific features mentioned in the text is shown on Figure 2.

2.3 Fish Community Sampling

Fish community sampling was performed to document the use of the site by fish during the spring. No sampling could take place during the summer due to a lack of water in all of the headwater drainage features. The community was sampled utilizing electrofishing and hoop netting where appropriate.

2.4 Headwater Drainage Features

The headwater drainage features within the study area were assessed based on the *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (here after referred to as the Guidelines) (prepared by Credit Valley Conservation Authority and Toronto and Region Conservation, approved January 2014). The Guideline is divided into three parts. Part 1 is the Evaluation and discusses various suggested study designs/methods. Part 2 determines the appropriate Classification following the outcome of Part 1. Finally, Part 3 outlines the Management Recommendations.

2.5 Amphibian Surveys

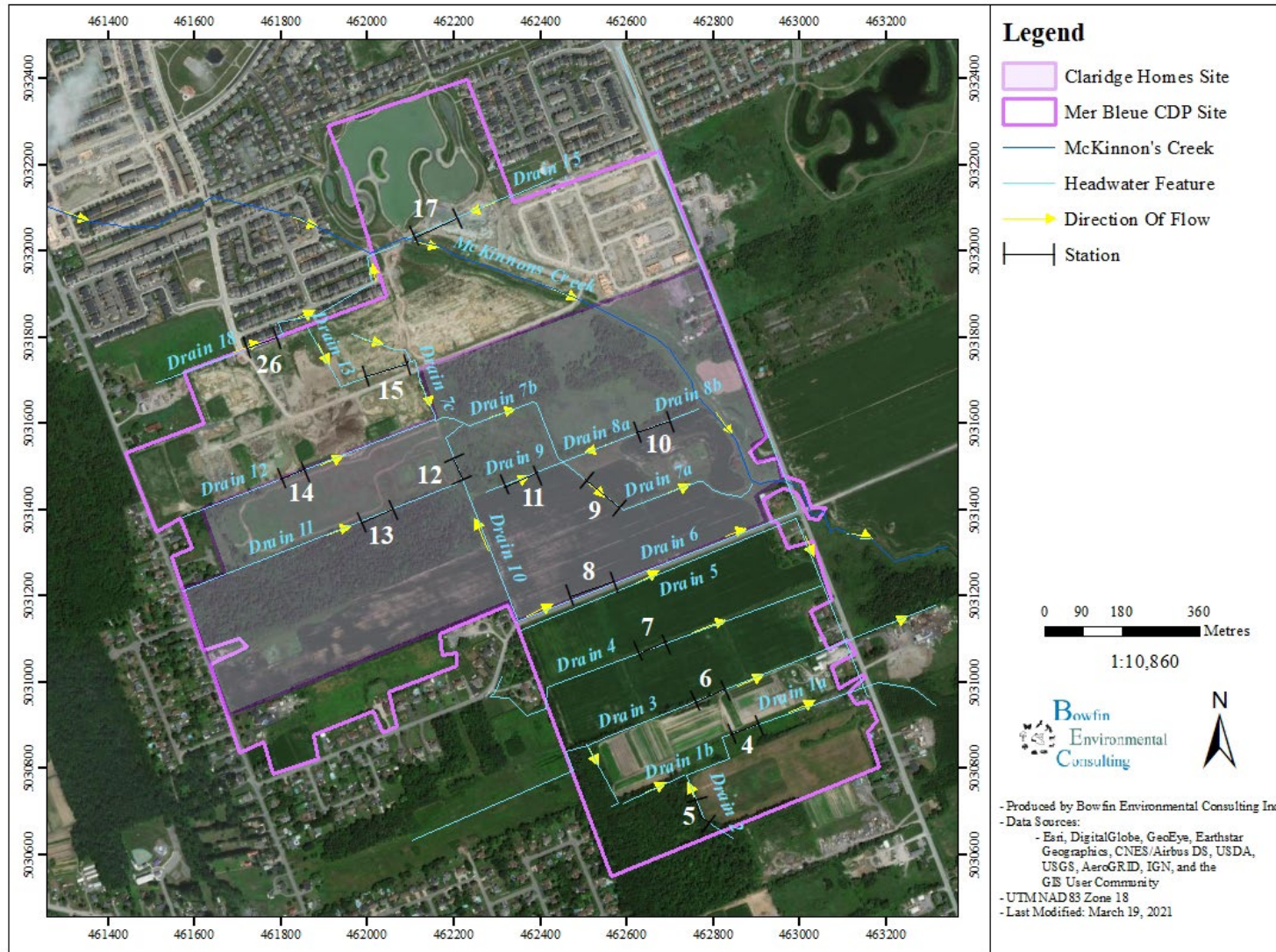
Nighttime amphibian calling surveys were completed as per the *Environment Canada Marsh Monitoring Program* (MMP) guide. The protocol is summarized below:

- The surveys were completed 3 times during the spring and early summer (once during each of the three survey period in order to collect data on all species)
- Observations began 30 minutes after sunset and end before midnight;
- Each station was surveyed for 3 minutes during which time the species and the calling code were recorded for each of the following distances: 0-50m, 50-100m, and >100m. Additional notes were taken on whether amphibians were in the feature being assessed. The calling codes were recorded as one of:
 - Code 1: Calls not simultaneous, number of individuals can be accurately counted
 - Code 2: Some calls simultaneous, number of individuals can be reliably estimated
 - Code 3: Full chorus, calls continuous and overlapping, number of individuals cannot be reliably estimated
- Surveys were only conducted if the wind strength was Code 0, 1, 2 or 3 on the Beaufort Wind Scale.
- Amphibian survey stations were separated by at least 500 m.

All surveys include the recording of the following information:

- Date
- Name of observer(s) conducting field work
- Time (start and end time, duration)
- Weather conditions (temperature, % cloud cover, wind)
- GPS location
- Species presence and abundance information

Figure 2: Location of Headwater Features and Survey Stations (2016 and 2019 Subject Lands)



3.0 RESULTS

3.1 Site Investigations

3.1.1 Summary of Visits and Sampling Site Locations

Several visits were completed between September 2013 and December 2019. Fish community sampling was completed during the spring (April 28, 2015). No water was present during the summer for summer sampling. Amphibian surveys were completed during the spring of 2016. As new subject lands were established in 2019, the site was visited to confirm features remained the same. Environmental conditions for each visit are described in Table 1 below.

