

Headwater Drainage Feature Assessment 2822 Carp Road Ottawa, Ontario



Submitted to:

Argue Construction Ltd. 2900 Carp Road Carp, Ontario K0A 1L0

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May 14, 2020 Project: 61730.65

TABLE OF CONTENTS

1.0	INTRODUCTION	.1
1.1 1.2	Purpose 2 Objective	.1 .1
2.0	METHODOLOGY	.2
2.1 2.2	Desktop Review Field Investigations	.2 .2
	2.2.1 Headwater Drainage Feature Assessment	.2
3.0	HEADWATER DRAINAGE FEATURES ASSESSMENT	.3
3.1 ;	I Site Characteristics 3.1.1 HDF1	.3 .4
4.0	CLASSIFICATION	.6
5.0	MANAGEMENT RECOMMENDATIONS AND MITIGATION MEASURES	.8
6.0	SUMMARY	.8
7.0	LIMITATION OF LIABILITY	.8
8.0	REFERENCES	.9

LIST OF TABLES

Table 2.1	Summary of Field Investigations	2
Table 3.1	Summary of Existing Conditions for HDF1	5
Table 4.1	Summary of HDF Classification and Management recommendations	7

LIST OF FIGURES

Figure 1 Flow Chart Providing Directions of Management Option's (TRCA/CVC, 2014)......6

LIST OF APPENDICES

Appendix A	Report Figures
Appendix B	Site Photographs
Appendix C	Site Investigation Field Sheets
Appendix D	CVs for Key Personnel

1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was retained by Argue Construction Ltd. to carry out a Headwater Drainage Feature Assessment (HDFA) for the property located at 2822 Carp Road, in the City of Ottawa, Ontario, hereafter referred to as the "subject property". The site location is illustrated on Figure A.1 in Appendix A. This report provides the methodologies and results of the HDFA conducted at the subject property.

1.1 Purpose

The proponent is seeking to construct two multi-unit commercial buildings on the approximately 1.04-hectare (ha) site.

Based on correspondence with Mississippi Valley Conservation Authority (MVCA) staff on January 31, 2020, a Headwater Drainage Feature Assessment is required for the un-named watercourse located on-site to determine its conservation value, contributions to downstream fish habitat and local hydrology, prior to permitting any infilling or construction of any structures within 30 m of the watercourse.

1.2 Objective

Under Section 28(1) of the Conservation Authorities Act, conservation authorities have the ability to define the definition of a watercourse, which is defined under Section 28 (5) of the Act as "An identifiable depression in the ground in which a flow of water regularly or continuously occurs". Headwater drainage features are defined as "non-permanently flowing drainage features that may not have defined bed or banks; they are first-order and zero-order intermittent and ephemeral channels, swales and connected to headwater wetlands, but do not include rills or furrows". According to conservation authorities in Ontario, headwater drainage features meet the definition of a watercourse.

The objective of the work presented herein is twofold; 1) to identify headwater drainage features on the subject site and 2) to evaluate and classify any headwater drainage features on-site, in accordance with *"Evaluation, Classification and Management of Headwater Drainage Features Guidelines"* from the Toronto Region Conservation Authority and the Credit Valley Conservation (TRCA/CVC, 2014), and to recommend mitigation and conservation measures for headwater drainage features present on-site.



1

2.0 METHODOLOGY

2.1 Desktop Review

A desktop information gathering exercise was completed to aid in the scoping of field investigations and to gather background information relating to headwater drainage features onsite. Information relating to the presence and assessment of headwater drainage features onsite was obtained from the following sources:

- Evaluation, Classification and Management of Headwater Drainage Features Guidelines (TRCA/CVC, 2014);
- Ontario Stream Assessment Protocol, Section 4, Module 11 (OSAP, 2017);
- Land Information Ontario (OMNR, 2011);
- Mississippi Valley Conservation Authority Geoportal (MVCA, 2019); and
- Make a Map: Natural Heritage Areas (OMNRF, 2014).

2.2 Field Investigations

Two field investigations were undertaken to evaluate the headwater drainage feature identified on-site. Field investigations completed in support of this HDFA are outlined in Table 2.1 below.

 Table 2.1
 Summary of Field Investigations

Date	Time	Weather	Visit Number
March 31, 2020	10:00-11:30	2°C, overcast, no precipitation, Beaufort 4	1
April 27, 2020	12:20-1:00	11°C, partly cloudy, no precipitation, Beaufort 3	2

Site photographs taken during the field investigations are provided in Attachment A. Copies of field notes are provided in Attachment B.

2.2.1 Headwater Drainage Feature Assessment

Field data collection of headwater drainage features on-site followed the protocol outlined in Section 4: Module 11, "Unconstrained Headwater Sampling" from the Ontario Stream Assessment Protocol (Stanfield, 2017).

Data collected during the site investigations included flow conditions, sediment transport, feature roughness, riparian and feature vegetation, as well as upstream and downstream site features. As outlined in the OSAP manual for assessing headwater drainage features, two to three site visits can be required to complete a HDFA. The first site visit is conducted within the short period following a major freshet event, in Ontario the first sampling event typically occurs between late March to mid-April. The second field event is conducted after the melt/thaw related flow has



ceased, typically late April to mid-May. When flow conditions are still observed during the second site investigation, a third site visit may be conducted in July to mid-September to further ascertain the importance of the HDF for seasonal use by fish and other biota.

Due to the stagnant and dry conditions observed during the second site investigation, described in Section 3, the importance of the HDF was able to be evaluated without completing a third site investigation.

Classification of the headwater drainage features on-site followed the protocols outlined in the Evaluation, Classification and Management of Headwater Drainage Features Guidelines manual (TRCA/CVC, 2014). Functions of the headwater drainage feature that were evaluated included hydrology, vegetation, fish and fish habitat, and terrestrial habitat.

3.0 HEADWATER DRAINAGE FEATURES ASSESSMENT

3.1 Site Characteristics

The 1.04 ha site currently consists of cultural meadow habitat and existing development fronting to Carp Road. Based on aerial photographs reviewed, prior to 2014 the subject property contained a small forest parcel and between 2016 and 2017, the current on-site headwater drainage feature (HDF) was created by excavating a narrow channel onto the site from a drainage ditch on the adjacent south property.

Based on the desktop review and the site investigations, a single headwater drainage feature (HDF) occurs on-site and is identified as HDF1. HDF1 is illustrated on Figure A.2 in Appendix A.

HDF1 originates on-site and flows in a southeastern direction onto the neighbouring property addressed as 2826 Carp Road, before turning west and flowing into roadside ditches along Carp Road. The on-site portion of HDF1 is approximately 100 m in length. The watercourse is mapped as originating on neighbouring farm fields and flowing onto 2822 Carp Road, however based on observations during site investigations, the on-site portion of the watercourse is not connected to any upstream watercourses.

Once off-site, the HDF joins with an existing drainage ditch on the adjacent south property which conveys flows in an easterly direction from the west side of Carp Road. This unidentified tributary of Huntley Creek then flows in a south-south easterly direction for approximately 950 m prior to discharging to Huntley Creek.

According to the Aquatic Species at Risk map (DFO, 2018), no aquatic Species at Risk (SAR) or critical habitat for SAR occur within the subject area or the HDF present on-site.



3.1.1 HDF1

During the site investigation HDF1 was assessed in four segments, based on site break triggers, the segments are illustrated on Figure A.3 in Appendix A.

HDF1-1A is described as channelized, and had interstitial flow during the initial spring and was document as stagnant during late spring site investigation.

Segment HDF1-1B is described as no-defined feature and had a mix of interstitial flow and standing water during the initial spring investigation and standing water and dry conditions during the late spring visit.

Segment HDF1-1C is described as no-defined feature and had standing water conditions during the initial spring investigation and completely dry conditions during the second site investigation.

Segment HDF1-1D is described as no-defined feature with a mix of interstitial flow and standing water during the first investigation and standing water and dry conditions during the second investigation.

The riparian zone surrounding HDF1 is representative of a cultural meadow populated primarily by opportunistic woody and herbaceous species; the watercourse is primarily unvegetated within the channelized portions while the non-defined portions of the HDF consisted of cultural meadow vegetation as described above. Vegetation included reed canary grass, wild carrot, graminoids, red osier dogwood, slender willow and balsam poplar.

Substrates within HDF1 were primarily comprised of silty sand over bedrock or gravel.

Table 3.1 below summarizes the existing conditions and characteristics of HDF1 observed during the site investigation. During the site investigations, the HDF was assessed in four segments based on site break triggers as described above but the segments have been grouped for evaluation purposes.



	Hydrology			Veg Asse	Vegetation Assessment		Channel Form			Sediment Transport		
Site Visit	Flow Influence (FI)	Flow Condition (FC)	Feature Type (FT)	Feature	Riparian	Average Wetted Width (m)	Average Depth (range) (cm)	Average Bankfull Width (m)	Substrate	Sediment Transport	Sediment Dep.	
1	Freshet (1)	Interstitial (3) and Standing (2)	Channelized (2)	Meadow (4)	Meadow (4)	4.4	17 (4-30)	4.7	Silty sand	None	None	
2	Baseflow (3)	Standing (2) and Dry (1)	Channelized (2)	Meadow (4)	Meadow (4)	3.3	6.7 (4-12)	3.9	Silty Sand	None	None	

Table 3.1 Summary of Existing Conditions for HDF1



4.0 CLASSIFICATION

HDF1 on-site was classified based on the information collected during the site investigations pertaining to hydrology, riparian habitat, fish and fish habitat and terrestrial components. Using the linking classification to management flow chart provided by the TRCA and CVC (2014), illustrated in Figure 1 below, the classification of HDF1 was used to determine management recommendations.



