

Headwater Drainage Feature Assessment 6150 Thunder Road, Ottawa

April 26, 2021

Submitted To:

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Project Number: AVE1118.1



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1.0 INTRODUCTION

This report is a Headwater Drainage Feature Assessment written by Kilgour & Associates Ltd. (KAL) on behalf of Avenue 31 in support of potential future development at 6150 Thunder Road in Ottawa, Ontario (the “Site”). The report provides a detailed description of the headwater drainage features (HDFs) the Site following the field methodologies identified with the *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (CVC & TCRA, 2013) (the “HDF Guidelines”).

2.0 HEADWATER DRAINAGE FEATURES

2.1 Overview

This study identifies and describes six HDFs (R1 through R6) located on the Site (Figure 1). These features all drain to a permanent water course identified within this report as channel R7. The features were studied during the spring and summer of 2018 as part of a due-diligence review of the site prior to the commencement of planning for the site, though the formal HDFA report was not completed at the time. The site was briefly revisited on October 8, 2020 to note where portions of the Site landcover had been cleared. Landcover descriptions adjacent to reaches have been updated within this report accordingly.

2.2 Assessment Methodology

The Standard level of assessment follows Ontario Stream Assessment Protocol (OSAP) methodologies for descriptions of flow conditions, riparian vegetation and site features that are important components of habitat (headwater sampling protocol OSAP S4.M10), and includes an electrofishing survey to describe fish and fish habitat (OSAP S4.M10). Additionally, an ecological land classification (ELC) was applied to the riparian zone of each channel as a means of documenting community type. Amphibian breeding is assessed following the Marsh Monitoring Protocol (MMP).

2.2.1 Channel Form and Fish

Headwater channels on the Site were investigated three times in 2018 following *Evaluation, Classification and Management of Headwater Drainage Features Guidelines* (Toronto and Region Conservation Authority and Credit Valley Conservation, 2014) to document their hydrological and riparian and terrestrial habitat. On April 12, 2018 (i.e. during the spring freshet), KAL biologists Liza Hamilton and Tyler Peat identified and described seven channelized features on the Site (reaches R1 through R7; Figure 2), noting the channel dimensions, substrate, form, and riparian vegetation.

On June 21, 2018, KAL biologists Rob Hallett and Tyler Peat conducted an electrofishing survey of R1, R3, R4, and a portion of R2 north of R4. These channels were deemed at the time to be sufficiently wet to potentially support fish, whereas R2, R5, and R6 were dry at the time of electrofishing surveys and therefore not able to support fish. R7, a permanent stream, was not fished as the project does not propose to alter or build within 30 m of that feature. As a permanently flowing channel connected to larger creeks downstream, R7 is considered to directly support fish regardless.



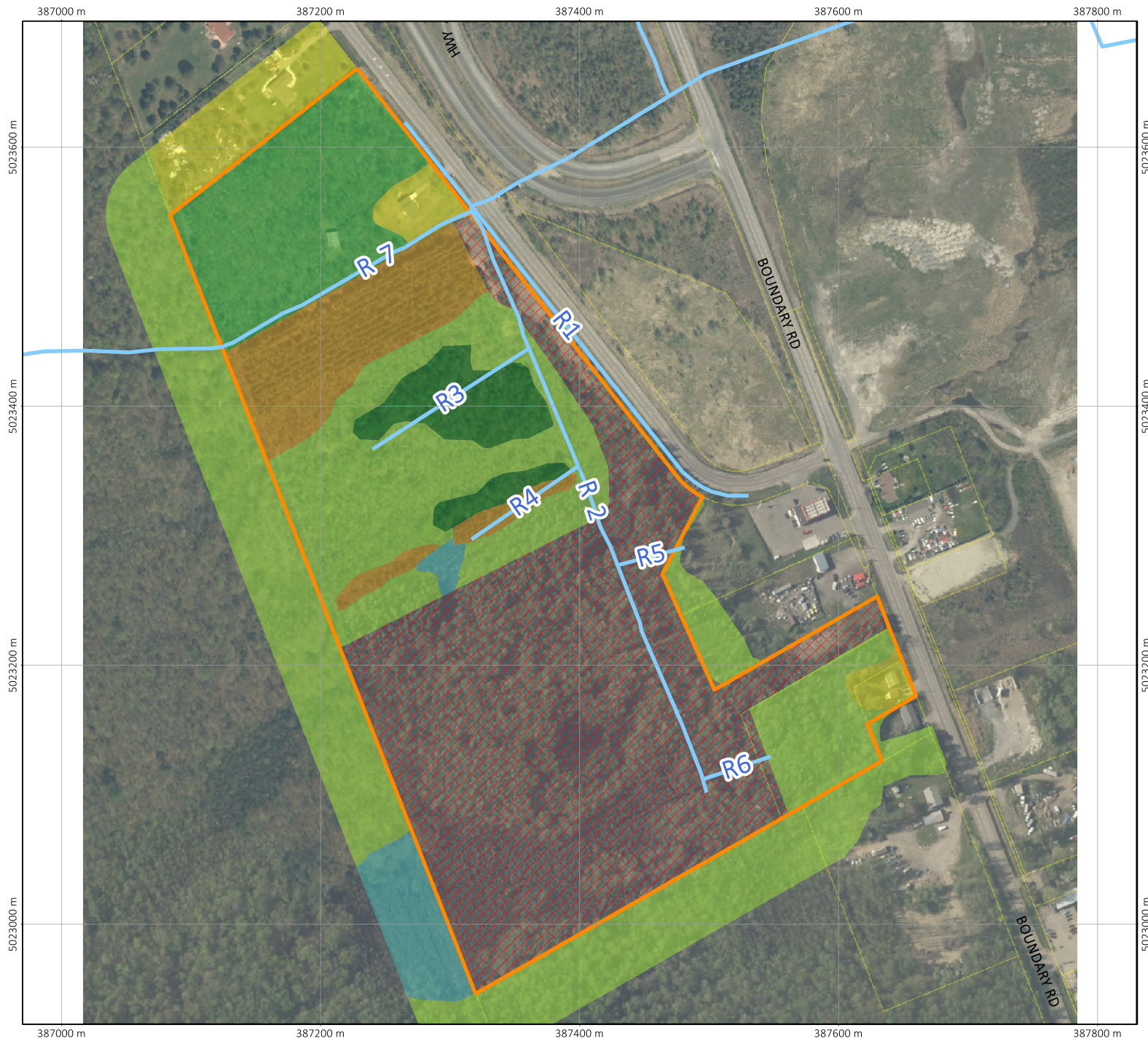


Figure 1 Existing Site conditions

Legend

— Property Boundary

ELC

Residential

FOD7

FOD8-2

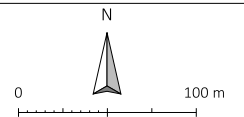
FOMM10-2

TAGM1

SWT2

Cleared

— Surface Water Features



Project: AVE1118
Created By: AF
MTM Zone 9
(NAD 83)