Table 1: Summary of Dates Times of Site Investigations

Date	Time (h)	Staff	Air Temperature (Min-Max) °C	Cloud Cover (%) Beaufort Wind Scale [Descriptor (scale)]	Purpose
September 6, 2013	0730-1300	S. St.Pierre B. Pierson	10.0-23.0 (4.1-21.0)	Few clouds Wind: light air (1) changing to few clouds Wind: gentle breeze (3)	-Fish Habitat Description
September 17, 2013	0745-1245			Clear sky Wind: light air (1) changing to clear sky Wind: light breeze (2)	
April 24, 2014	2000-2215	S. St. Pierre B. Pierson	5.0-7.0 (-0.6-12.2)	Clear sky Wind: light breeze (2) changing to clear sky Wind: light air (1)	- Amphibian Survey
April 28, 2014	1030-1530	S. St. Pierre B. Pierson M. Lavictoire	14.0-13.0 (5.1-15.8)	Partly cloudy Wind: light breeze (2) changing to partly cloudy Wind: moderate breeze (4)	-Fish Community Sampling
May 13, 2014	2030-2300	S. St. Pierre B. Pierson	15 (8.9-16.8)	Cloudy Wind: gentle breeze (3) changing to partly cloudy Wind: light breeze (2)	- Amphibian Survey
June 16, 2014	2215-0115			Partly cloudy Wind: calm (0) changing to clear sky Wind: calm (0)	
April 12, 2016	0930-1330	S. St. Pierre B. Pierson	3 (-3.0-6.5)	Few clouds Wind: gentle breeze (3)	- Headwater Assessment

Date	Time (h)	Staff	Air Temperature (Min-Max) °C	Cloud Cover (%) Beaufort Wind Scale [Descriptor (scale)]	Purpose
C. Fontaine					
April 28, 2016	1000-1200	S. St. Pierre B. Pierson	2.0 (-3.3-9.8)	Few clouds Wind: light breeze (2)	- Headwater Assessment
August 9, 2016	0730-1200	B. Pierson	17-26	Partly cloudy	- Headwater Assessment
	1045-1145	S. St. Pierre C. Fontaine	(13.4-32.7)	Wind: light breeze (2)	
December 10, 2019	0800-0945	C. Fontaine	8.0 (-11.8-8.6)	Overcast Wind: gentle breeze (3)	- Headwater Feature Review of existing conditions

M. Lavictoire – Michelle (Nunas) Lavictoire – B. Sc. Wildlife Biology, M.Sc. Natural Resources
 S. St. Pierre – Shaun St. Pierre – B. Sc. Biology and Fisheries and Wildlife Technologist
 B. Pierson—Brittney Pierson—Honours BSc. Biology and Environmental Science
 C. Fontaine - Cody Fontaine - Fisheries and Wildlife Technologist

*Min-Max Temp Taken From: Environment Canada. National Climate Data and Information Archive. Ottawa International Airport. Available <http://climate.weatheroffice.gc.ca/> [November 26, 2020]

3.1.2 Habitat and Fish Community Descriptions

There was one sampling station on each feature (Figure 2). A summary of the water temperatures and other parameters collected at the stations during 2014 is provided in Table 2. Electroshocking surveys were completed on April 28, 2014. The settings utilized were 50-115 volts and 1.0-1.2 amps.

The following sections provide information on the aquatic habitat and fish communities collected between 2013 and 2016. A total of 7 features are described herein (labelled 6-12; labelling coincides with other reports which included a larger area). Each of the headwater features were walked in their entirety and a single site was established in a representative area. Also note that some of the channels were broken into separate reaches for the purposes of the headwater assessment in order to highlight specific differences such as the type of riparian vegetation (i.e. Drain 8 is broken into reaches 8a and 8b)

The potential *Fisheries Act* implications reviewed by the Department of Fisheries and Oceans (DFO) under a separate process. As per DFO's request, headwater feature, that do not provide fish habitat, are not discussed in the fisheries technical reports.

Comparison of Selected Channel Parameters

A summary of the water temperatures and other parameters collected at the stations during 2013-2016 is provided in Table 2. To put these into context a summary of the flood conditions for the survey period is provided below.

In 2013 and 2014, the flood conditions were considered to be Normal during the entire sampling period (as per the SNC website).

The snow pack of winter 2014-2015 melted prior to ice off resulting in low peak flows in 2015. This was followed by a period of low precipitation and cooler than normal temperatures until towards the end of April. Above seasonal temperatures were then experienced at the beginning of May. Temperatures returned to near average by mid-May. This resulted in likely lower water levels during spring sampling and in some instances higher water temperatures.

By the end of March 2016, the South Nation Conservation recorded the flood conditions as normal. The snow pack of winter 2015-2016 melted prior to ice off resulting in low peak flows in 2016. This was followed by a heavy snow storm at the start of April and cold air temperatures through to mid-April. Thin layers of ice were present on slow flowing channels in the mornings until after April 15, 2016.

Table 2: Feature Sampling Parameters

Date	Watercourse	Station No.	Time (h)	Air Temp (°C)	Water Temp (°C)	pH	TDS (ppm)	Cond (µS)	Ave. Depth (cm)	Ave. Wetted Width (m)	Ave. Channel Width (m)
09/17/2013	Drain 6	8	1050	19				DRY			
04/28/2014			1510	13	20.7	7.79	617	1243	5	1.3	1.2
04/12/2016			1040	5	6	NA	NA	NA	5.9	1.7	
09/17/2013	Drain 7	9	0754	7				DRY			
04/28/2014			1144	14	11.2	8.11	361	741	10	2.0	3.0
04/12/2016			1036	5	3.7	7.7	221	316	22.3	3.3	
09/17/2013	Drain 8	10	0813	7				DRY			
04/28/2014			1159	14	13.5	7.89	543	1065	2	0.6	1.3
04/12/2016			1047	5	4.4	7.56	571	791	4.5	0.6	
09/17/2013	Drain 9	11	0832	7				DRY			
04/28/2014			1208	14	14.1	7.74	163	328	4	0.9	1.3
04/12/2016			1052	4	3	NA			15.8	2.5	
09/17/2013	Drain 10	12	1002	19				DRY			
04/28/2014			1220	14	16.2	7.45	211	417	10	2.1	2.9
04/12/2016			1104	5	5	NA	NA	NA	4.5	0.6	
09/06/2013	Drain 11	13	1014	19				DRY			
04/28/2014			1228	14	13.7	7.58	263	534	6	1.1	2.1
04/12/2016			1122	5	6	NA	NA	NA	14.3	3.0	
09/06/2013	Drain 12	14	0937	19				DRY			
04/28/2014			1240	14							1.6
04/12/2016			1130	4	6	NA	NA	NA	NA	10.4	1.2

Aquatic Habitat and Fish Community Sampling Results

The Mer Bleue UEA consisted of active and historical agricultural fields resulting in a large number of dug drains. Of the 17 features identified (other than McKinnon's Creek) 7 (Drains 6-12) were within the Claridge Homes lands. Drain 6 is the north roadside ditches for Wall Road. All of the remaining features were constructed ditches one would typically expect to encounter within farmlands with the exception of Drain 7. Drain 7 appears to have been a natural channel that was channelized. Stations 8-14 were established on these features. Their locations are depicted on Figure 3, above. Habitat assessments for the stations were completed in September 2013 while fish sampling was completed in April 2014. Headwater assessments were completed in April and August of 2016.