*Other Conservation Authority policies or other legislation with respect to wetlands, watercourses and/or species at risk need to be assessed in the context of this key. +Note that headwater wetlands are considered to be HDFs in the context of this guideline.

Figure 1 Flow Chart Providing Directions of Management Option's (TRCA/CVC, 2014)

HDF1 had interstitial flow in March and stagnant to dry conditions in April, which according to the Evaluation, Classification and Management of Headwater Drainage Features Guidelines (TRCA/CVC, 2014), provides contributing or valued function for hydrology. The HDF is connected to downstream fish habitat but is unlikely to contribute allochthonous transport due to the absence of flow nor is it likely to provide any critical life stage fish habitat. The adjacent terrestrial habitat is limited to a small parcel of cultural meadow adjacent to agricultural fields and commercial developments and is not connected to any adjacent natural features or corridors. As such, and in accordance the flow chart presented in Figure 1 above, the management recommendation for HDF1 is mitigation.

A summary of the classification and management recommendation for HDF1 is provided in Table 4.1 below

	Step 1		Step 2	Step 3	Step 4		
Reach	Hydrology	Modifiers	Riparian	Fish Habitat	Terrestrial Habitat	Recommendation	
1	Limited: provides only interstitial flow during spring freshet	No modifiers identified down stream	Limited – cultural meadow	Connectivity	Limited – channelized	Mitigation	

Table 4.1 Summary of HDF Classification and Management recommendations



5.0 MANAGEMENT RECOMMENDATIONS AND MITIGATION MEASURES

In accordance with the Evaluation, Classification and Management of Headwater Drainage Features Guidelines (TRCA/CVC, 2014), HDFs classified as 'valued' require mitigation. HDF1 has been field verified to provide contributing hydrology and connectivity to downstream fish habitat, and requires mitigation for any alterations to the watercourse. As outlined in the guidance document, mitigation management options for HDF1 on-site include:

- Replicate hydrologic functions through enhanced lot level conveyance measures, such as Low Impact Development stormwater options or well-vegetated swales connected to downstream;
- Consideration of using clean roof drainage directed to vegetated swales or bioswales to mitigate the loss of catchment area during potential future site redevelopment;
- All future development and construction activities within the study area, including ditching, culvert installation, erosion and sediment control and storm water management should be completed in accordance with Ontario Provincial Standard Specification 182 and OPSS 805; and
- No in-water work should occur between March 15 and June 30 of any year to protect downstream fish habitat. This in-water timing restriction is likely to result in any modification to the watercourse occurring 'in the dry'.

6.0 SUMMARY

A headwater drainage feature assessment was completed and one HDF was identified on-site, identified as HDF1. Mitigation was recommended for HDF1 based on flow conditions and functions contributing to downstream aquatic habitats. Mitigation should include maintaining the hydroperiod and connection with downstream features, as well as replicating hydrologic function.

7.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Sincerely,

Marrington

Taylor Warrington, B. Sc. Biologist

Drew Paulusse, B.Sc. Senior Biologist



8.0 **REFERENCES**

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APPENDIX A

Report Figures Figure A.1 – Site Location Figure A.2 – Site Layout Figure A.3 – HDF1 Segments



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APPENDIX B

Site Photographs

Report to: Argue Construction Ltd. Project: 61730.65 (May 14, 2020)



Site Photograph 1 – HDF1-1A looking downstream (March 31, 2020)



Site Photograph 3 – HDF1-1C looking downstream (March 31, 2020)



Site Photograph 2 – HDF1-1B looking upstream (March 31, 2020)



Site Photograph 4 – HDF1-1D looking upstream (March 31, 2020)





Site Photograph 5 – HDF1-1A looking downstream (April 27, 2020)



Site Photograph 7 – HDF1-1C looking downstream (April 27, 2020)



Site Photograph 6 – HDF1-1B looking upstream (April 27, 2020)



Site Photograph 8 – HDF1-1D looking upstream (April 27, 2020)



Project Headwater Drainage Feature Assessment	APPENDIX B	
2822 Carp Road Ottawa, Ontario	File No. 61730.65	Site Photographs

APPENDIX C

Site Investigation Field Notes

Report to: Argue Construction Ltd. Project: 61730.65 (May 14, 2020)

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Stream Name:	101-1	S	tream Code:	HUFT	- I Site	Code:	HUF	1-11-	
Site Limits:	Upstream	WP#	15.50 243	- 15.981	USO Field	Assessment:	Samp		Connected HDF:
Direction of Assessment	Downstream	WP# 4	15. 307110	-75.78	6Ha d			le 3 to	downstream network
Flow Influence	M F	mehot (1)	psueam		Spate (2)			Baseflow (3	0
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Flow Condition		ry (1)		×	Interstitial Flo	ow (3)		Substantial	Flow (5)
		tanding Water (2	2)		Minimal Flow	(4)			
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Feature Vegetation				ned (3)	Meadow (4)	C Scrubland	(5) D W	etland(6)	Forest (7)
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Right Bank	None (1) 🗆 Lawn (2) 🗆 Crop	oped (3)	(Meadow (4)	Scrubland	(5) 🗆 W	etland (6)	Forest (7)
10-30 m Left Bank	None (2) 🖸 Grot	ped (3)	Meadow (4)	Scrubland	(5) 🖸 W	etland (6)	Forest (7)
Right Bank	None (1) 🔲 Lawn (2) 🗆 Crop	oped (3)	Meadow (4)	Scrubland	(5) 🗆 W	etland (6)	Forest (7)
Channel Gradient (S4 M		(isual (1)	Clinometer (2)	Laser L	evel (3)	Survey Level (4		ther (5)	LiDAR (6)
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Channel Dimensions	Feature Wid	ith (m):	2.2	M	Bankfull	Depth (mm)	5	iocm	
Entrenchment Tot	tal: D,	40 m	40 m Left	Bank	m Rigi	ht Bank	m	Total width	m
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Sediment Transport	-	D Sheet	Erosion (6)	E	Instream Ba	ank Erosion (7)		Other	(8)
	Feature	None (1) 🗆	Rill (2)	Rill and Gul	ly (3)	Gully (4)	Outlet	Scour (5)
		Sheet	Erosion (6)	C	Instream Ba	ank Erosion (7)		Other	(8)
Sediment Deposition	Measu	res (mm):							
	Minimal <	5 mm (2)	D Moderate	5-30 mm (3)	D Substa	ntial: 31-80 mm (4) 0	Extensive: > 8	0 mm (5)
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WP# Perched Height (mm): Jumping Height (mm):											
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Site Limits:	Downstream WF	# 45 201041 -1	5.187455 Field Asse	Sample 2	Not connected
Direction of Assessment:	E	Upstream	Downstream	Sample 3	to downstream network
Flow Influence	Freshet (1)		Spate (2)	Base	flow (3)
Flow Condition	Dry (1)	er (2)	Interstitial Flow (3)Minimal Flow (4)	Subs	tantial Flow (5)
Feature Type	Defined Natur	ral Channel (1)	No Defined Feature	e (4) 🛛 Swal	e (7)
	Channelized	or Constrained (2)	Tiled Feature (5)	C Road	side Ditch (8)
	Multi-thread (3)	Wetland (6)	Pond	(9)
Feature Vegetation		wn (2) Cropped (3)	Meadow (4)	Scrubland (5) U Wetland(6) LI Forest (7)
Riparian Vegetation			same as	HDF1-1A	
0 - 1.5 m Left Bank	None (1) La	wn (2) Cropped (3)	Meadow (4)	Scrubland (5) 🛛 Wetland (6) 🖸 Forest (7)
Right Bank	None (1)	wn (2) Cropped (3)	Meadow (4)	Scrubland (5) UWetland (6) Forest (7)
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Right Bank	None (1)	wn (2) Cropped (3)	Meadow (4)	Scrubland (5) UWetland (6)
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Channel Dimensions	Feature Width (m):	78.50	Bankfull Depth	(mm)	50 cm
Entrenchment Tota	al: 2 > 40 m	<pre>3 < 40 m Left Bank</pre>	m Right Bank	m Total	widthm
Surface Flow Method	Perched Culvert (1	Hydrauli	c Head (2) Dista	nce by Time (3)	Estimated (4)
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>8m	17 18	_/_		/	
Sediment Transport	Adjacent 🖾 Nor	ne (1)	Rill and Gully (3)		Dutlet Scour (5)
	Feature She	ne (1) Rill (2) eet Erosion (6)	Rill and Gully (3)	Gully (4) 0 (5) (4) 0 (6) (7) 0 (7)	Dutlet Scour (5) Dther (8)
Sediment Deposition	Measures (mm):				
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Pg, 2 of 2 Sample # 2 Sample # 3					
Other:					
a Provide Cashouring					
ation Riparian Vegetation					
lo Evidence (3)					
Unknown (5)					
nperature.					