Several beaver dams were removed from R7 just west of the Site in late June 2018. The affect on Site water levels was observed on July 5, 2018 by KAL biologist Terry Hams while completing bird surveys, with flows R7 noted as being greatly reduced and all other channels having dried.

2.2.2 Vegetation

KAL Biologist, Terry Hams, completed an initial tree inventory and an ecological land classification (ELC) of the Site on June 20, 2018. Vegetation cover on the Site was described following standard ELC methods, including the collection of soil samples (Lee *et al.*, 1998).

As the south half of the Site was cleared and partially regraded in 2019, the ELC for the Site and the tree information for the remaining stands were updated by Ed Malindzak (October 15, 2020) and Anthony Francis (on October 18, 2020). The updated tree survey identified the size and species distributions of trees within forested areas of the Site.

2.2.3 Anurans

Site amphibian (anuran) surveys were conducted and lead by KAL biologists, Rob Hallett and Liza Hamilton, following protocols set forth by the Marsh Monitoring Program (Bird Studies Canada *et al.*, 2008). Three surveys are completed to identify early, mid, and, late-season breeding amphibian species generally in April, May, and June, respectfully, though survey dates are temperature dependent. Surveys are completed on nights of calm weather with temperatures above 5 degrees Celsius (°C), 10°C, and 17°C for each of the three respective survey periods. Surveys begin a half-hour after sunset and are finished by midnight with a five-minute recording period at each survey station. Amphibian species are recorded at each point along with the estimated distance from observers, calling code, an estimate of the number of individuals, and estimated directions of calling anurans.

Amphibian surveys were performed on April 23, May 30, and June 21, 2018 (Table 2). Three stations were surveyed in wetland and aquatic habitats (F1 through F3; Figure 2). Station F3 was located at the north end of the Site with the observers facing south. Stations F1 and F2 were the same point located near the southwestern corner of the Site, but with one observer facing south (F1) and one facing north (F2).

Table 1 Summary of frog survey times and weather conditions

Survey Date	Temperature (°C)	Weather conditions	Wind speed (km/hour)
23-Apr-18	10*	Clear	4
30-May-18	21*	Mostly Cloudy	11-14
21-Jun-18	17**	Clear	7 - 10

* Temperatures on these nights were warmer than the preceding nights, with evening temperatures just above 5°C and 10°C, respectively, within a few days of the surveys. Frogs for the period would still be expected to be calling regardless.

** Temperatures on this night just reached the minimum required temperature but had been were warmer the preceding nights, with evening temperatures above 17°C. Frogs for the period would still be expected to be calling regardless.

2.3 General Reach Descriptions

Channel R1 is the roadside ditch along Thunder Road. This feature is unlikely to altered (realigned) in any meaningful way under future development plans. All other channels on site had been (i.e. in 2018) located



within young, early successional wooded areas and coniferous plantation covering former agricultural fields. A single small wetland pocket was observed at the upstream end of the Channel R4. Natural landcover along Channels R6, R5 and most of R2 was completely removed in 2019.

Channel 7, the permanent watercourse crossing the north end of the Site is highly linearized, U-shaped drainage channel, though it does not have status as a municipal or ward drain. All other channels are small, shallow, linear, U-shaped agricultural ditches that ultimately connect to Channel 7.

Channels 3 and 4, and north half of Channel 2 were all wet until mid-summer in 2017, but only so because of the presence of beaver dams along Channel 7, which prevented the site from draining normally. With the dams having been removed, Channels other than 7, can be expected to run dry shortly after the spring freshet. Channels 5, 6 and the upper half of Channel 2 are ephemeral and ran dry very quickly after the freshet, even when beaver dams were present. Small numbers of fish were observed in all areas below Channel 5 in 2017. However, with the beaver dams having been removed, only Channel 7 is considered as a potential fish habitat.

2.4 Component Classifications

The following tables summarize the functions provided by the Site channels.



Table 2. Hydrology Classification, 2018

Drainage Feature	Hydrology Classification					
	Assessment Period	Flow Conditions		Flow Classification	Modifiers	Hydrological Function
		Description	(OSAP Code)			
R1	April 12	Standing water	4	Ephemeral	Road sided ditch. Water remained in this reach for a longer period of time than usual due to beaver dams in R7.	Contributing Functions
	June 21	Standing water				
	July 5	Dry				
R2	April 12	Standing water	3	Intermittent (lower half)	Water remained in lower portion of this reach for a longer period of time than usual due to beaver dams in R7.	Valued Functions (lower half)
	June 21	Upper channel: Dry Lower channel: standing water		Ephemeral (upper half)		Contributing Functions (upper half)
	July 5	Dry				
R3	April 12	Standing water	4	Intermittent	Water remained in this reach for a longer period of time than usual due to beaver dams in R7.	Valued Functions
	June 21	Standing water				
	July 5	Dry				
R4	April 12	Standing water	4	Intermittent	Water remained in this reach for a longer period of time than usual due to beaver dams in R7.	Valued Functions
	June 21	Standing water				
	July 5	Dry				
R5	April 12	Standing water Standing	1	Ephemeral		Contributing Functions
	June 21	Dry				
	July 5	Dry				
R6	April 12	Standing water Standing	3	Ephemeral		Contributing Functions
	June 21	Dry				
	July 5	Dry				
R7	April 12	Surface flow	1	Perennial	Conducts flows from the east across the Site and on to neighbouring properties to the west. As a permanent perennial feature, this channel is not considered an HDF.	Important Functions
	June 21	Surface flow				
	July 5	Surface flow				