All drains were dry during September 2013 and August 2016.

During the early spring visit in 2014 the water depths remained shallow. The drains with the 'most' water were drains 7 and 10 with an average of 10-11 cm (Table 3). Drain 11 had an average depth of 6 cm. Drains 6 and 9 had water depths between 3 cm and 5 cm. Drains 8 and 14 had depths of 1-2 cm. Drain 12 was dry during the spring (Table 3).

Electrofishing could be completed along three drains (Drains 7 and 10). Dip netting was completed at all other sites with water.

Drain 6

Drains 6 was a road ditch which flowed east towards Tenth Line Road. One station (station 8) was created on Drain 6, north side of Wall Road. It was noted that the upper end of Drain 6 was physically connected with Drain 10 though the two watercourses flowed in different directions. Soybeans were planted in the field adjacent to Drain 6 in 2016.

Station 8

Station 8 was situated 460 m west of Tenth Line Road. The station length was 40 m. The entire station was dry. The average channel and bankfull depth were 1.2 m and 12 cm in spring 2013.

The substrate was composed of fines. The entire channel was choked with vegetation (reed canary grass, and purple loosestrife). There were no signs of erosion.

The banks were fully vegetated with herbaceous vegetation. Herbaceous vegetation consisted of grass species, common sow-thistle and purple loosestrife. There was no canopy cover.

During the spring visit in April 2014, the site was dipped 60 times as it was too shallow to shock. The average wetted width and water depth obtained in April were 1.3 m and 5 cm (range 3-12 cm), respectively. No fish were captured.



Photo 1: Drain 6 (Station 8) looking upstream from the downstream end (April 28, 2014)



Photo 2: Drain 6 (Station 8) looking upstream from the downstream end (December 10, 2019)

Drain 7

Drain 7 connected with McKinnon's Creek to the west of Tenth Line Road, within the study area. This channel was 1230 m long and appeared to have been a natural watercourse that was entirely channelized. There were many side branches which were labelled as Drains 8-10, 12 and 13 (Drain 11 was a side branch to Drain 10). The surrounding land was mostly cropped (reaches 7a and 7c) with the exception of 7b where the watercourse travelled within thicket and woodland habitats.

Station 9

Station 9 was 360 m upstream of the confluence with McKinnon's Creek. The surrounding land consisted of an agricultural field. The station length was 40 m. The entire station was dry in spring 2013. The average channel and bankfull depth were 3.0 m and 22 cm.

The substrate was composed of fines. The in-stream cover consisted of aquatic vegetation (reed canary grass, narrow-leaved cattail, and purple loosestrife). There were no signs of erosion.

The banks were fully vegetated with herbaceous vegetation, and very poorly with woody species. Herbaceous vegetation consisted of reed canary grass, timothy and common sow-thistle. Woody vegetation included green ash. There was no canopy cover.

During the spring visit in April 2014, the site was shocked for 328 seconds over an area of approximately 80 m². The average wetted width and water depth obtained in April were 2.0 m and 10 cm (range 7-22 cm), respectively. No fish were captured.



Photo 3: Drain 7 (Station 9) looking upstream from the downstream end (April 28, 2014)



Photo 4: Drain 7 (Station 9) looking upstream from the downstream end (September 17, 2013)



Photo 5: Drain 7 (Station 9) looking upstream from the downstream end (December 10, 2019)

Drain 8

Drain 8 flowed from east to west merging with Drain 7 530 m upstream from McKinnon's Creek. Drain 8 was 335 m long and consisted of a straight channel. The surrounding land along reach 8a consisted of an agricultural field (soybeans in 2016) and of thicket along 8b.

Station 10

Station 10 was situated approximately 185 m east of its confluence with Drain 8. The station length was 40 m. The entire station was dry. The average channel and bankfull depth were 1.3 m and 19 cm in spring 2013.

The substrate was composed of fines. The channel was heavily choked with vegetation (purple loosestrife, narrow-leaved cattail, and reed canary grass). There were no signs of erosion.

The banks were fully vegetated herbaceous vegetation and very poorly vegetated with woody species. Herbaceous vegetation consisted of New England aster, timothy and brome species. Woody species included slender willow, grey birch and trembling aspen. There was scarce canopy cover.

During the spring visit in April 2014, the site was dipped 10 times as it was too shallow to shock and was choked with vegetation. The average wetted width and water depth obtained in April were 0.7 m and 2 cm (range 1-6 cm), respectively. No fish were captured.



Photo 6: Drain 8 (Station 10) looking upstream from the downstream end (April 28, 2014)



Photo 7: Drain 8 (Station 10) looking upstream from the downstream end (December 10, 2019)

Drain 9

Drain 9 was located across from Drain 8 and flowed from west to east. Drain 9 was 185 m long and consisted of a straight channel. The surrounding land consisted of an agricultural field (soybeans in 2016) and a wooded area.

Station 11

Station 11 was situated approximately 60 m west of the confluence with Drain 7. The surrounding land consisted of an agricultural field and a wooded area. The station length was 40 m. The entire station was dry. The average channel and bankfull depth were 1.3 m and 18 cm in spring 2013.

The substrate was composed of fines. The channel was entirely choked with aquatic vegetation (reed canary grass, black bulrush, and purple loosestrife). There were no signs of erosion.

The banks were fully vegetated with herbaceous vegetation and very poorly vegetated with woody species. Herbaceous vegetation consisted of common ragweed, reed canary grass and timothy. Woody species included green ash and American elm. There was no canopy cover.

During the spring visit in April 2014, the site was dipped 10 times as it was too shallow to shock and was choked with vegetation. The average wetted width and water depth obtained in April were 0.9 m and 4 cm (range 2-8 cm), respectively. No fish were captured.



Photo 8: Drain 9 (Station 11) looking upstream from the downstream end (April 28, 2014)



Photo 9: Drain 9 (Station 11) looking upstream from the downstream end (September 17, 2013)



Photo 10: Drain 9 (Station 11) looking upstream from the downstream end (December 10, 2019)

Drain 10

Drain 10 flowed from south to north merging with Drain 7 approximately 845 m upstream of McKinnon's Creek. The dug channel was straight. The surrounding land consisted of an agricultural field and wooded area.

Station 12

Station 12 was situated approximately 95 m south of the confluence with Drain 7. The station length was 40 m. The entire station was dry. The average channel and bankfull depth were 2.9 m and 23 cm in spring 2013.