	Un	constrained	l Headwater	Drain	age Feature	Assess	ment	
Date: Mar 311	2020	Project #	: 61730.1	55	Recorder/C	rew:]	W	
Stream Name: HC)FI	Stream	Code: HDFI	-1	Site Code:		HDF1-10	<u> </u>
Site Limits:	Upstream	WP#45.30	7523 -75	.986	853 Field Asses	sment:	Sample 1	Unconnected HDF:
Dimetion of the	Downstream	WP# 45. 30	7245 -75!	1870	50	L	J Sample 2	Not connected
Direction of Assessment:	Dr. Farak	t (1)		winstrea	nate (2)	L		low (3)
	La Preshe	a(1)		0.8	haie (x)		L Dasel	
Flow Condition	Dry (1)	ng Water (2)			iterstitial Flow (3) Iinimal Flow (4)		Substa	antial Flow (5)
Feature Type	Define	d Natural Channel	1 (1)		o Defined Feature	(4)	Swale	(7)
	Chann	elized or Constrai	ned (2)		iled Feature (5)		C Roads	side Ditch (8)
Feature Vegetation		1 Lawn (2)	Cropped (2)		leadow (4)	Crubland (5)	Wetland/6) C Forest (7)
. catale regetation			- cropped (3)	LA N		(3)		,
Riparian Vegetation	-	-	- and -	- (· same as	HOFI-	-IA	
V - 1.5 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3) Cropped (3)		leadow (4)	Scrubland (5) Scrubland (5)	Wetland (6	E Forest (7) 3) I Forest (7)
1.5 • 10 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3) Cropped (3)		leadow (4) 🖾 😫 leadow (4) 🗖 S	Scrubland (5) Scrubland (5)	Wetland (6	Forest (7) 5) Forest (7)
10 - 30 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3)		leadow (4)	Scrubland (5) Scrubland (5)	Wetland (6	5) D Forest (7) 5) D Forest (7)
Channel Gradient /SA	17) Vieual	(1) Clinome	ter (2)	ser Leve		y Level (4)	Other (5)	LiDAR (6)
Distance (m):			Elevation (cm)	:	1		Gradient (°):
Dominant Substrate (S. Sub-Dominant Substrat	Clay (2.M3) te (S2.M3)	Hard Pan) 5	Silt, Sand (0.06	6-2 mm)]]	Gravel (22-66 r	nm) Cobble	9 (67-249 mm) Bo	Dulder (250 mm) Bedrock
Feature Roughness	2	< 10% Minimal (1)	10 - 40	0% Mode	erate (2)	40 - 60% Hig	h (3)	60% Extreme (4)
Width Measurement	Can't Meas	ure (1)	sanktuli (2) 🛃	Mean	width (3)	Estimated (4)) GIS (5) L	- Measure/GIS (6)
Channel Dimensions	Feature Width (n	n): <	Im		Bankfull Depth	(mm)	< 100	ch
Entrenchment To	tal: 2 > 40 r	n □ < 40 m	Left Bank		m Right Bank		m Total	widthm
Surface Flow Method	Perched Cu	lvert (1)	Hydraulic	Head (2)	Dista	nce by Time	(3)	Estimated (4)
Wetted Width (m)	Wetted Dep	oth (mm) I 3	lydraulic head (m	m) 3	Volume (L) 1 2	3	Distance (m)	Time (s) 3 1 2 3
60cm	74	5	/		/		/	
	Adjacent	None (1)	🗖 Rill (2)		Rill and Gully (3)	G	iully (4) 🗆 O	outlet Scour (5)
Sediment Transport		Sheet Erosion	1 (6)		nstream Bank Ero	sion (7)		ther (8)
	Feature	None (1) Sheet Erosior	□ Rill (2)		Rill and Gully (3) nstream Bank Ero	G G G	Sully (4)	Dutlet Scour (5) Other (8)
Sediment Deposition	Measures (mm):						
None (1)] Minimal: < 5 mm	(2)	Moderate: 5-30 mm	(3)	Substantial: 31	1-80 mm (4)	Extensive	a: > 80 mm (5)

Date: N	00x 31/2	2020Proje	Uncon	strained H	eadwater Di	ainage Feat	Sample # 1	ient Samola # 2	Pg. 2 of 2
			All and and a second	D	DINT FEAT	TURE DATA		- Sample # 2	- Sample # S
Fish Ba Ground Fish Co	water Indicate	nents: WP# WP# ors 🖾	None	Perched Heig Perched Heig Watercress Present	ht (mm): ht (mm): Seepage Comment:	Jumping He Jumping He Bubbling	eight (mm): eight (mm):	Other:	
		1 The Cleaner	S. St. States	TTO OCTA			and the second second		-1
WP#	Photo #	Code	Category			an a	Description	ALTAN TARA TARA MA	
			110.9						
						1 12 12 12 12 12 12 12 12 12 12 12 12 12			
1					1	a desta			
Site Br	reak	Feature Typ	e E Fea	ture Modifier	Flow	Conditions [3 Feature Vege	etation 🖸 Rip	arian Vegetation
Point I Catego	Data Data Dry		Ongoing and No Evidence	Active (1) (4)	Histo Unkn	ric Evidence (2) own (5)	Reported but	No Evidence (3)	
POINT	DATA KEY:			letter has					Min and and a second
A B C D E F G H I J K L M N O P O	Spring/upwelli Seepage area Watercress - Outlet (tile or ot Beaver dam - Manmade dam Other barrier t Potential cont Channel harde Culvert - note Flow transition Flow transition Flow transition Flow transition Flow transition Flow transition Flow transition	ng - estimate - measure or estimate total other) - record her) - record her) - record n - measure per o fish movem amination sou ening - indicat type, size and point D/S - fl point M/S- fik opint D-S/IF- during non-fit ent source	<0.5 Vsec or >0 estimate length surface area oc flow status as pe shed height and erched height and erched height a ent rce (storm sewe ed by rip-rap, ar i whether or not ow condition ch flow condition of sh sampling acti	5 Vsec; measu of bank where cupied per feature flow. jumping height nd jumping hei er outlet or indu mour stone, or perched. If per anges from dry anges from dry changes from civities	ire temp seepage occurs . Estimate volume Estimate volume ght istrial discharge pi gabion baskets. rched record perce to standing wate imal to substantia dry/standing water	a <0.5 l/sec or >0.5 to be <0.5 l/sec or > to be <0.5 l/sec or > t	Vsec, Measure to >0,5 Vsec. ping height, egment break spendent of segm independent of se	emperature. ent break egment break	
RS	Offline pond Other	annei	2941 - 1 2941 - 1	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	A State State	STORE WE CH		御 御 四 四 四	and the state of t

	Und	onstrained	leadwater Di	ainage Fe	ature Assess	ment	
Date: May 31/20	120	Project #:	61730.6	S Rec	order/Crew:	W	
Stream Name: HD	FI	- Stream Cod	HDEI-I	Site	Code:	HOFI-IN	
Site Limite:	llostream	WP# 45.304	931 -75 95	TESH Field	d Assessment	Sample 1	Unconnected HDF:
Sile Linins.	Downstream	WP# 4 2000	11 -75 95	21501 110		Sample 2	Not connected
Direction of Assessment:	Domisiouni		E Down	stream		Sample 3	to downstream network
Flow Influence	Freshet	(1)	[Spate (2)		Baseflo	w (3)
Flow Condition	Dry (1)	n Water (2)	r r	Interstitial Fl	low (3) w (4)	Substar	ntial Flow (5)
Feature Type		Natural Channel (1)		No Defined	Feature (4)	Swale (7)
	Channe	lized or Constrained	(2)	Tiled Featur	e (5)	C Roadsid	te Ditch (8)
	Multi-th	read (3)	.,	Wetland (6)		Pond (9)
Feature Vegetation	None (1)	Lawn (2)	Cropped (3)	Meadow (4)	Scrubland (5)	B Wetland(6) GCattails	Forest (7) Serveeds
Riparian Vegetation			animentar	-			-
0 - 1.5 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3) Cropped (3)	Meadow (4) Meadow (4)	Scrubland (5)	Wetland (6)	Forest (7)
1.5 - 10 m Left Bank Right Bank	None (1) None (1)	Lawn (2) D	Cropped (3) Cropped (3)	Meadow (4) Meadow (4)	Scrubland (5)	Wetland (6)	Forest (7)
10 - 30 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3) Cropped (3)	Meadow (4) Meadow (4)	Scrubland (5) Scrubland (5)	Wetland (6) Wetland (6)	Forest (7)
Channel Gradient /SA			(2) Laser	level (3)	Survey Level (4)	Other (5)	LiDAR (6)
Distance (m):			Elevation (cm) :		,	Gradient (°)	
Dominant Substrate (S Sub-Dominant Substra	Clay (H 2.M3) E te (S2.M3) E	ard Pan) Silt	Sand (0.06-2	mm) Gravel ((22-66 mm) Cobble]]	9 (67-249 mm) Bou	ulder (250 mm) Bedrock
Feature Roughness Width Measurement	Can'i Measu	10% Minimal (1) re (1) 🛛 Ban	10 - 40% kfull (2)	Moderate (2) Mean Width (3)	40 - 60% Hig	h (3) > 6) GIS (5)	0% Extreme (4) Measure/GIS (6)
Channel Dimensions	Feature Width (m)	- 7	m	Bankful	I Depth (mm)	<50	cm
Entrenchment To	tal: > 40 m	□ < 40 m	Left Bank	m Rig	ht Bank	m Total w	ridthm
Surface Flow Method	Perched Cub	vert (1)	Hydraulic Hea	id (2)	Distance by Time	(3)	Estimated (4)
Wetted Width (m)	Wetted Dept 1 2 18 2	th (man) Hyd 3 1 2 19	Iraulic head (mm) 1 2 3	Volum 1	ne (L) 2 3	Distance (m) 1 2 3	Time (s) 1 2 3
	Adjacent D	None (1)	🗆 Rill (2)	Rill and Gu	lly (3) 🗖 G	ully (4) 🛛 Ou	tlet Scour (5)
Sediment Transport	Feature D	Sheet Erosion (6 None (1) Sheet Erosion (6) 🔲 Rill (2)	 Instream B Rill and Gu Instream B 	ank Erosion (7) Ily (3)	ully (4) 0t	her (8) itlet Scour (5) her (8)
		-					
None (1)	Measures (m] Minimal: < 5 mm	(2) Mod	derate: 5-30 mm (3)	D Substa	ntial: 31-80 mm (4)	Extensive:	> 80 mm (5)