Table 3. Riparian Classification (Updated 2020)

Drainage Feature	Riparian Classification			
	OSAP Descriptions	OSAP Riparian Codes	ELC Codes	Riparian Conditions
R1	RUB – Cleared LUB – Road shoulder	RUB – 1 LUB – 1	- -	Limited Functions
R2	RUB – Cleared/Forest LUB – Cleared	RUB – 2 LUB – 4	- -	Limited Functions (Upper half) Important Functions (Lower half)
R3	RUB – Forest LUB – Forest	RUB – 6/2 LUB – 6/2	CUF CUF	Important Functions
R4	RUB – Forest LUB – Forest	RUB – 6/2 LUB – 6/2	CUW CUW	Important Functions
R5	RUB – Cleared LUB – Cleared	RUB – 6 LUB – 6	- -	Limited Functions
R6	RUB – Cleared LUB – Cleared	RUB – 2 LUB – 6	- -	Limited Functions
R7	RUB – Forest LUB – Meadow	RUB – 6 LUB – 4/6	CUW FOD	Important Functions*

RUB – right upstream bank

LUB – left upstream bank

* “Important Function” level is discussed further in Section 3.1



Table 4. Fish and Fish Habitat Classification, June 21, 2018

Drainage Feature	Riparian Classification		
	Fish Observation • Fishing effort	Fish & Fish Habitat Designation*	Modifiers/Notes
R1	Incidental fish present, no SAR present. • 630 SS = ~5.3s/m ²	Contributing Functions	20 fish (13 Central Mudminnows, 3 Brassy Minnows, 1 Brook Stickleback, and 3 Northern Redbelly Dace. These species are very common and highly tolerant. Only present as beaver dam backed up water into to this feature. Feature dried as soon as the dam was removed. Shallow feature is considered unlikely to support fish without the dams being present.
R2	Fish present lower half only, no SAR present. • 721 SS = 2.7 s/m ²	Valued Functions (lower half) Contributing Functions (upper half)	155 fish (60 Central Mudminnows, 52 Brook Stickleback, 15 Northern Redbelly Dace, 8 Pumpkinseeds, 1 Fathead Minnow, and 1 Creek Chub). These species are very common and highly tolerant. Only present as beaver dam backed up water into to this feature. Feature dried as soon as the dam was removed. Bottom most end may provide some habitat in wet years regardless.
R3	Incidental fish, no SAR present. • 339 SS = 4.8 s/m ²	Contributing Functions	130 fish (73 Central Mudminnows, 52 Brook Stickleback, and 3 Fathead Minnows, and 2 Pumpkinseeds). These species are very common and highly tolerant. Only present as beaver dam backed up water into to this feature. Feature dried as soon as the dam was removed. Shallow feature is considered unlikely to support fish without the dams being present.
R4	Incidental fish, no SAR present. • 327 SS = 2.7 s/m ²	Contributing Functions	32 Brook Stickleback were observed. This species is very common and highly tolerant. Only present as beaver dam backed up water into to this feature. Feature dried as soon as the dam was removed. Shallow feature is considered unlikely to support fish without the dams being present.
R5	No fish present, no SAR present. • Dry	Contributing Functions	
R6	No fish present, no SAR present. • Dry	Contributing Functions	
R7	Fish assumed present.	Valued Functions	Permanent channel assumed to have fish at all times of the year.

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

SS = shocking seconds



Table 5. Terrestrial Habitat Classification (Updated 2020)

Drainage Feature	Description	Amphibians	Terrestrial Classification
R1	Roadside ditch.	No frogs were observed in the feature.	Limited Functions
R2	Lower half includes some portions within plantation forest. Upper half was located within moist forest/plantation (no adjacent wetland evident during srveys), but surrounding area has now been fully cleared.	No frogs were observed in the feature.	Contributing Functions (lower half) Limited Functions (upper half)
R3	Flows through plantation forest.	No frogs were observed in the feature.	Contributing Functions
R4	Upstream end is a small wetland pocket. Flows through plantation forest very near the clearing edge.	No frogs were observed in the feature.	Valued Functions
R5	All surrounding vegetation has been cleared.	No frogs were observed in the feature.	Limited Functions
R6	All surrounding vegetation has been cleared.	No frogs were observed in the feature.	Limited Functions
R7	Permanent stream within a forested area.	No frogs were observed in the feature.	Valued Functions



2.5 Reach Summary

Dimensions of the HDF reaches are summarized in Table 5.

Table 6. Reach Dimensions During Spring Freshet (April 12, 2018)

Drainage Feature	Length (m)	Mean Bankfull Width (m)	Mean Wetted Width (m)	Mean Depth (m)
R1	401 (along the Site edge)	4.0	1.6	0.19
R2	485	3.0	90	0.90
R3	144	2.0	2.0	0.18
R4	100	3.0	3.0	-
R5	54	2.0	1.4	0.26
R6	55	2.5	1.2	0.32
R7	218 (on the Site)	5.1	3.2	-