The substrate was composed of fines. The channel was entirely vegetated with purple loosestrife, reed canary grass, and narrow-leaved cattail. There were no signs of erosion.

The banks were fully vegetated with herbaceous vegetation and very poorly vegetated with woody species. Herbaceous vegetation consisted of Canada goldenrod, wild carrot and timothy. Woody species included common buckthorn. There was no canopy cover.

During the spring visit in April 2014, the site was shocked for 416 seconds over an area of approximately 84 m². The average wetted width and water depth obtained in April were 2.1 m and 11 cm (range 4-20 cm), respectively. No fish were captured.



Photo 11: Drain 10 (Station 12) looking upstream from the downstream end (April 28, 2014)



Photo 12: Drain 10 (Station 12) looking upstream from the downstream end (September 17, 2013)



Photo 13: Drain 10 (Station 12) looking upstream from the downstream end (December 10, 2019)

Drain 11

As mentioned above, Drain 11 was a side branch to Drain 10. This drain flowed from west to east and was 685 m long. This was yet another straight channel. The surrounding land consisted of an agricultural field and wooded area.

Station 13

Station 13 was situated approximately 155 m south of the confluence with Drain 10. The station length was 40 m. The entire station was dry. The average channel and bankfull depth were 2.1 m and 23 cm in spring 2013.

The substrate was composed of fines. The channel was choked by aquatic vegetation (purple loosestrife, narrow-leaved cattail, and reed canary grass). There were no signs of erosion.

The banks were fully vegetated with herbaceous vegetation and moderately vegetated with woody species. Herbaceous vegetation consisted of purple loosestrife, late goldenrod and black bulrush. Woody species included pussy willow, common buckthorn and slender willow. There was poor canopy cover.

During the spring visit in April 2014, the site was dipped 50 times as it was too shallow to shock and was choked with vegetation. The average wetted width and water depth obtained in April were 1.2 m and 6 cm (range 2-15 cm), respectively. No fish were captured.



Photo 14: Drain 11 (Station 13) looking upstream from the downstream end (April 28, 2014)



Photo 15: Drain 11 (Station 13) looking upstream from the downstream end (September 17, 2013)



Photo 16: Drain 11 (Station 13) looking upstream from the downstream end (December 10, 2019)

Drain 12

Drain 12 was located 950 m upstream of Drain 7's confluence with McKinnon's Creek. This drain was 625 m long and flowed from west to east. Again, this was a straight dug channel. The surrounding land consisted of an agricultural field that was planted in soybeans on the north side.

Station 14

Station 14 was situated approximately 315 m east of the confluence with Drain 7. The station length was 40 m. The entire station was dry in spring 2013. The average channel and bankfull depth were 1.6 m and 20 cm.

The substrate was composed of fines. The channel was entirely choked by aquatic vegetation (purple loosestrife, broad-leaved cattail, and reed canary grass). There were no signs of erosion.

The banks were fully vegetated herbaceous vegetation and poorly vegetated with woody species. Herbaceous vegetation consisted of purple loosestrife, Canada goldenrod and wild carrot. Woody species included pussy willow and common buckthorn. There was no canopy cover.

The site was dry during the visit in spring 2014; therefore no fish sampling was completed.



Photo 17: Drain 12 (Station 14) looking upstream from the downstream end (April 28, 2014)



Photo 18: Drain 12 (Station 14) looking upstream from the downstream end (September 17, 2013)



Photo 19: Drain 12 (Station 14) looking upstream from the downstream end (December 10, 2019)

4.0 HEADWATER DRAINAGE FEATURES ASSESSMENT

4.1 Classification

4.1.1 Step 1: Hydrology Classification

In Step 1 the flow is classified based on the amounts recorded during the three visits. These are summarized in Table 4 (as per OSAP S4.M10).

The amount of rainfall recorded in the seven days preceding each station visit is summarized in Table 3 to provide context to the water depths in Table 4.

Table 3: Summary of Rainfall for the 7 Days Preceding the Flow Surveys

Dates	Total Rainfall (mm)
August 30, 2013 to September 6, 2013	30.4
September 10, 2013 to September 17, 2013	36.6
April 21, 2014 to April 28, 2014	20.4
April 5, 2016 to April 12, 2016	20.2
April 21 to April 28, 2016	4.8
August 2, 2016 to August 9, 2016	0
December 3, 2019 to December 9, 2019	9.1

Total Rainfall taken from: Environment Canada. 2014 and 2016. National Climate Data and Information Archive – Ottawa INTL. On-line (<http://climate.weatheroffice.gc.ca>) accessed October 1, 2014, September 30, 2016 and November 26, 2020.

While almost all the channels were dug resulting in a straight pattern with defined banks (though these were still poorly defined in some instances) the amount of flow was not sufficient to carve a channel. As such, many features were fully vegetated in reed canary grass and other species that for the most part were not obligate wetland species giving them a swale classification.

Four features had standing water during the spring freshet (Drains 8, and 10-12). All of the others contained substantial surface water flow during this visit. By the second visit most features had standing water only with the exception of one (Drains 6) which was dry. All features were dry come summer (note that there was little rainfall in the general area in the summer of 2016). Figures 3-5 depict the flow conditions during the three visits.

The four stations with standing water only during the first visit were classified as Limited. All others were ranked as Contributing. Contributing was chosen over Valued as none of the features had substantial or minimal flow during the second visit.

Table 4: Hydrology classification features using data from OSAP S4.M10

Drain ID	Definitions of Flow Influence	Flow Conditions	Feature Code Type	Hydrology Classification
6	Spring Freshet or rainfall events	Surface flow Substantial (5)	Swale (7) or Roadside Ditch (8)	Contributing
	Late April-May July-August	No surface water (1)	Note that Wall Road is not impervious.	
7	Spring Freshet or rainfall events	Surface flow Substantial (5)	Channelized (2)	Contributing
	Late April-May July-August	No surface water (1) No surface water (1)	While this feature was also heavily vegetated it has been left as channelized at it appears to have been a natural channel at one time.	
8	Spring Freshet or rainfall events	Standing water (2)	Swale (7)	Limited
	Late April-May July-August	No surface water (1)	Dug, straight channel that is fully vegetated mostly by reed canary grass.	
9	Spring Freshet or rainfall events	Surface flow Substantial (5)	Swale (7)	Contributing
	Late April-May July-August	Standing water (2) No surface water (1)	Dug, straight channel that is fully vegetated mostly by reed canary grass.	
10	Spring Freshet or rainfall events	Standing water (2)	Swale (7)	Limited
	Late April-May July-August	No surface water (1)	Dug, straight channel that is fully vegetated mostly by reed canary grass.	
11	Spring Freshet or rainfall events	Standing water (2)	Swale (7)	Limited
	Late April-May July-August	No surface water (1)	Dug, straight channel that is fully vegetated mostly by reed canary grass.	