ate: Mar 31/6	2020	Proje	ect #: 6173	0.65	Recorder/C	rew: TW	11 10 10 10 10 10 10 10 10 10 10 10 10 1	
tream Name: H	DFI	Stree	am Code: HD	FI-I	Site Code:	HD	F1-10	
ite Limits:	Upstream	WP# 45	.306931	15.98755	4 Field Asses	sment: 🖄 Sa	mple 1 U	nconnected HDF:
	Downstream	WP# 45	307041 -7	5.98745	5	🗆 Sa	mple 2 [Not connected
irection of Assessmer	nt:	Upst	ream 🛛 🖾	Downstream	an in		mple 3 t	o downstream netwo
ow Influence	KI Fre	eshet (1)		🗆 Spa	ate (2)		Baseflow	(3)
ow Condition	Dn Dr	/ (1) Inding Water (2)			erstitial Flow (3) imal Flow (4)		Substantia	al Flow (5)
ature Type	De	fined Natural Char	nnel (1)	No	Defined Feature	(4)	Swale (7)	The state of the second
	Ch Ch	annelized or Cons	trained (2)	D Tile	d Feature (5)		D Roadside	Ditch (8)
	🗆 Mu	Iti-thread (3)		🗆 We	tland (6)		D Pond (9)	
ature Vegetation	□ None (1)	🗖 Lawn (2)	Cropped (3	8) 🖾 Me	adow (4) 🗖 S	Scrubland (5) 🖄	Wetland(6) E	Forest (7) Sreeds
15 m Left Bank	None (1)	[] Lawn (2)	Cronned (3			crubland (5)	Wetland (6)	Evrest (7)
Right Bank	□ None (1)	Lawn (2)	Cropped (3		adow (4)	crubland (5)	Wetland (6)	Forest (7)
5 - 10 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3) 🖸 Me) 🕅 Me	adow (4) 🖸 S adow (4) 🗖 S	crubland (5)	Wetland (6) Wetland (6)	Forest (7) Forest (7)
- 30 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3) 🖸 Me	adow (4) 🖸 S	crubland (5)	Wetland (6) Wetland (6)	Forest (7)
annel Gradient (SA			meter (2)	Laser Level (v Level (4)	Other (5)	LiDAR (6)
stance (m):			Elevation (cm):			Gradient (°):	
	Cla	v (Hard Pan)	- Silt Sand (0.06-2 mm)	Gravel (22-66 m	m) Cobble (67-24	19 mm) Boulde	er (250 mm) Bedroo
minant Substrate (S	2.M3)					Ú Ì	Ĺ	
b-Dominant Substra	ite (S2.M3)			M				
ature Roughness		< 10% Minimal (1) 🔯 10	- 40% Modera	te (2) 4	0 - 60% High (3)	□ > 60%	Extreme (4)
dth Measurement	Can't Me	asure (1)	Bankfull (2)		hidth (3)	stimated (4)		easure/GIS (6)
annel Dimensions	Feature Width	(m):	7m		Bankfull Depth	(mm)	<Soc	m
trenchment To	tal: > 40	m - < 40 m	m Left Bank		m Right Bank	m	Total widt	hm
face Flow Method	Perched (Cutvert (1)	Hydrau	lic Head (2)	Distar	ice by Time (3)		stimated (4)
Wetted Width (m)	Wetted D	epth (mm)	Hydraulic head	(mm)	Volume (L)	Dista 3 1	ance (m) 2 3	Time (s)
Jm	18 2	12 19	_/		/		/	/
	Adjacent	1 None (1)	🗖 Rill (2)		and Gully (3)	Gully (4)	D Outlet	Scour (5)
ediment Transport		Sheet Erosi	on (6)	D Inst	eam Bank Eros	ion (7)	D Other	(8)
	Feature	Mone (1)	🗆 Rill (2)		and Gully (3)	Gully (4)	D Outlet	Scour (5)
		Sheet Frosi	on (6)		eam Bank Eros	ion (7)	Other	(8)

	U	nconstrain	ed Headwater	Drai	nage Fea	ature Asse	ssment	
Date: APP 2712	0506	Projec	1# 617201	25	Reco	order/Crew:	TW	
Stream Name	IDEI-I	Stream	n Code: HOF	1-1	Site	Code:	HOFI-1	A
Site Limits:	Unstream	WP# 45.	307245 - 75	.987	050 Field	Assessment:	Sample 1	Unconnected HDF:
One Limita.	Downstream	WP# 45	307110 -75	.981	-4aa		Sample 2	Not connected
Direction of Assessment:		D Upstre	am D	ownstre	am	di tangi	Sample 3	to downstream network
Flow Influence	Fresh	net (1)	The second		Spate (2)	1. 15	🖄 Base	flow (3)
Flow Condition	Dry (Dry (1) ding Water (2)			Interstitial Flo Minimal Flow	w (3) (4)	Subs	tantial Flow (5)
Feature Type	Defin	ed Natural Chann	nel (1)		No Defined F	eature (4)	Swale	e (7)
the second second	🔼 Chan	nelized or Constr	ained (2)		Tiled Feature	(5)	C Road	side Ditch (8)
F. t. Mandatlan	D Multi-	-thread (3)			Wetland (6)	Considered	(5) Wetland	(9) 6)
Feature Vegetation	None (1)	Lawn (2)	Cropped (3)	вŲ	Meadow (4)		(5) L Welland(b) D Forest (7)
Riparian Vegetation	Non (4)			r),	Alexandre (A)	C Senthland	(5) Wetland	(6) Ecrect (7)
Right Bank	None (1)	Lawn (2)	Cropped (3)	DX DX	Meadow (4) Meadow (4)	Scrubland	(5) U Wetland ((6) Forest (7)
1.5 - 10 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3) Cropped (3)	X	Meadow (4) Meadow (4)	Scrubland Scrubland	(5) U Wetland (Forest (7) (6) Forest (7) (6) Forest (7)
10 - 30 m Left Bank Right Bank	 None (1) None (1) 	Lawn (2)	Cropped (3) Cropped (3)	N N N	Meadow (4) Meadow (4)	Scrubland Scrubland	(5) 🖸 Wetland (6) Forest (7) (6) Forest (7)
Channel Gradient (S4.	(7) Visu	al (1) Clino	meter (2)	aser Le	vel (3)	Survey Level (4) Other (5)	LiDAR (6)
Distance (m):			Elevation (cm):			Gradient	(°):
Dominant Substrate (S Sub-Dominant Substra	Clay 2.M3) te (S2.M3)	(Hard Pan)	Silt Sand (0.0)6-2 mm) Gravel (2	22-66 mm) Cob	ble (67-249 mm) B	oulder (250 mm) Bedrock
Feature Roughness Width Measurement	Can't Mea	< 10% Minimal (sure (1)	1) 10 - 4 Bankfull (2)	10% Mo	derate (2) an Width (3)	40 - 60% H	ligh (3) □ > (4) □ GIS (5) [60% Extreme (4) Measure/GIS (6)
Channel Dimensions	Feature Width	(m):	a.a	1	Bankfull	Depth (mm)	SO C	m
Entrenchment To	otal: > 40	m	m Left Bank _		m Righ	t Bank	m Total	widthm
Surface Flow Method	Perched C	Culvert (1)	Hydraulic	Head (2)	Distance by Tin	ne (3)	Estimated (4)
Wetted Width (m)	Wetted D	epth (mm) 2 3	Hydraulic head (m 1 2	nm) 3	Volume 1 2	e (L)	Distance (m) 1 2	Time (s) 3 1 2 3
1507513	3a 8 2	17	_/	_	_/			
Sediment Transport	Adjacent Feature	None (1) Sheet Eros None (1) Sheet Eros	Rill (2) Rill (2) Rill (2) Rill (2) ion (6)		Rill and Gully Instream Bar Rill and Gully Instream Bar	y (3) nk Erosion (7) y (3) nk Erosion (7)	Guily (4) 0 0 Guily (4) 0 0 0 0	Dutlet Scour (5) Dther (8) Dutlet Scour (5) Dther (8)
Sediment Deposition	Measures	(mm):	Moderate: 5-30 mm	n (3)	Substan	tial: 31-80 mm (4		e: > 80 mm (5)
			moderate. 0-00 mil	(0)	- outoian		- Enterior	

Date:	APR 27/	303Proje	Unc ct #: <u>6</u>	constrained H	eadwater Di Field	ainage Featu Assessment:	ure Assessm] _{Sample # 1}	ient Sample # 2	Pg. 2 of 2
- AN	and the second			PC	INT FEAT	TURE DATA			
Fish Ba Ground Fish Co	arrier Measurem Iwater Indicator	ents: WP# WP# ns X	None	Perched Heigh Perched Heigh Watercress Present	nt (mm): nt (mm): Seepage Comment:	Jumping He Jumping He Bubbling	eight (mm): eight (mm):	Other:	
		No. Concel	二人の		R. sa jast	The second second	and a second second		the straight gray
WP#	Photo #	Code	Catego	ory	Ale di Seri Seco		Description		
Additi	ional Notes:								
Site Bi Trigge	reak 🔀 F	eature Type	e 🛄	Feature Modifier	Flow	Conditions [3 Feature Vege	etation 🖸 Ripar	ian Vegetation
Point	Data		Ongoing a	and Active (1)	Histor	ic Evidence (2)	Reported but	No Evidence (3)	1
Catego	ory		No Evide	nce (4)	Unkn	own (5)		CONTRACTOR OF THE OWNER	
A B C D E F G H I	Spring/upwellin Seepage area - Watercress - er Outlet (tile or oth Iniet (tile or oth Beaver dam - n Manmade dam Other barrier to Potential contai	g - estimate measure or stimate total ther) - record fi neasure perc - measure p fish movem mination sou	<0.5 Visec o estimate le surface are flow status ow status a hed height erched heig ant roe (storm s ad by rip-rational statement to the statement of the statement to the state	or >0.5 Vsec; measuringth of bank where a occupied as per feature flow. Is per feature flow. and jumping height thand jumping height sewer outlet or indus b. armour stone or	re temp seepage occurs Estimate volume t Int strial discharge pi gabion beskets.	e <0.5 l/sec or >0.5 o be <0.5 l/sec or 3 pe).	i Vsec. Measure tr ×0.5 Vsec.	Imperature.	ante strate este ante strate este ante trate este ante trate este ante trate este ante trate este ante