3.0 MANAGEMENT RECOMMENDATIONS

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

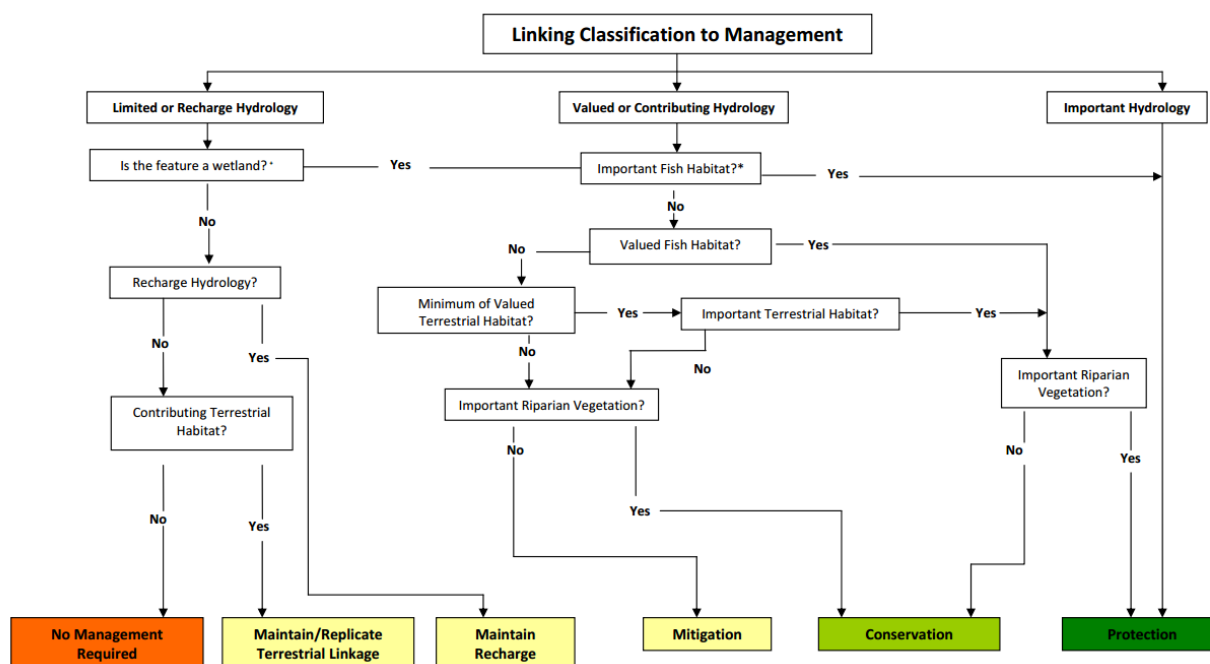


Figure 2. Headwater Drainage Feature Assessment (H DFA) flow chart providing direction on management options

3.1 Management Recommendations for Reaches

Channels R1, R5, R6 and the upper half of R2

These features are fully within the cleared area. They are ephemeral channels that do not provide fish habitat. Following the HDFA Guide flow chart linking component classification to management directives (Figure 2), these reaches:

1. Provide Contributing Hydrology.
2. Do not provide Important Fish Habitat;
3. Do not provide Valued Fish Habitat;
4. Do not provide Valued Terrestrial Habitat;
5. Do not provide Important Riparian Vegetation.



This chain of classification descriptors leads to a management directive of **Mitigation**. These features are not required to be maintained per se, but their functionality must be replicated or enhanced through lot level conveyance measures as part of the site stormwater management system. As the features convey runoff to more ecologically important reaches, replacement features/systems, should be vegetated to mimic online wet vegetation pockets to the extent possible, and should convey water to the same final receiver (i.e. R7), though natural channel design is not required.

Channels R3 and R4

These reaches are small, ephemeral to intermittent drainage features located entirely within a treed area. While some fish were observed when beaver dams backed up water into them, they are not considered valued fish habitat. The HDFA Guide flow chart linking component classification to management directives (Figure 2) progresses as follows:

1. Provides Contributing/Valued Hydrology;
2. Does not provide Important Fish Habitat;
3. Does provide Valued Fish Habitat;
4. Does not provide Valued Terrestrial Habitat; and
4. Provides Important Riparian Vegetation.

This chain of classification descriptors leads to a management directive of **Conservation** for this reach. The feature may be maintained or, if necessary relocated, using natural channel design techniques to maintain or enhance the overall productivity of the reach. If realigned, the features may be relocated on or off the Site. In any case, the riparian corridors must be maintained or enhanced. If catchment drainage will be removed due to diversion of stormwater flows, lost functions should be restored through enhanced lot level controls (e.g. restore original catchment using clean roof drainage).

Channels R2 (lower half)

This reach, with its direct connection to R7 likely retains some water well into summer providing some potential fish habitat for tolerant forage fish. The HDFA Guide flow chart linking component classification to management directives (Figure 2) progresses as follows:

1. Provides Contributing/Valued Hydrology;
2. Does not provide Important Fish Habitat;
3. Provides Valued Fish Habitat;
4. Provides Important Riparian Vegetation.

This chain of classification descriptors would typically lead to a management directive of **Protection** for this reach, based in part on the assessment of “Important Riparian Vegetation”. Under a management directive of **Protection**, the feature should not generally be relocated. For this feature, however, the assessment of “Important Riparian Vegetation” comes from only the west side. The east side of the channel has limited vegetation and is generally located within <30 m of the Thunder Road (it connects with R7 within 3 m of the roadway), thus preventing options for an undisturbed, naturalized buffer on that side. The management recommendation for this feature is thus **Conservation** to allow its relocation.



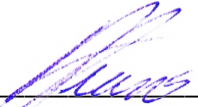
The feature should be realigned westward to allow for an improved, naturalized setback with an enhancement of the riparian corridors. Drainage must still be conveyed to R7 and stormwater management systems on the site must be designed to avoid impacts (i.e. sediment, temperature) to this headwater channel.

Channel R7

This perennial channel conveys off-site flows across the property. As a permanent stream, it does not qualify as headwater feature. As feature with important hydrology, it automatically receives a management directive of **Protection**. As such, this reach may be maintained and/or enhanced, but should not generally be relocated. Improvements, however, could be possible to its overall channel form and thus some minor realignment may be considered within that context. The riparian zone should be protected and enhanced where feasible. The hydro-period must be maintained. Use natural channel design techniques or wetland design to restore and enhance existing habitat features if and where needed. Stormwater management systems must be designed to avoid impacts (i.e. sediment, temperature) to this headwater channel.

4.0 CLOSURE

This report provides detailed descriptions of the HDFs on the Thunder Road site, as well as management recommendations to direct future development near those features. Points of clarification can be addressed to the undersigned.



Anthony Francis, PhD
KILGOUR & ASSOCIATES LTD.