Drain ID	Definitions of Flow Influence	Flow Conditions	Feature Code Type	Hydrology Classification
12	Spring Freshet or rainfall events	Standing water (2)	Wetland (6) Dug, straight channel that is fully vegetated, but the plant species include cattails.	Limited
	Late April-May			
	July-August	No surface water (1)		

Figure 3: Summary of Flow Conditions (Visit 1)

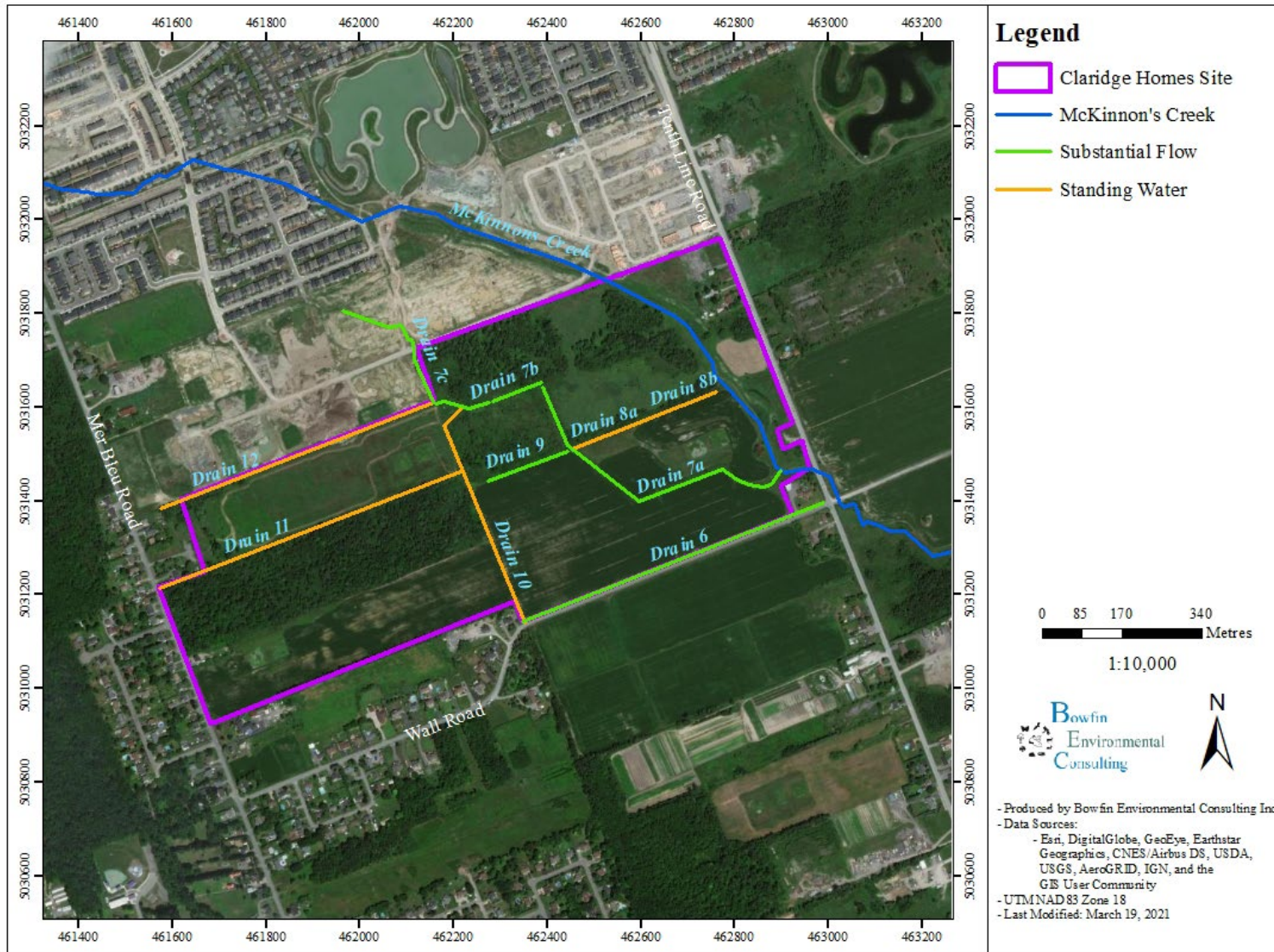


Figure 4: Summary of Flow Conditions (Visit 2)