	Unconstrained	d Headwater Dra	inage Feature Asse	ssment	
Date: APR 271	2020 Project	#: 61730.65	Recorder/Crew:	TW	30 9 M
Stream Name:	HDFI Stream	Code: HDFI-1	Site Code:	HDF 1-1B	
Site Limits:	Upstream WP#45.3	07041 -75987	455 Field Assessment:	Sample 1 Unconnecte	ed HDF:
	Downstream WP# 45. 30	07245 -75.98-	1050	Sample 2 Not co	onnected
Direction of Assessment:	Upstrea	m 🖄 Downstr	eam	Sample 3 to downst	ream network
Flow Influence	Freshet (1)	0	Spate (2)	Baseflow (3)	
Flow Condition	Dry (1) Dry Standing Water (2)		Interstitial Flow (3) Minimal Flow (4)	Substantial Flow (5))
Feature Type	Defined Natural Channe	l (1) 🗹	No Defined Feature (4)	Swale (7)	1.25.8 1.54
	Channelized or Constrai	ined (2)	Tiled Feature (5)	Roadside Ditch (8)	
	Multi-thread (3)		Wetland (6)	Pond (9)	(7)
Feature Vegetation	LI None (1) LI Lawn (2)	Cropped (3)	Meadow (4) LI Scrubland	(5) LI Wetland(6) LI Forest	(7)
Riparian Vegetation					
0 - 1.5 m Left Bank	D None (1) Lawn (2)	Cropped (3)	Meadow (4) Scrubland	(5) 🖸 Wetland (6) 🖸 Fo	prest (7)
Right Bank	□ None (1) □ Lawn (2)	Cropped (3)	Meadow (4) Scrubland	(5) U Wetland (6) Fo	prest (7)
1.5 - 10 m Left Bank	None (1) Lawn (2)	Cropped (3)	Meadow (4) Scrubland	(5) Wetland (6) G Fo	prest (7)
Right Bank	□ None (1) □ Lawn (2)	Cropped (3)	Meadow (4) Scrubland	(5) U Wetland (6) Fo	prest (7)
10 - 30 m Left Bank	None (1) Lawn (2)	K Gropped (3)	Meadow (4) Scrubland	(5) 🖸 Wetland (6) 🛄 Fo	prest (7)
Right Bank	□ None (1) □ Lawn (2)	Cropped (3)	Meadow (4) Scrubland	(5) U Wetland (6) Fo	prest (7)
Channel Gradient (S4.N	7) Visual (1) Clinom	eter (2) Laser Le	evel (3) Survey Level (4	4) Other (5) Li	DAR (6)
Distance (m):		Elevation (cm) :		Gradient (°):	
Dominant Substrate (S Sub-Dominant Substrat	Clay (Hard Pan) 2.M3)	Silt Sand (0.06-2 mr	n) Gravel (22-66 mm) Cot	oble (67-249 mm) Boulder (250 m	m) Bedrock
Feature Roughness	X < 10% Minimal (1)) 10 - 40% Ma	oderate (2) 40 - 60%	High (3) > 60% Extreme	e (4)
Width Measurement	Can't Measure (1)	Bankfull (2)	ean Width (3) 🖾 Estimated	(4) GIS (5) Measure/G	IS (6)
Channel Dimensions	Feature Width (m):	S.Sm	Bankfull Depth (mm)	<50cm	
Entrenchment To	tal: > 40 m < 40 m	Left Bank	m Right Bank	m Total width	m
Surface Flow Method	Perched Culvert (1)	Hydraulic Head	(2) Distance by Ti	me (3) Estimated	(4)
Wetted Width (m)	Wetted Depth (mm)	Hydraulic head (mm)	Volume (L)	Distance (m)	Time (s)
5-8m	954				2 3
patchy	Adjacent None (1)		Rill and Gully (3)	Gully (4) Dutlet Scour (5	5)
Sediment Transport		n (6)	Instream Bank Emeion (7)		
	Feature IN None (1)		Rill and Gully (3)	Gully (4) Dutlet Scour (4)	5)
	Sheet Erosio	n (6)	Instream Bank Erosion (7)	□ Other (8)	
Sediment Deposition	Measures (mm):		<u> </u>		
None (1)	Minimal: < 5 mm (2)	Moderate: 5-30 mm (3)	Substantial: 31-80 mm	(4) Extensive: > 80 mm (5)

Contraction in such	APR 27	2020 Proje	Uncon at#: 617	strained He	adwater Dr Field	ainage Feat Assessment:	ure Assessm	nent Sample # 2	Pg. 2 of 2
1 Section	and a start with		A STATE OF STATE	PO	INT FEAT	URE DAT	A		and the second second
Fish Ba	arrier Measuren Iwater Indicato	nents: WP# WP# ors	None	Perched Heigh Perched Heigh Watercress	t (mm): t (mm): Seepage	Jumping H Jumping H Bubbling	eight (mm): eight (mm):	Other:	
Fish Co	ollection		Absent	Present	Comment:				
WP#	Photo #	Code	Category		and the last	i hi ki u su sta	Description		
Site B Trigge	rbak 🔲 Ir	Feature Typ Other: Con	e 🖸 Fea	iture Modifier	X Flow (Conditions	X Feature Vege	etation 🕅 Rip	arlan Vegetation
Point	Data		Ongoing and	Active (1)	Histori	ic Evidence (2)	Reported but	No Evidence (3)	
POINT	DATA KEY:				CHINIC				
a strong on the	and the second s	11 1 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	and the second of the second		Reference and the second	CONTRACTOR OF THE R. P. LEWIS CO., NAME OF THE PARTY OF THE PARTY.	and the second se	and the second se	and the second sec

	Ur	constrained	Headwater	Drain	ige Feati	ure Asses	sment	
Date: APR 27/	2080	Project #:	61730.	65	Recorde	er/Crew:	TW	
Stream Name: HD	FI	Stream C	ode: HDF	1-1	Site Cod	de:	HOF 1-1C	Contraction and the
Site Limits:	Upstream	WP# 45.30	1523 -75.	9868	53 Field As	ssessment:	Sample 1	Unconnected HDF:
	Downstream	WP# 45.30	7245 -75.	9870	50		Sample 2	Not connected
Direction of Assessment:		Upstream	Do	wnstream	1	Section 2 and	Sample 3	to downstream network
Flow Influence	Fresh	et (1)		□ Sp	ate (2)		Basel	low (3)
Flow Condition	Dry (1) ing Water (2)			erstitial Flow nimal Flow (4)	(3)	Subst	antial Flow (5)
Feature Type	Define	ed Natural Channel	(1)	PA No	Defined Feat	iture (4)	Swale	(7)
	Chan	nelized or Constrain	ed (2)		ed Feature (5	5)	C Road	side Ditch (8)
Feature Vecatation		thread (3)	Cropped (2)		etiand (6)	Scrubland /	5) D Wetland	(9) Ecrest (7)
reature vegetation	None (1)	Lawn (2) L	L Cropped (3)	A M	auow (4) L			
Riparian Vegetation				×	14 24 541 1	- I win to be the		
0 - 1.5 m Left Bank Right Bank	None (1)	Lawn (2) C	Cropped (3) Cropped (3)		eadow (4) C	Scrubland (5) Wetland (5) Wetland (6) Forest (7) 6) Forest (7)
1.5 - 10 m Left Bank Right Bank	None (1)	Lawn (2) C	Cropped (3) Cropped (3)		adow (4) C	Scrubland (5) Wetland (5) Wetland (6)
10 - 30 m Left Bank Right Bank	None (1)	Lawn (2)	Cropped (3) Cropped (3)		eadow (4) E	Scrubland (5) 🖸 Wetland (5) 🗆 Wetland (6) Forest (7) 6) Forest (7)
Channel Gradient (S4		(1) Clinomet	er (2)	ser Level	(3) S	urvey Level (4)	Other (5)	LiDAR (6)
Distance (m):			Elevation (cm)	:	r mil		Gradient	(*):
Dominant Substrate (S Sub-Dominant Substra	Clay 2.M3) te (S2.M3)	(Hard Pan) Si	tt Sand (0.06	5-2 mm)]]	Gravel (22-	66 mm) Cobb	ole (67-249 mm) B	oulder (250 mm) Bedrock
Feature Roughness Width Measurement	Can't Meas	< 10% Minimal (1) sure (1)	10 - 40 ankfull (2)	Mode Mean	rate (2) L Width (3) C	40 - 60% H	igh (3) □ > (4) □ GIS (5) [60% Extreme (4) Measure/GIS (6)
Channel Dimensions	Feature Width (m):<	Im		Bankfull De	epth (mm)	<10	cm
Entrenchment To	otal: > 40	m 🗖 < 40 m	Left Bank		_m Right B	Bank	m Total	widthm
Surface Flow Method	Perched Co	ulvert (1)	Hydraulic I	Head (2)		Distance by Tim	ne (3)	Estimated (4)
Wetted Width (m)	Wetted De 1 2	pth (mm) Hy 3	ydraulic head (mi 1 2	m) 3	Volume (1 1 2	3	Distance (m) 1 2	Time (s) 3 1 2 3
Sediment Transport	Adjacent	None (1)	□ Rill (2) (6)		ill and Gully (stream Bank	(3)	Gully (4)	Outlet Scour (5) Other (8)
	Feature	None (1) Sheet Erosion	(6)		ill and Gully (stream Bank	(3) Erosion (7)	Gully (4)	Outlet Scour (5) Other (8)
Sediment Deposition	Measures	(mm):			_			
None (1)	Minimal: < 5 mm	n (2) 🗖 M	oderate: 5-30 mm	(3)	Substantia	al: 31-80 mm (4) Extensiv	re: > 80 mm (5)