5.0 REFERENCES

- Bird Studies Canada, United States Environmental Protection Agency, and Environment Canada. 2008. Marsh Monitoring Program Participant's Handbook for Surveying Amphibians (Revised). Available online at: <https://www.birdscanada.org/bird-science/marsh-monitoring-program/>
- Credit Valley Conservation and Toronto Region Conservation Authority. 2014. Evaluation, Classification and Management of Headwater Drainage Features.
- Lee, H.R., W. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig, and S. McMurray. 1998. Ecological Land Classification for Southern Ontario: First Approximation and its Application. Ontario Ministry of Natural Resources, North Bay.



Appendix A: Site Photos

Note: Reach numbers located within the comment lines directly on photos indicate the order in which they were originally photographed and do not necessarily reflect the final assigned reach numbers used throughout this report.

Reach 1



Upstream view



Downstream view



Reach 2



Upstream view



Downstream view



Reach 3



Upstream view



Downstream view



Reach 4



Upstream view



Downstream view



Reach 5



Upstream view



Downstream view



Reach 6



Upstream view



Downstream view



Reach 7



Upstream view



Downstream view



Appendix B: Field Notes



Daily Work Plan for Field Work

Client/Project #: S/MP773

Date: 2018/04/12

Personnel Data: LH, TP

Staff Name	Date of Birth YYYY/MM/DD	Emergency contact and number	Staff hazard review initials®
L. Hamilton	1983/05/02	M. Vegard 613-993-5683	LH.
T. Peet	1988/07/19	Miranda Miller 613-388-6611	TP

If there are more than four crew, use a second sheet; * indicates person responsible for check in / check out; ® initial if staff has had the opportunity to review the hazard assessment and mitigations for this project, is aware of risks, and agrees the work can be done safely.

Vehicle (circle those that apply)	Owner	Licence
KAL Truck (Chev Silverado), Grey	Bruce Kilgour	685 7JZ (Ontario)
QUAD	Bruce Kilgour	2CK47 (Ontario)
QUAD Trailer	2317833 Ontario	M7807M (Ontario)
Tracker	2317833 Ontario	C23182ON (Transport Canada)
Tracker Trailer	2317833 Ontario	J3161S (Ontario)
Red Inflatable	2317833 Ontario	C23183ON (Transport Canada)
Inflatable Trailer	Bruce Kilgour	J7553K (Ontario)
White inflatable	Kilgour & Associates Ltd.	unmarked
LIZA'S HONDA FIT	L. HAMILTON.	N89 H2W

Describe Anticipated Daily Activities Including Location(s), Route(s) and Access Points and approx. schedule

HDA visit #1 @ 9:50 Thunder Rd., Ottawa, ON

Map is attached? Y ☒ N ☐

Check in / Check out Procedure

KAL Contact Person and cell number:	Charles Harty
Hotel Details	N/A
Client Contact Person and cell number:	N/A
Check in method and frequency:	upon arrival / departure.

Both injured, out of reach of cell phones.

Anticipated Worst Outcome/ Catastrophic Failure (describe):

If CH hasn't heard from us in over 4 hrs, he calls both. If no one answers, he calls all

Emergency Response Procedure (describe):

Home Base: Time leaving 8:30 Time returning 11:15	Field Location: Time arriving 8:50 Time Leaving 11:00
--	--

Person	Pre-Field Condition	Post-Field Condition
LIZA	GOOD	GOOD
TYLER	GOOD	GOOD
Vehicle	Pre-Field Condition	Post-Field Condition
LIZA'S HONDA FIT	GOOD Start km: 82125	GOOD End km: 82155

Calibration									
Unit	Serial No.	Pre / Post	pH			Cond.	Turbidity		DO
			4	7	10	1413	0		100% Sat.
pH pen		Pre							
		Post							
YSI Pro Plus		Pre							
		Post							
HI Turb. Meter		Pre							
		Post							
Lamotte Turb. Meter		Pre							
		Post							
		Pre							
		Post							

Rules of thumb (when to flag your result):

- DO (mg/L): < 5 mg/L, check that YSI is calibrated to 100% saturation, if yes, then use HACH kit to confirm low DO
- pH: If < 6.5 or > 9, check pH meter vs buffer solutions
- If unit cannot calibrate, it must be serviced, so notify Bruce Kilgour

Issues with field equipment

Do not forget to mention all equipment issues to Rob Hallett as soon as possible

Datasheet Log

Field Map

Client/Project #: SIMP773

Crew: LH, TP

Date: 2018/04/12

Location: 6150 Thunder Rd.

HDFA Visit #1



Notes

Headwater Drainage Features - Up- and Down- Stream

Stream Code Site Code Zone Easting Northing Date (YYYY) (MM) (DD) Time (24hr)

Stream Name Discharge Approximates Baseflow? ☐ Baseflow ☒ Freshet ☐ Spate ☐ Upstream Site Length (m)

Access Route Site Description

Optional Features: Water Temp (C) Air Temp (C) pH Conductivity (Na) Turbidity (NTU) Dissolved O₂ (ppm)

Number of upstream features Upstream Roughness Photo # Photo Name

Upstream Feature(s)			Type	Flow	Sediment Transport		Sediment Deposition	Width MT	Wetted		Bakfull	Riparian Vegetation						Upstream Longitudinal Gradient				
Feature Number	Distance (m)	Bearing			Adjacent Feature				Feature Width (m)	Wetted Depth (mm)		Entrenchment Width (m)	Feat. Veg	0-1.5 m		1.5-10 m		10-30 m		Method Used	Distance (m)	Elevation Rise (m)
														Left	Right	Left	Right	Left	Right			
1			8	2		2		1.57	190	4.0	6	4	4	5	1	7	4					
2																						
3																						
4																						

Upstream Flow Measure(s)		Record EITHER Hydraulic Head OR Volume OR Distance														
Feature Number	Wetted Width (m)	Depth (mm)			Hydraulic Head (mm)			Volume (lit)			Distance (m)			Time (sec)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Comments