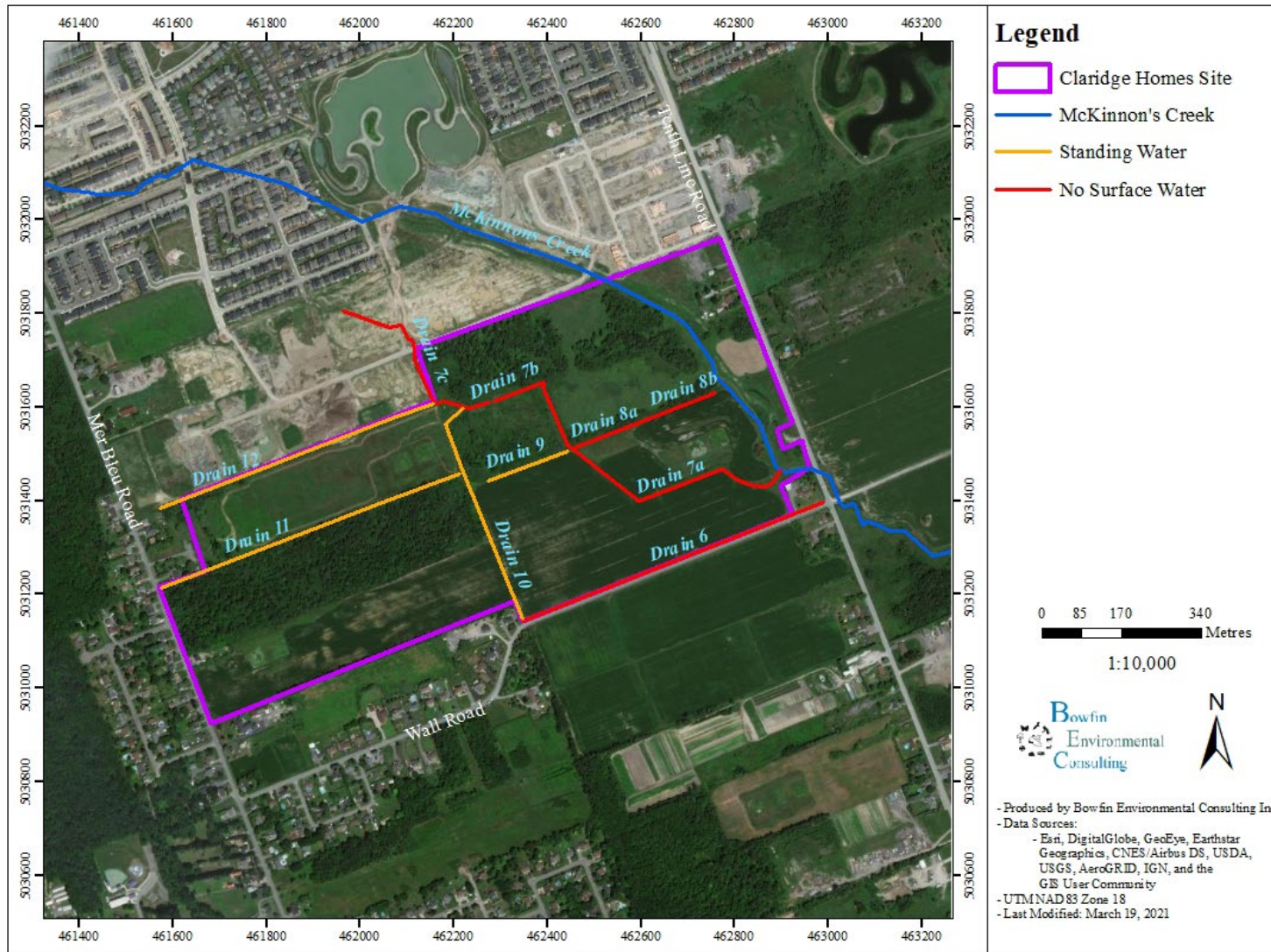
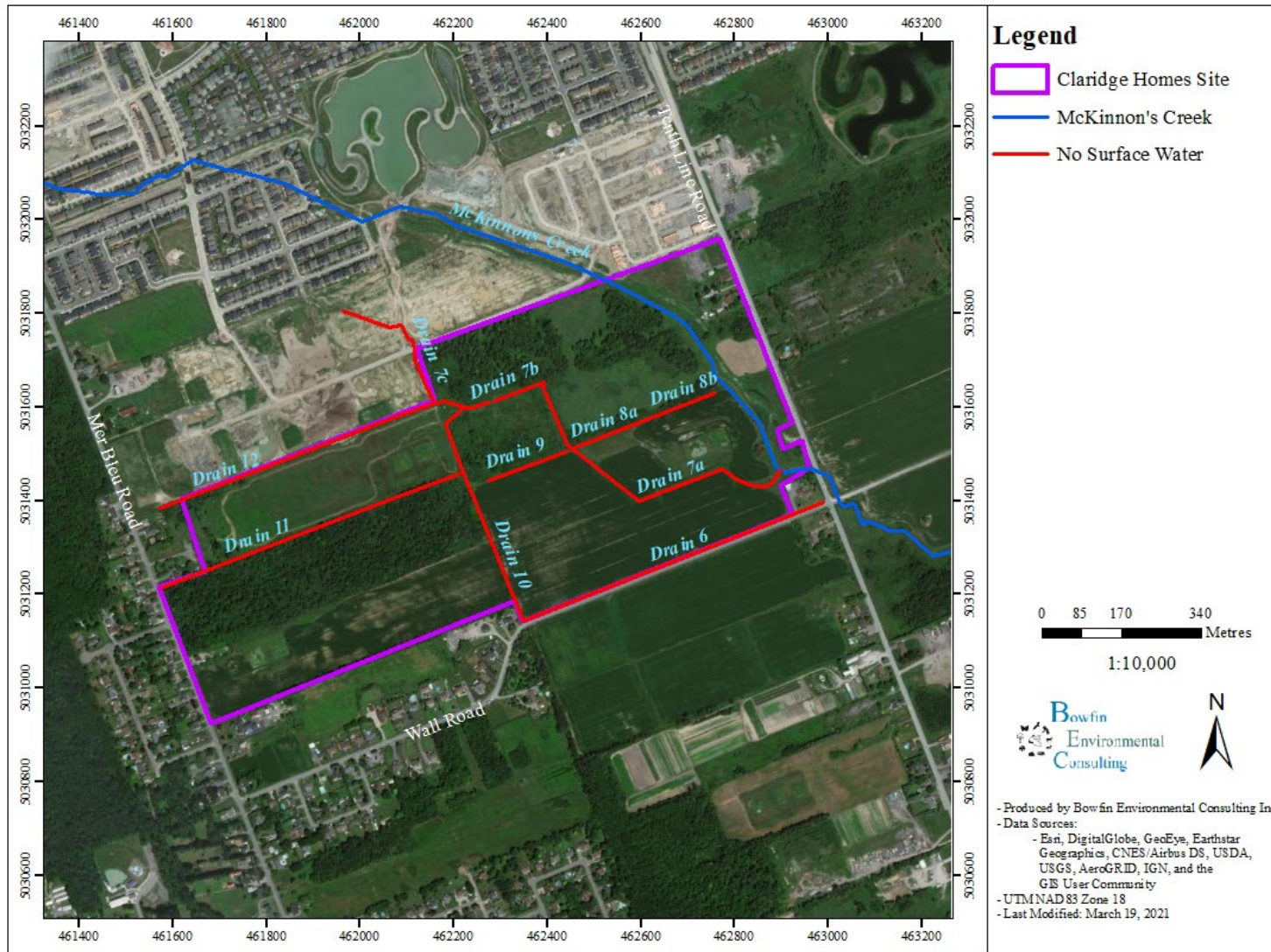


Figure 5: Summary of Flow Conditions (Visit 3)



4.1.2 Step 2: Riparian Classification

In Step 2 the riparian habitat is classified based on the width and type of vegetation on the banks. The differences in riparian classification on the same feature resulted in reach breaks on drains 7 and 8. These are summarized in Table 5.

Table 5: Riparian Classification

Drain	Riparian Feature Code (OSAP S4.M10)	Riparian Classification	Comments
6	1 (None) 3 (Cropped)	Limited	The feature is located along the edge of Wall Road and an agricultural field (hay in 2015 for Drain 5 and soybeans in 2016 for Drain 6).
7a and 7c	3 (Cropped)	Limited	Upper and lower portions of feature are located within a soybean field.
7b	5 (Scrubland) 6 (Forest)	Important	Middle section of channel travels within the thicket and woodland communities.
8a	3 (Cropped) 5 (Scrubland)	Limited	Located within an agricultural field.
8b	3 (Cropped) 5 (Scrubland)	Important	The very upstream end travels in the thicket.
9	3 (Cropped) 5 (Scrubland)	Important	The south side follows along a soybean field. The north side includes both thicket and woodland communities.
10	3 (Cropped) 5 (Scrubland)	Important	The feature is surrounded by an agricultural field to the west (soybeans) and a cultural woodland area to the east.
11	3 (Cropped) 6 (Forest)	Important	Feature contains an agricultural field to the north and a deciduous forest to the south.
12	3 (Cropped)	Limited	Feature contains an agricultural field (soybean on north) with a hedgerow running along it.