Date: /	Herayk	20 <u>20</u> Proje	Uni ect #:	Constrained H	leadwater Dr	ainage Feati Assessment: I	ure Assessm 3 Sample # 1	nent Sample # 2	Pg. 2 of 2
	1.46			P	OINT FEAT	TURE DATA			and the second
Fish Ba Ground Fish Co	Inter Measurer Iwater Indicat	nents: WP# WP# tors	None Absent	Perched Heig Perched Heig Watercress Present	ght (mm): ght (mm): Seepage Comment:	Jumping He Jumping He Bubbling	eight (mm): eight (mm):	Other.	
		ST STREET		a share a second second	Contract of the			Phar Pilat	- to a software in a set
WP#	Photo #	Code	Categ	ory	Provinces Advances and		Description	X	
Addit	ional Notes	önne	ction		pstrean	n netwo	nk		
Site Bi Trigge	rèak 🛄 Ir 🛄	Feature Typ Other: Con	e	Feature Modifier	Flow Histor	Conditions	Feature Veg	etation Rip	arian Vegetation
Catego	Data		No Evide	ence (4)	Unkne	own (5)	Reported ou	I NO EVIDENCE (3)	
POINT	DATA KEY:		1000		a the bar and the			and the second s	
ABCDEFGIJKLMZOP	Spring/upwelli Seepage area Watercress - Outlet (tile or of Beaver dam - Manmade dar Other barrier Potential cont Channel hard Culvert - note Flow transitio Flow transitio Flow transitio Fish observer Potential nutr	ing - estimate - measure or estimate total other) - record her) - record measure perc n - measure perc mination sou ening - indicat type, size and n point D/S - fl n point D/S - fl n point D/S/IF- d during non-fl int course	<0.5 Visec e estimate le surface are flow status iow status iow status ince de height erched hei ent ince (storm ed by rip-ra d whether c low conditio - flow cond sh samplin	or >0.5 l/sec; measy ength of bank where a occupied is as per feature flow as per feature flow. t and jumping height ight and jumping height ight and jumping height sewer outlet or indu ap, armour stone, of or not perched. If pe on changes from dh on changes from mi lition changes from ng activities	ure temp a seepage occurs v. Estimate volume t Estimate volume t t ight ustrial discharge pi r gabion baskets. rched record perct y to standing water nimal to substantia dry/standing water	e <0.5 l/sec or >0.5 to be <0.5 l/sec or pe). hed height and jurr , independent of s I surface flow, inde to interstitial flow,	5 Vsec, Measure t >0.5 Vsec. nping height, egment break ependent of segm independent of se	emperature.	

	Unconstr	alned Headwater	Drainage Feature Asse	esment
Date: APR 271	2020	Project #: 61730.6	S Recorder/Crew:	τw
Stream Name:	IDFI	Stream Code: HDF	- Site Code:	HDFI-ID
Site Limits:	Upstream WP#	45.306931 -75	5.987554 Field Assessment:	Sample 1 Unconnected HDF:
	Downstream WP#	15.307041 -75.	987455	Sample 2 Not connected
Direction of Assessment:		Upstream 🖸 Dov	wnstream	Sample 3 to downstream network
Flow Influence	Freshet (1)		Spate (2)	Baseflow (3)
Flow Condition	Dry (1) Standing Water	(2)	 Interstitial Flow (3) Minimal Flow (4) 	Substantial Flow (5)
Feature Type	Defined Natural Channelized or	Channel (1) Constrained (2)	No Defined Feature (4)	Swale (7) Roadside Ditch (8)
	Multi-thread (3)	(-)	Wetland (6)	Pond (9)
Feature Vegetation	None (1) Lawn	(2) Cropped (3)	Meadow (4) Scrubland	(5) X Wetland(6) Forest (7)
Riparian Vegetation			and a state of the	
0 - 1.5 m Left Bank Right Bank	None (1) Lawn None (1) Lawn Lawn	(2) Cropped (3) (2) Cropped (3)	Meadow (4) Scrubland Meadow (4) Scrubland	(5) Wetland (6) Forest (7) (5) Wetland (6) Forest (7)
15.10 m loft Bank	A None (1)	(2) D Cmmod (2)	Mandaw (4) - Scathland	(5) Wetland (6) Errest (7)
Right Bank	None (1) Lawn	(2) Cropped (3)	Meadow (4) Scrubland	(5) Wetland (6) Forest (7)
10 - 30 m Left Bank Bight Bank	None (1) Lawn	(2) Cropped (3)	Meadow (4) Scrubland	(5) Wetland (6) Forest (7)
Distance (m):		Elevation (cm)		
			·	
Dominant Substrate (S	Clay (Hard Pan 2.M3)	Silt Sand (0.06	-2 mm) Gravel (22-66 mm) Cob	bble (67-249 mm) Boulder (250 mm) Bedrock
Sub-Dominant Substra	te (S2.M3)			
Feature Roughness Width Measurement	 < 10% Min Can't Measure (1) 	nimal (1) 🔲 10 - 40 🔲 Bankfull (2) 🕻	% Moderate (2) 40 - 60% I Ø Mean Width (3) Ø Estimated	High (3)
Channel Dimensions	Feature Width (m):	<5m	Bankfull Depth (mm)	< 50cm
Entrenchment To	tal: > 40 m	< 40 m Left Bank	m Right Bank	m Total widthm
Surface Flow Method	Perched Culvert (1)	Hydraulic H	Head (2) Distance by Tir	me (3) Estimated (4)
Wetted Width (m)	Wetted Depth (mm)	Hydraulic head (mr	m) Volume (L)	Distance (m) Time (s)
1-3 m	4128			
dryprease	Adjacent DX None	(1) 🗖 Rill (2)	Rill and Gully (3)	Gully (4) Outlet Scour (5)
Sediment Transport	Shee	t Erosion (6)	Instream Bank Erosion (7)	D Other (8)
	Feature None	(1)	Rill and Gully (3) Instream Bank Erosion (7)	Gully (4) Outlet Scour (5)
Sediment Deposition	Measures (mm):			
None (1)] Minimal: < 5 mm (2)	Moderate: 5-30 mm	(3) Substantial: 31-80 mm (4) Extensive: > 80 mm (5)

Date:	IPR 27	2000 Proje	Uno ct#: <u>. (o</u>	constrained H	eadwater Dr Field	ainage Feati Assessment: [ure Assessm] _{Sample # 1}	Sample # 1	Pg. 2 of 2 Sample # 3
and services and	A N N N N N N N	A CONTRACTOR	and a second	PO	INT FEAT	URE DATA	1		
Fish Ba Ground Fish Co	amer Measure Iwater Indicat	ments: WP# WP# ors	None Absent	Perched Heig Perched Heig Watercress Present	ht (mm): ht (mm): Seepage Comment:	Jumping He Jumping He Bubbling	eight (mm): eight (mm):	Other:	
		STATISTICS AND			1. 10.100 L	and the second	a al al al	的人们和中国家	Constantina 4
WP#	Photo #	Code	Catego	ory			Description		
Additi	lonal Notes								
Site Bi	reak	Feature Type	e 🛄	Feature Modifier	Flow 1	Conditions [3 Feature Veg	etation 🔲 Rij	parian Vegetation
Point I	Data		Ongoing a	and Active (1)	Histor	ic Evidence (2)	Reported but	No Evidence (3)	
POINT	DATA KEY:		THU LVIDE		Crine and				
ABCDEFGI-JKLMZOPO	Spring/upwell Seepage area Watercress - Outlet (tile or of Beaver dam - Manmade dar Other barrier Potential conf Channel hard Culver - note Flow transitio Flow transitio Flow transitio Flow transitio Flow transitio Potential nutri	ing - estimate - measure or estimate total other) - record her) - record her) - record her) - record her) - record f measure perc n - measure perc n - measure perc n - measure perc indicate type, size and n point D/S - fl n point	<0.5 l/sec c estimate le surface are flow status ow status a hed height erched height erched height ant rcce (storm s ad by rip-ra i whether or ow condition flow condition flow condition	or >0.5 l/sec; measu ength of bank where a occupied s as per feature flow as per feature flow. It and jumping height ght and jumping height sewer outlet or indus ip, armour stone, or r not perched. If per in changes from dry n changes from dry n changes from d j activities	te temp seepage occurs Estimate volume istimate volume t int strial discharge pi gabion baskets, ched record perch to standing water mal to substantia y/standing water	<0.5 l/sec or >0.5 b be <0.5 l/sec or 3 be). independent of si surface flow, inde to interstitial flow,	Vsec, Measure to >0.5 Vsec. ping height. egment break spendent of segm independent of se	emperature.	notional design of the second se

APPENDIX D

CVs for Key Personnel

Report to: Argue Construction Ltd. Project: 61730.65 (May 14, 2020)



Drew Paulusse, B.Sc.