- C2 tails in ditch (80% cover)
- Substrate is mud, silt, organic matter.
- SIMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____
 Stream Name: _____ Stream Code: _____ Site Code: _____
 Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF: _____
 Downstream WP# _____ ☐ Sample 2 ☐ Not connected
 Direction of Assessment: ☐ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
1.5 - 10 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
10 - 30 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ Elevation (cm): _____ Gradient (°): _____

Dominant Substrate (S2.M3) Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock ☐

Sub-Dominant Substrate (S2.M3) Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock ☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)	Hydraulic head (mm)	Volume (L)	Distance (m)	Time (s)
	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
_____	_____	_____	_____	_____	_____

Sediment Transport

Adjacent	<input type="checkbox"/> None (1)	<input type="checkbox"/> Rill (2)	<input type="checkbox"/> Rill and Gully (3)	<input type="checkbox"/> Gully (4)	<input type="checkbox"/> Outlet Scour (5)
Feature	<input type="checkbox"/> Sheet Erosion (6)	<input type="checkbox"/> Rill (2)	<input type="checkbox"/> Instream Bank Erosion (7)	<input type="checkbox"/> Gully (4)	<input type="checkbox"/> Other (8)
	<input type="checkbox"/> None (1)	<input type="checkbox"/> Sheet Erosion (6)	<input type="checkbox"/> Instream Bank Erosion (7)	<input type="checkbox"/> Other (8)	

Sediment Deposition Measures (mm): _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Headwater Drainage Features - Up- and Down- Stream

Stream Code Site Code Zone Easting Northing Date (YYYY) (MM) (DD) Time (24hr)

Stream Name Discharge Approximates Baseflow? ☐ Baseflow ☒ Freshet ☐ Spate Upstream Site Length (m)

Access Route

Site Description

Optional Features

Water Temp (C) Air Temp (C) pH Conductivity (Ns) Turbidity (NTU) Dissolved O₂ (ppm)

Number of upstream features

Upstream

Roughness

Photo #

Photo Name

Upstream Feature(s)

Feature Number	Distance (m)	Bearing	Type	Flow	Sediment Transport Adjacent Feature	Sediment Deposition	Width MT	Wetted Feature Width (m)	Wetted BF Depth (mm)	Barrell	Feat. Veg	0-1.5 m Left	0-1.5 m Right	1.5-10 m Left	1.5-10 m Right	10-30 m Left	10-30 m Right	Upstream Longitudinal Gradient Method Used	Distance (m)	Elevation Rise (±0.1)
1			1	2			3	0.90	90	3.0	1	4	4	4	4	7	4			
2																				
3																				
4																				

Upstream Flow Measure(s)

Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm)			Hydraulic Head (mm)			Volume (lit)			Distance (m)			Time (sec)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Comments

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____

Stream Name: _____ Stream Code: _____ Site Code: _____

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF: ☐ Not connected
Downstream WP# _____ ☐ Sample 2 ☐ to downstream network
☐ Sample 3

Direction of Assessment: ☐ Upstream ☐ Downstream

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)

Riparian Vegetation

Distance	Bank	None (1)	Lawn (2)	Cropped (3)	Meadow (4)	Scrubland (5)	Wetland (6)	Forest (7)
0 - 1.5 m	Left Bank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Right Bank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.5 - 10 m	Left Bank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Right Bank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10 - 30 m	Left Bank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Right Bank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ Elevation (cm): _____ Gradient (°): _____

Dominant Substrate (S2.M3) ☐ Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock

Sub-Dominant Substrate (S2.M3) ☐ Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)			Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

Sediment Transport

Adjacent	None (1)	Rill (2)	Rill and Gully (3)	Gully (4)	Outlet Scour (5)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Feature	None (1)	Rill (2)	Rill and Gully (3)	Gully (4)	Outlet Scour (5)
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sediment Deposition Measures (mm): _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Headwater Drainage Features - Up- and Down- Stream

Stream Code Site Code Zone Easting Northing Date (YYYY) (MM) (DD) Time (24hr)

Stream Name Discharge Approximates Baseflow? ☐ Baseflow ☒ Freshet ☐ Spate Upstream Site Length (m)

Access Route

Site Description

Start - 465094 5021327
end - 465102 5021327

- Perpendicular to main ditch
- Second Petro-cd.

Optional Features

Water Temp (C) Air Temp (C) pH Conductivity (Ns) Turbidity (NTU) Dissolved O₂ (ppm)

Number of upstream features

Upstream Roughness

Photo #

Photo Name

Upstream Feature(s)

Feature Number	Distance (m)	Bearing	Type Flow	Sediment Transport Adjacent Feature	Sediment Deposition	Width MT	Feature Width (m)	BF Depth (mm)	Entrenchment Width (m)	Feat. Veg	Riparian Vegetation						Upstream Longitudinal Gradient		
											0-1.5 m	1.5-10 m	10-30 m	Left	Right	Left	Left	Right	Elevation Rise (m)
1			1	2		3	1.4	260	2.0H	1	5	5	5	5	5	5			
2																			
3																			
4																			

Upstream Flow Measure(s)

Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm)			Hydraulic Head (mm)			Volume (lit)			Distance (m)			Time (sec)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Comments

- Substrate - mud, sand.
- SMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____

Stream Name: _____ Stream Code: _____ Site Code: _____

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF: ☐ Not connected
Downstream WP# _____ ☐ Sample 2 ☐ Sample 3 to downstream network

Direction of Assessment: ☐ Upstream ☐ Downstream

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
1.5 - 10 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
10 - 30 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ Elevation (cm): _____ Gradient (°): _____

Dominant Substrate (S2.M3) ☐ Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock

Sub-Dominant Substrate (S2.M3) ☐ Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)			Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Sediment Transport

Adjacent	<input type="checkbox"/> None (1)	<input type="checkbox"/> Rill (2)	<input type="checkbox"/> Rill and Gully (3)	<input type="checkbox"/> Gully (4)	<input type="checkbox"/> Outlet Scour (5)
Feature	<input type="checkbox"/> Sheet Erosion (6)	<input type="checkbox"/> Rill (2)	<input type="checkbox"/> Instream Bank Erosion (7)	<input type="checkbox"/> Gully (4)	<input type="checkbox"/> Other (8)
	<input type="checkbox"/> None (1)	<input type="checkbox"/> Rill (2)	<input type="checkbox"/> Rill and Gully (3)	<input type="checkbox"/> Gully (4)	<input type="checkbox"/> Outlet Scour (5)
	<input type="checkbox"/> Sheet Erosion (6)		<input type="checkbox"/> Instream Bank Erosion (7)		<input type="checkbox"/> Other (8)

Sediment Deposition Measures (mm): _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Headwater Drainage Features - Up- and Down- Stream

Stream Code Site Code 6 Zone 18 Easting 465135 Northing 502125 Date (YYYY) 2018 (MM) 04 (DD) 12 Time (24hr)

Stream Name Discharge Approximates Baseflow? ☐ Baseflow ☒ Freshet ☐ Spate Upstream Site Length (m)

Access Route

Site Description

ditch running perpendicular to main ditch running along property.