4.1.3 Step 3: Fish and Fish Habitat Classification

The fish habitat is classified based on fish observations during the spring and summer. Features that provide habitat for Species at Risk or critical (spawning) habitat would be considered the most significant.

The fish habitat is classified based on fish observations during the spring of April 2014. All Drains have been listed as Contributing for the following reasons:

- No critical habitat or species at risk or species of conservation is present in any of the headwater features as no fish were present in any of the drains
- All features flow into McKinnon's Creek and eventually into Bear Brook River. The contribution of allochthonous material downstream via these ephemeral channels with little flow would not affect the overall productivity of such a large watercourse.

4.1.4 Step 4: Terrestrial Habitat Classification

This step is more of a classification of amphibian habitat than of the terrestrial habitat. According to the guidelines, only those features associated with wetland habitats can be considered Important or Valued. Features classed as Contributing are those that may or do provide a linkage between habitat for wildlife movement and Limited is given to those that do not meet any of the above criteria.

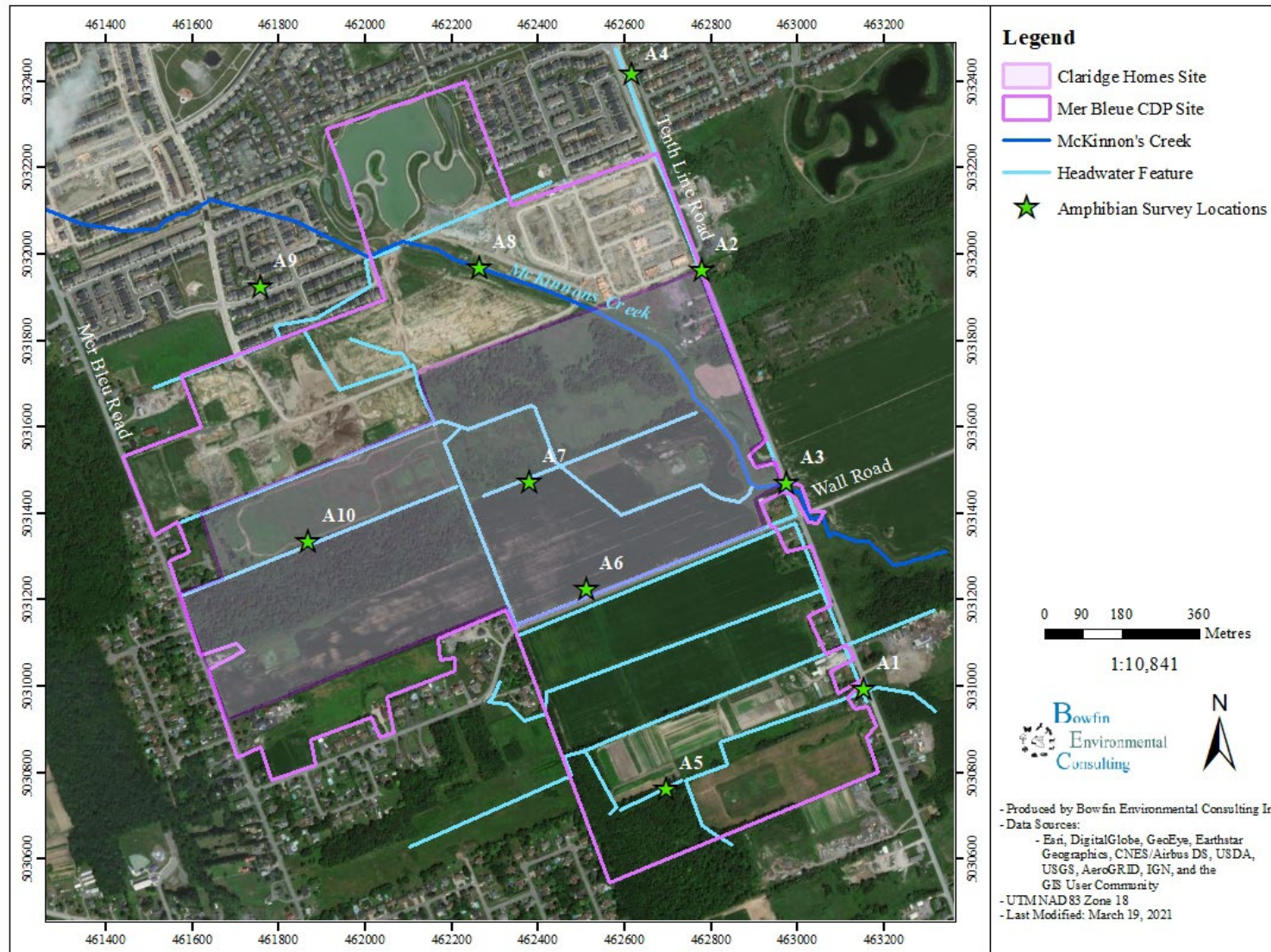
At a landscape scale, these features do not provide good corridor options as they are one or more of: poorly defined, very short or lead to Tenth Line Road or into residential areas.

The MMP amphibian monitoring protocol was followed with the extra step of identifying whether or not amphibians were calling from the specific feature or not. Details are provided in Appendix A.

Table 6: Terrestrial Habitat Classification

Drain	Riparian Condition (OSAP S4.M10)	Marsh Monitoring Protocol Calling Code	Comments	Classification
6	1 (None) 3 (Cropped)	1	Few calls. These features are roadside ditch.	Limited
7a-c	3 (Cropped) 5 (Scrubland) 6 (Forest)	0	There were no frogs located within the feature.	Limited
8a and 8b	3 (Cropped) 5 (Scrubland)	1	Few calls.	Limited
9	3 (Cropped) 5 (Scrubland)	1	Few calls.	Limited
10	3 (Cropped) 5 (Scrubland)	0	No frogs	Limited
11	3 (Cropped) 6 (Forest)	3	Many frog calls heard in a fresh moist poplar deciduous forest to the south	Limited
12	3 (Cropped)	0	No frogs	Limited