Senior Biologist / Manager of Environmental Services

Mr. Paulusse has over 12 years of experience in the environmental consulting industry, providing private industry and municipal and federal government clients with cost effective solutions to manage environmental constraints associated with land development proposals and infrastructure projects. Mr. Paulusse's expertise, as it relates to land development proposals and infrastructure projects is field assessment and regulatory permitting associated with species at risk, fish habitat and wetlands.

Education

- B.Sc., Biology, Trent University, 2007
- Environmental Technician, Fleming College, 2004

Professional Experience

2018-date	GEMTEC Consulting Engineers and Scientists Limited <i>Manager of Environmental Services</i>	Ottawa, Ontario
2011-2018	Geofirma Engineering Limited Senior Biologist	Ottawa, Ontario
2007-2011	INTERA Engineering Limited Biologist	Ottawa, Ontario
2007	Canadian Wildlife Service, Environment Canada Wetland Conservation Officer	Burlington, Ontario
2005	Centre for Inland Waters, Environment Canada Junior Marine Technologist	Burlington, Ontario

Professional Affiliations and Technical Training

- Canadian Society of Environmental Biologists
- Ontario Association for Impact Assessment
- MTO/DFO/MNRF Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings. Ministry of Transportation. 2018
- Ontario Wetland Evaluation System Certification Course. Ministry of Natural Resources and Forestry. 2017
- Headwater Drainage Feature Assessment Training Course. Rideau Valley Conservation Authority. 2017



- Ecological Land Classification System Certification Course. Ministry of Natural Resources and Forestry. 2015
- Ontario Benthic Biomonitoring Network Certification Course. Ministry of Environment, Conservation and Parks. 2011

Project Highlights

- DFO Self-Assessment and Preparation of Tender Special Provisions, Osceola Culvert Replacement, County of Renfrew, Ontario (2019): Project manager and technical lead responsible for the evaluation of the significance of fish habitat and species at risk, and completion of a DFO self-assessment. Work included aquatic habitat assessments, pathway of effects evaluation, culvert design recommendations and reporting.
- Biological Inventory, Ontario Power Generation Incorporated, Bath, Ontario (2018): Project manager and technical lead responsible for conducting a three-season inventory of avian and amphibian species at the Lennox Provincially Significant Wetland. Work included conducting presence and abundance surveys following the Canadian Wildlife Service marsh monitoring protocol and Bird Studies Canada breeding bird surveys, statistical analysis of species data trends and reporting.
- Wetland Management Plan, Ontario Power Generation Incorporated, Bath, Ontario (2018): Project manager and technical lead responsible for the development of an adaptive wetland management plan for the Lennox Provincially Significant Wetland. Work included a synthesis of historical data, statistical analysis of data trends, vegetation assessment, air photo interpretation, development of short-term and long-term management objectives and development of a standardized monitoring program.
- Environmental Compliance Monitoring, Petrie Island Causeway Rehabilitation Project, Ottawa, Ontario (2018): Project manager and technical lead responsible for monitoring constructor compliance with various Department of Fisheries and Oceans, Ministry of Natural Resources and Conservation Authority permit conditions during the Petrie Island Causeway Rehabilitation Project within the Ottawa River. Work included species at risk surveys, fish salvage, exclusion fence inspection, monitoring of sediment and erosion control measures, turbidity monitoring, regulatory agency consultation and weekly reporting.
- Wetland Delineation and Wetland Function Assessment, National Capital Commission, Ottawa, Ontario (2018): Project manager and technical lead responsible for the delineation of wetland pockets within the LeBreton Flats Redevelopment Area and the assessment of wetland function for the purpose of evaluating compensation requirements. Work was completed following both the federal and provincial wetland evaluation frameworks.



- Environmental Impact Statement, Code Drive Development, Smiths Falls, Ontario (2018): Project manager and technical lead responsible for the completion of an Environmental Impact Statement in support of a severance application for the creation of eight residential lots within a significant woodland and adjacent to a large local wetland. Work included targeted surveys for species at risk, breeding amphibians and marsh birds, impact assessment, development of lot-specific mitigation measures and agency consultations.
- Tree Conservation Report, Royal LePage Team Realty, Ottawa, Ontario (2018): Mr. Paulusse completed an inventory of all trees located on an urban commercial lot for the purpose of identify significant retainable trees and trees in conflict with the proposed site redevelopment. Work included, site inventory, tree removal permit preparation and reporting.
- Environmental Compliance Monitoring, Airport Parkway Culvert Rehabilitation Project, Ottawa, Ontario (2018): Project manager and technical lead responsible for monitoring constructor compliance with Ministry of Natural Resources and Conservation Authority permit conditions. Work included species at risk surveys, exclusion fence inspection, monitoring of sediment and erosion control measures and weekly reporting.
- **Tier I and II Natural Environment Report, Crain's Construction, Ottawa, Ontario (2018):** Project manager and technical lead responsible for completing an inventory of site flora and fauna, completion of species at risk surveys, regulatory agency consultation, impact assessment and reporting.
- Species at Risk Assessment, National Capital Commission, Gatineau, Quebec (2018): Project manager responsible for the completion of avian species at risk surveys to determine the presence or absence of chimney swift and barn swallows at a contaminated site. Work was undertaken to support an Ecological Risk Assessment.
- Fish Habitat Assessment, Various Culvert Replacements, Ottawa, Ontario (2018): Project manager and technical lead responsible for the evaluation of the significance of fish habitat at three culvert crossings in rural Ottawa. Work included aquatic habitat assessments, pathway of effects evaluation, culvert design recommendations and reporting.
- Environment Effects Evaluation Assessment, Britannia Wall Rehabilitation Project, Ottawa, Ontario (2018): Project manager and technical lead responsible for completing a comprehensive tree inventory, wetland boundary delineation, significant wildlife habitat assessment and evaluation of effects associated with the rehabilitation of the Britannia Wall, a 600-metre-long community flood protection structure.
- Environmental Compliance Monitoring, Petrie Island Beach Head Rehabilitation Project, Ottawa, Ontario (2018): Project manager and technical lead responsible for monitoring constructor compliance with various Department of Fisheries and Oceans, Ministry of Natural Resources and Conservation Authority permit conditions during the Petrie Island





Beach Head Rehabilitation Project within the Ottawa River. Work included species at risk surveys, exclusion fence inspection, monitoring of sediment and erosion control measures, and reporting.

- **Provincially Significant Wetland Boundary Evaluation and Mitigation Plan, Town and County Chrysler, Smiths Falls, Ontario (2018):** Project manager and technical lead responsible for revising the wetland boundary associated with a provincially significant wetland and development of a mitigation plan to enable the redevelopment of an adjacent commercial lot. Work included wetland vegetation delineation, regulatory technical document submissions, agency consultations, mitigation measure development and reporting.
- Environmental Impact Statement and Headwater Drainage Feature Assessment, Swank Construction Limited, Morrisburg, Ontario (2017-2018): Project manager and technical lead responsible for the completion of an Environmental Impact Statement with Headwater Drainage Feature Assessment for a 100-lot residential subdivision. Work included ecological land classification, breeding bird surveys, impact assessment and a three season assessment of hydrological conditions and their contributions to downstream fish habitat.
- Natural Heritage Inventory and Environmental Impact Assessment, Combermere Lodge Limited, Barry's Bay, Ontario (2017-2018): Project manager and technical lead responsible for the completion of a Natural Heritage Inventory and Environmental Impact Assessment completed in support of a 54-lot condominium development located in an environmentally sensitive area. Work included wetland boundary delineation, identification of significant wildlife habitat, application of the significant wildlife habitat mitigation support tool, completion of a two-year survey of site flora and fauna, impact assessment and town hall presentations.
- Lake Capacity Assessment, Combermere Lodge Limited, Barry's Bay, Ontario (2017-2018): Project manager and technical lead responsible for the predictive assessment of septic effluent impacts relating to the operation of a 54-lot condominium development on three adjacent waterbodies. Work included limnological investigations over two seasons, application of the provincial lakeshore capacity model, hydrogeological investigations, mass flux analysis, mitigation measure development and reporting.
- Detailed Quantitative Ecological Risk Assessment, National Capital Commission, Gatineau, Quebec (2016 to 2018): Project manager and technical lead for the completion of a Detailed Quantitative Ecological Risk Assessment completed for a former landfill property located adjacent to the Ottawa River. Work included aquatic habitat assessment, benthic community characterization, species at risk surveys, terrestrial wildlife surveys and analysis of site-specific aquatic toxicity data.
- Environmental Compliance Monitoring, Carp Snow Dump, Ottawa, Ontario (2017): Project manager and technical lead responsible for monitoring constructor compliance with a Ministry of Natural Resources overall benefit permit for blanding's turtle associated with the



construction of the Carp Snow Dump. Work included weekly exclusion fence inspection and weekly reporting to the contract administrator.