Optional Features

Water Temp (C) 1 Air Temp (C) 20 pH Conductivity (Ns) Turbidity (NTU) Dissolved O₂ (ppm)

Number of upstream features

Upstream Roughness

Photo #

Photo Name

Upstream Feature(s)

Channel Feature(s)											Riparian Vegetation						Upstream Longitudinal Gradient				
Feature Number	Distance (m)	Bearing	Type	Flow	Transport		Sediment Deposition	Width MT	Wetted Feature Width (m)	Wetted Depth (mm)	B-Full Entrenchment Width (m)	Feat. Veg	Riparian Vegetation						Method Used	Distance (m)	Elevation Rise (m)
					Adjacent	Feature							0-1.5 m	1.5-10 m	10-30 m	Left	Right	Left			
1			1	2			2		1.15	320	2.50	1	5	5	5	5	5	5			
2																					
3																					
4																					

Upstream Flow Measure(s)

Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm)			Hydraulic Head (mm)			Volume (lit)			Distance (m)			Time (sec)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Comments

Substrate - mud, silt, partially frozen still.
SIMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____

Stream Name: _____ Stream Code: _____ Site Code: _____

Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF: ☐ Sample 2 ☐ Not connected
Downstream WP# _____ ☐ Sample 3 to downstream network

Direction of Assessment: ☐ Upstream ☐ Downstream

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)

Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland(6) ☐ Forest (7)

Riparian Vegetation

0 - 1.5 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
1.5 - 10 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
10 - 30 m	Left Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)
	Right Bank	<input type="checkbox"/> None (1)	<input type="checkbox"/> Lawn (2)	<input type="checkbox"/> Cropped (3)	<input type="checkbox"/> Meadow (4)	<input type="checkbox"/> Scrubland (5)	<input type="checkbox"/> Wetland (6)	<input type="checkbox"/> Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ Elevation (cm) : _____ Gradient (°): _____

Dominant Substrate (S2.M3) ☐ Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock

Sub-Dominant Substrate (S2.M3) ☐ Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)	Wetted Depth (mm)	Hydraulic head (mm)	Volume (L)	Distance (m)	Time (s)
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
_____	_____	_____	_____	_____	_____

Sediment Transport

Adjacent	<input type="checkbox"/> None (1)	<input type="checkbox"/> Rill (2)	<input type="checkbox"/> Rill and Gully (3)	<input type="checkbox"/> Gully (4)	<input type="checkbox"/> Outlet Scour (5)
Feature	<input type="checkbox"/> Sheet Erosion (6)	<input type="checkbox"/> Instream Bank Erosion (7)	<input type="checkbox"/> Other (8)		
	<input type="checkbox"/> None (1)	<input type="checkbox"/> Rill (2)	<input type="checkbox"/> Rill and Gully (3)	<input type="checkbox"/> Gully (4)	<input type="checkbox"/> Outlet Scour (5)
	<input type="checkbox"/> Sheet Erosion (6)	<input type="checkbox"/> Instream Bank Erosion (7)	<input type="checkbox"/> Other (8)		

Sediment Deposition Measures (mm): _____

☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Headwater Drainage Features - Up- and Down-Stream

Stream Code Site Code Zone Easting Northing Date (YYYY) (MM) (DD) Time (24hr)

Stream Name Discharge Approximates Baseflow? ☐ Baseflow ☒ Freshet ☐ Spate Upstream Site Length (m)

Access Route

Site Description

Optional Features

Water Temp (C) Air Temp (C) pH Conductivity (Ns) Turbidity (NTU) Dissolved O₂ (ppm)

Number of upstream features

Upstream Photo # Photo Name

Roughness

Upstream Feature(s)

Feature Number	Distance (m)	Bearing	Type Flow	Sediment Transport Adjacent Feature	Sediment Deposition	Width MT	Feature Width (m)	Feat. Depth (mm)	Enrichment Width (m)	Feat. Veg	Riparian Vegetation						Upstream Longitudinal Gradient		
											0-1.5 m	1.5-10 m	10-30 m	Left	Right	Left	Method Used	Distance (m)	Elevation Rise (m)
1			1	4		3	3.20	150	5.1	6	5	2	5	2	7	2			
2																			
3																			
4																			

Upstream Flow Measure(s)

Record EITHER Hydraulic Head OR Volume OR Distance

Feature Number	Wetted Width (m)	Depth (mm)			Hydraulic Head (mm)			Volume (lit)			Distance (m)			Time (sec)		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3

Comments

Flow = 0.13 m/s. Pockets of sediment > 10cm.
Substrate - Muck
- channel channel is wetted very close to road, then patchy as you go downstream.
- SIMP773

Unconstrained Headwater Drainage Feature Assessment

Date: _____ Project #: _____ Recorder/Crew: _____
 Stream Name: _____ Stream Code: _____ Site Code: _____
 Site Limits: Upstream WP# _____ Field Assessment: ☐ Sample 1 Unconnected HDF:
 Downstream WP# _____ ☐ Sample 2 ☐ Not connected
 Direction of Assessment: ☐ Upstream ☐ Downstream ☐ Sample 3 to downstream network

Flow Influence ☐ Freshet (1) ☐ Spate (2) ☐ Baseflow (3)
Flow Condition ☐ Dry (1) ☐ Interstitial Flow (3) ☐ Substantial Flow (5)
 ☐ Standing Water (2) ☐ Minimal Flow (4)