Figure 6: Amphibian Survey Stations



4.2 Part 3 – Management Recommendations

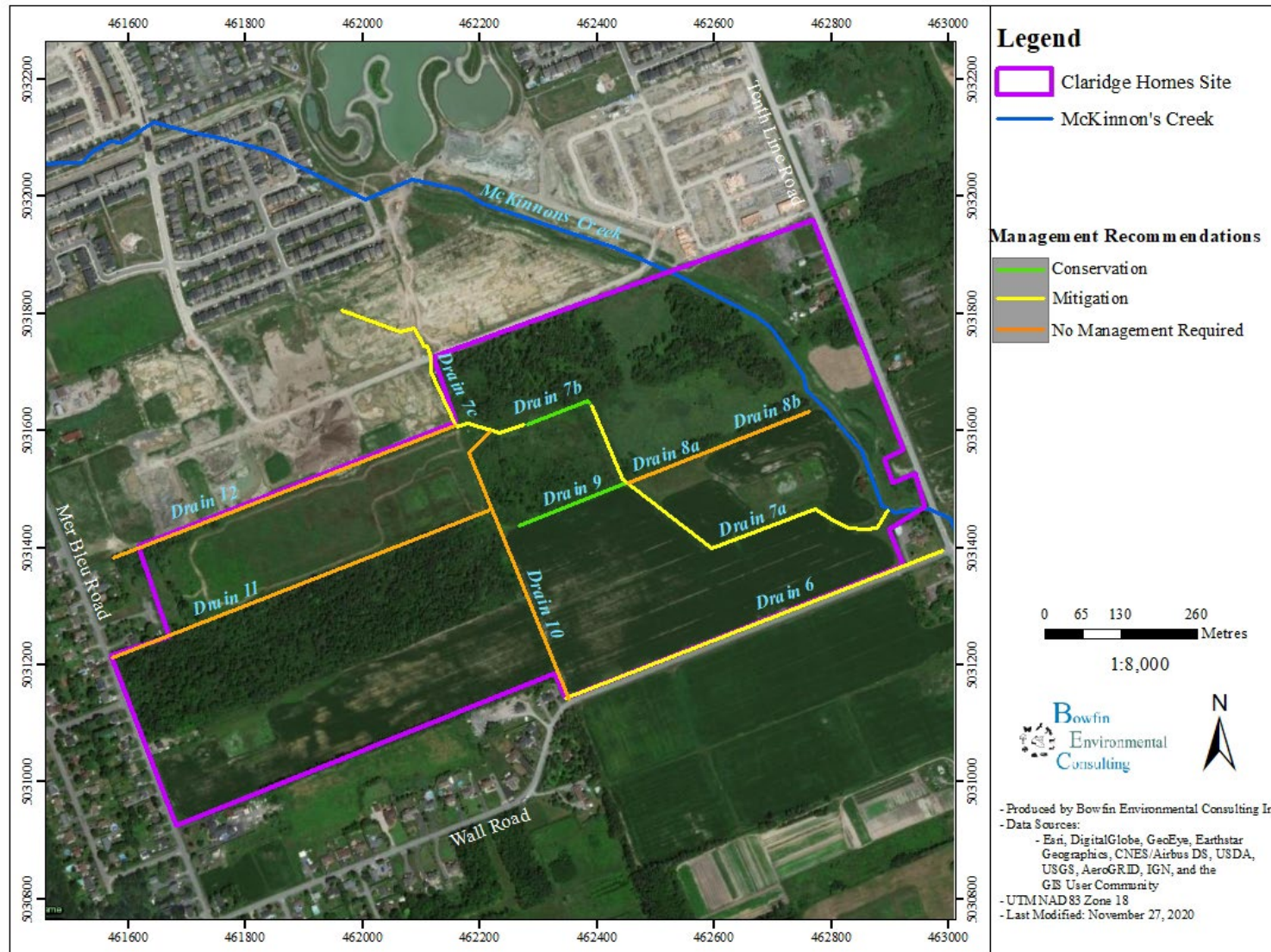
The management recommendations are grouped into six categories: protection, conservation, mitigation, maintain recharge, maintain/ replicate terrestrial linkage, and no management required.

The classification of Contributing hydrology together with Limited fish and terrestrial habitat resulted in many features being ranked as either Conservation (those with Important terrestrial habitat) (Drains 7b, and 9) or Mitigation (those with Limited terrestrial habitat) (Drains 6, 7a, 7c, and 14). The features with Limited hydrology were all classed as No Management Required (Drains 8a, 8b, 10, 11, and 12).

Table 7: Evaluation, Classification and Management Summary

Drainage Feature Segment	Hydrology Classification	Fish and Fish Habitat Classification	Terrestrial Habitat Classification	Riparian Classification	Management Recommendation
6	Contributing	Contributing	Limited	Limited	Mitigation
7a and 7c	Contributing	Contributing	Limited	Limited	Mitigation
7b				Important	Conservation
8a, 8b	Limited	Contributing	Limited	Important (but only for a small section) rest is Limited	No Management Required
9	Contributing	Contributing	Limited	Important	Conservation
10	Limited	Contributing	Limited	Important	No Management Required
11	Limited	Contributing	Limited	Important	No Management Required
12	Limited	Contributing	Limited	Limited	No Management Required

Figure 7: Summary of Management Recommendations



5.0 SUMMARY

The study area included the headwater features that flowed into McKinnon's Creek. The features were visited multiple times during various years including three visits during 2016 for flow classification. Almost all had been channelized to some degree. All features contained water and substantial surface flow present during the spring freshet visit with the exceptions of Drains 8, 10, 11, and 12 which only contained standing water. By the second visit in April all features were either dry (Drain 6) or contained standing water (all others). All features were dry come the summer. None contained fish habitat.

The management implications and options are as followed (as described in the guideline):

Mitigation:

1. The channel may be maintained, relocated or enhanced. No natural channel design is required. Can be replaced by well-vegetated swales or constructed wetland features.
2. Replicate on-site flow and outlet flows at the upstream end of the system to maintain.
3. Direct connection to downstream.

Conversation:

1. The channel may be maintained, relocated or enhanced. It is noted that should the channel be relocated then it is to be done using natural channel design.
2. The groundwater or wetland contribution is to be maintained or replicated. If the catchment drainage will be removed as part of the development then the function should be restored through enhancement of lot level control (i.e. restore original catchment using clean roof drainage), as feasible
3. Maintain or replace on-site flows using mitigation measures and/or wetland creation, if necessary.
4. Maintain or replace external flows
5. Drainage feature must connect to downstream

6.0 REFERENCES

Evaluation, Classification and Management of Headwater Drainage Features Guideline. Toronto and Region Conservation Authority and Credit Valley Conservation, TRCA Approval July 2013 (Finalized January 2014).

Marsh Monitoring Program Participant's Handbook Surveying Amphibians. 2008 Edition. 20 pages. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. February 2008.