- Fish Habitat Assessment, Little Bark Bay Properties, Barry's Bay, Ontario (2017): Project manager and technical lead responsible for the identification and evaluation of significance of fish habitat within and adjacent to a proposed plan of subdivision. Work included aquatic habitat assessments, pathway of effects evaluation, application of the Department of Fisheries and Oceans self-assessment process and reporting.
- Species at Risk and Migratory Bird Screening Assessment, City of Ottawa, New Edinburg Park Redevelopment Project, Ottawa, Ontario (2017): Project manager and technical lead responsible for the completion of a species at risk and migratory bird screening assessment to assist in bid tender package preparation for the re-development of New Edinburg Park. Work included a general habitat assessment, a probability of occurrence assessment, follow-up pre-construction surveys and reporting.
- Fish Habitat Assessment, Highway 417 Culvert Replacement Project, Ottawa, Ontario (2017): Project manager and technical lead responsible for the evaluation of the significance of fish habitat at two culvert crossings Ottawa. Work included aquatic habitat assessments, pathway of effects evaluation, application of the Department of Fisheries and Oceans self-assessment process and reporting.
- Fish Habitat and Headwater Drainage Feature Assessment, Private Landowner, Ottawa, Ontario (2017): Project manager and technical lead responsible for the completion of a twoseason hydrological assessment of on-site water courses and assessment of fish habitat. Work completed in support of a permit required to develop an unopened road allowance.
- Environmental Impact Statement and Wetland Boundary Assessment, Town and Country RV, Perth, Ontario (2016-2017): Project manager and technical lead responsible for delineation of a provincially significant wetland and impact assessment associated with the expansion of an existing commercial enterprise. Work included ecological land classification, identification of significant wildlife habitat, species at risk surveys, wetland vegetation assessment, impact assessment and development of site-specific mitigation measures.
- Environmental Impact Statement, Blueberry Creek Veterinary Clinic, Perth, Ontario (2016): Project manager and technical lead responsible for delineation of a provincially significant wetland and impact assessment associated with the development of a commercial lot. Work included ecological land classification, identification of significant wildlife habitat, species at risk surveys, wetland vegetation assessment, impact assessment and development of site-specific mitigation measures.



Taylor Warrington, B.Sc.

Biologist

Ms. Warrington has 4 years of experience in the environmental consulting industry, providing private industry and municipal and federal government clients with cost effective solutions to manage environmental constraints associated with land development proposals and infrastructure projects.

Education

- B.Sc., Life Sciences, McMaster University, 2015
- Graduate Certificate, Ecosystem Restoration, Niagara College, 2016

Professional Experience

2020-date	GEMTEC Consulting Engineers and Scientists Limit Biologist	ed Ottawa, Ontario
2019-2020	GEMTEC Consulting Engineers and Scientists Limit Junior Biologist	ed Ottawa, Ontario
2017-2019	Geofirma Engineering Limited Junior Biologist/Scientist	Ottawa, Ontario
2016	Dillon Consulting Junior Field Biologist	Little Current, Ontario
2014	McMaster University Laboratory-Research Assistant; URBAN Project Coordin	Hamilton, Ontario

Professional Affiliations and Technical Training

- Ottawa Conservation Partners Workshop: How to Prepare and Environmental Impact Statement. 2020.
- Class 2 Backpack Electrofishing Crew Leader Certification Course. June, 2019.
- Ontario Reptile and Amphibian Survey Course. Blazing Star Environmental, Natural Resource Solutions Inc., and Ontario Nature. 2018
- Ontario Benthic Biomonitoring Network Certification Course. Ministry of Environment, Conservation and Parks. 2016

Project Highlights

• Tier I and II Natural Environment Report, Crain's Construction, Lanark County, Ontario. Biologist responsible for completing on-going surveys in support of a proposed



quarry application. Surveys include winter mammal and ungulate use surveys, bat maternity roost surveys, ecological land classification, breeding bird surveys, turtle basking surveys, amphibian breeding surveys and targeted species at risk surveys for American ginseng and eastern whip-poor-will.

- Botanical Surveys, Ontario Power Generation Incorporated, Hydroelectric Generating Stations throughout Central and Eastern Ontario. Biologist responsible for completing on-going botanical surveys at 12 hydroelectric generating stations to update existing records. Botanical surveys will include a combination of field survey protocols including random meander, transects and quadrant sampling methods to identify vascular plant species present at each site.
- Foresters Falls Dam Removal, Renfrew County, Ontario. Biologist responsible for conducting a species at risk screening assessment to identify the presence of species at risk within the project area and evaluate the potential impacts on SAR and their habitat if the dam is removed. On-going surveys including targeted turtle basking surveys, and terrestrial wildlife and vegetation surveys.
- Environmental Impact Statement, Subdivision Development, Lanark County, Ontario. Biologist responsible for the completion of an Environmental Impact Statement for a proposed 25-lot subdivision application. Work included ecological land classification surveys, targeted surveys for species at risk, breeding amphibians and birds, basking turtle surveys, bat maternity roost surveys, headwater drainage feature assessment, butternut health assessment, impact assessment, development of lot-specific mitigation measures and agency consultation.
- Wetland Evaluation and Significant Wildlife Habitat Surveys, Ontario Power Generation Incorporated, Bath, Ontario (2019). Biologist responsible for conducting a wetland evaluation and significant wildlife habitat surveys at the Lennox Provincially Significant Wetland. Work included conducting turtle basking surveys, reptile hibernacula surveys, targeting species at risk surveys for Least Bittern and a wetland evaluation following the MNRF's Ontario Wetland Evaluation System.
- Environmental Impact Statement, Proposed Subdivision Development, Hawksbury, Ontario (2019). Biologist responsible for the completion of an Environmental Impact Statement in support of a proposed 272-lot subdivision application. Work included ecological land classification surveys, targeted surveys for breeding birds, bat maternity roost surveys, headwater drainage feature assessment, impact assessment and development of lotspecific mitigation measures.
- Surface Water Impact Assessment, Green Lake Development, Barry's Bay, Ontario (2019): Biologist responsible for the completion of a surface water impact assessment supporting two residential lot severances. Work included a review of existing data on Green



Lake, application of the provincial lakeshore capacity model, mitigation measure development and reporting.

- Biological Inventory, Ontario Power Generation Incorporated, Bath, Ontario (2018): Field Biologist responsible for conducting a three-season inventory of avian and amphibian species at the Lennox Provincially Significant Wetland. Work included conducting presence and abundance surveys following the Canadian Wildlife Service marsh monitoring protocol and Bird Studies Canada breeding bird surveys, statistical analysis of species data trends and reporting.
- Environmental Compliance Monitoring, Petrie Island Causeway Rehabilitation Project, Ottawa, Ontario (2018): Field biologist responsible for monitoring constructor compliance with various Department of Fisheries and Oceans, Ministry of Natural Resources and Conservation Authority permit conditions during the Petrie Island Causeway Rehabilitation Project within the Ottawa River. Work included species at risk surveys, fish salvage, exclusion fence inspection, monitoring of sediment and erosion control measures, turbidity monitoring, regulatory agency consultation and weekly reporting.
- Environmental Impact Statement, Code Drive Development, Smiths Falls, Ontario (2018): Field Biologist responsible for the completion of an Environmental Impact Statement in support of a severance application for the creation of eight residential lots within a significant woodland and adjacent to a large local wetland. Work included targeted surveys for species at risk, breeding amphibians and marsh birds, impact assessment, development of lot-specific mitigation measures and agency consultations.
- **Tier I and II Natural Environment Report, Crain's Construction, Ottawa, Ontario (2018):** Field biologist responsible for completing an inventory of site flora and fauna, completion of species at risk surveys, bat exit surveys, regulatory agency consultation, impact assessment and reporting.
- Species at Risk Assessment, National Capital Commission, Gatineau, Quebec (2018): Field biologist responsible for the completion of avian species at risk surveys to determine the presence or absence of chimney swift and barn swallows at a contaminated site. Work was undertaken to support an Ecological Risk Assessment.
- Environment Effects Evaluation Assessment, Britannia Wall Rehabilitation Project, Ottawa, Ontario (2018): Field Biologist responsible for completing a comprehensive tree inventory, wetland boundary delineation, significant wildlife habitat assessment and evaluation of effects associated with the rehabilitation of the Britannia Wall, a 600-metrelong community flood protection structure.
- Environmental Compliance Monitoring, Petrie Island Beach Head Rehabilitation Project, Ottawa, Ontario (2018): Field biologist responsible for monitoring constructor



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compliance with various Department of Fisheries and Oceans, Ministry of Natural Resources and Conservation Authority permit conditions during the Petrie Island Beach Head Rehabilitation Project within the Ottawa River. Work included species at risk surveys, exclusion fence inspection, monitoring of sediment and erosion control measures, and reporting.

- Natural Heritage Inventory and Environmental Impact Assessment, Combermere Lodge Limited, Barry's Bay, Ontario (2017-2018): Field biologist responsible for the completion of a Natural Heritage Inventory and Environmental Impact Assessment completed in support of a 54-lot condominium development located in an environmentally sensitive area. Work included wetland boundary delineation, identification of significant wildlife habitat, application of the significant wildlife habitat mitigation support tool, completion of a two-year survey of site flora and fauna, and impact assessments.
- Species at Risk and Migratory Bird Screening Assessment, City of Ottawa, New Edinburg Park Redevelopment Project, Ottawa, Ontario (2017): Field biologist responsible for the completion of a species at risk and migratory bird screening assessment to assist in bid tender package preparation for the re-development of New Edinburg Park. Work included a general habitat assessment, a probability of occurrence assessment, follow-up pre-construction surveys and reporting.
- **Post-Construction Windfarm Monitoring for Wildlife Impacts, Little Current, Ontario** (2016): Field biologist responsible for the completion of post-construction monitoring of a windfarm for avian and mammalian fatalities. Work included fatality surveys, vegetation surveys, and wildlife scavenger surveys.
- Long-term Changes in Ecosystem Health, Frenchman's Bay, Pickering, Ontario (2015): Field biologist responsible for evaluating the long-term changes in ecosystem health of Frenchman's Bay. Work included: data review, analysis of data trends, watershed and land-use mapping, digitization of wetland vegetation cover and analysis of changes over time, reporting and symposium presentation.



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