Feature Type ☐ Defined Natural Channel (1) ☐ No Defined Feature (4) ☐ Swale (7)
 ☐ Channelized or Constrained (2) ☐ Tiled Feature (5) ☐ Roadside Ditch (8)
 ☐ Multi-thread (3) ☐ Wetland (6) ☐ Pond (9)

Feature Vegetation ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)

Riparian Vegetation
0 - 1.5 m Left Bank ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)
 Right Bank ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)
1.5 - 10 m Left Bank ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)
 Right Bank ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)
10 - 30 m Left Bank ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)
 Right Bank ☐ None (1) ☐ Lawn (2) ☐ Cropped (3) ☐ Meadow (4) ☐ Scrubland (5) ☐ Wetland (6) ☐ Forest (7)

Channel Gradient (S4.M7) ☐ Visual (1) ☐ Clinometer (2) ☐ Laser Level (3) ☐ Survey Level (4) ☐ Other (5) ☐ LiDAR (6)

Distance (m): _____ Elevation (cm): _____ Gradient (°): _____

Dominant Substrate (S2.M3) Clay (Hard Pan) ☐ Silt ☐ Sand (0.06-2 mm) ☐ Gravel (22-66 mm) ☐ Cobble (67-249 mm) ☐ Boulder (250 mm) ☐ Bedrock ☐
Sub-Dominant Substrate (S2.M3) ☐ ☐ ☐ ☐ ☐ ☐ ☐

Feature Roughness ☐ < 10% Minimal (1) ☐ 10 - 40% Moderate (2) ☐ 40 - 60% High (3) ☐ > 60% Extreme (4)

Width Measurement ☐ Can't Measure (1) ☐ Bankfull (2) ☐ Mean Width (3) ☐ Estimated (4) ☐ GIS (5) ☐ Measure/GIS (6)

Channel Dimensions Feature Width (m): _____ Bankfull Depth (mm) _____

Entrenchment Total: ☐ > 40 m ☐ < 40 m Left Bank _____ m Right Bank _____ m Total width _____ m

Surface Flow Method ☐ Perched Culvert (1) ☐ Hydraulic Head (2) ☐ Distance by Time (3) ☐ Estimated (4)

Wetted Width (m)			Wetted Depth (mm)			Hydraulic head (mm)			Volume (L)			Distance (m)			Time (s)		
1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

Sediment Transport
 Adjacent ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
 Feature ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)
 ☐ None (1) ☐ Rill (2) ☐ Rill and Gully (3) ☐ Gully (4) ☐ Outlet Scour (5)
 ☐ Sheet Erosion (6) ☐ Instream Bank Erosion (7) ☐ Other (8)

Sediment Deposition Measures (mm): _____
☐ None (1) ☐ Minimal: < 5 mm (2) ☐ Moderate: 5-30 mm (3) ☐ Substantial: 31-80 mm (4) ☐ Extensive: > 80 mm (5)

Daily Work Plan for Field Work

Client/Project #: 773

Date: 2018/06/12

Personnel Data:

Staff Name	Date of Birth YYYY/MM/DD	Emergency contact and number	Staff hazard review initials®
R. HALL	1980/11/25	KATIE 613 851 5951	RH
T. POAT	1988/07/19	MIRANDA 613 438 6611	TP

If there are more than four crew, use a second sheet; * indicates person responsible for check in / check out; ® initial if staff has had the opportunity to review the hazard assessment and mitigations for this project, is aware of risks, and agrees the work can be done safely.

Vehicle (circle those that apply)	Owner	Licence
<u>KAL Truck (Chevy Silverado), Grey</u>	Bruce Kilgour	685 7JZ (Ontario)
<u>QUAD</u>	Bruce Kilgour	2CK47 (Ontario)
QUAD Trailer	2317833 Ontario	M7807M (Ontario)
Tracker	2317833 Ontario	C23182ON (Transport Canada)
Tracker Trailer	2317833 Ontario	J3161S (Ontario)
Red Inflatable	2317833 Ontario	C23183ON (Transport Canada)
Inflatable Trailer	Bruce Kilgour	J7553K (Ontario)
White inflatable	Kilgour & Associates Ltd.	unmarked

Describe Anticipated Daily Activities Including Location(s), Route(s) and Access Points and approx. schedule

complete HOPA Fishing @ Thunder Road

Map is attached? ☒ YES ☐ NO

Check in / Check out Procedure

KAL Contact Person and cell number:	A. Francis
Hotel Details	
Client Contact Person and cell number:	
Check in method and frequency:	

Traffic encounter

Anticipated Worst Outcome/ Catastrophic Failure (describe):

911

Emergency Response Procedure (describe):

Home Base: KAC Time leaving 1206 Time returning 1730	Field Location: Thunder road Time arriving 1245 Time Leaving 1700
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Person	Pre-Field Condition	Post-Field Condition
AAA TP	good	good
Vehicle	Pre-Field Condition	Post-Field Condition
<hr/> Start km:		<hr/> End km:

Calibration										
Unit	Serial No.	Pre / Post	pH			Cond.	Turbidity			DO
			4	7	10		0			
						1413	0			100% Sat.
pH pen		Pre								
		Post								
YSI Pro Plus	unit 2	Pre	4.00	7.03	—	1410				
		Post	4.03	7.00	—	1398				
HI Turb. Meter		Pre								
		Post								
Lamotte Turb. Meter		Pre								
		Post								
		Pre								
		Post								

Rules of thumb (when to flag your result):

- DO (mg/L): < 5 mg/L, check that YSI is calibrated to 100% saturation, if yes, then use HACH kit to confirm low DO
- pH: If < 6.5 or > 9, check pH meter vs buffer solutions
- If unit cannot calibrate, it must be serviced, so notify Bruce Kilgour

Issues with field equipment

Do not forget to mention all equipment issues to Rob Hallett as soon as possible

none

Datasheet Log

DWP, map, Fish x d, notes



Field Map

Client/Project #: SIMP773

Crew: ~~L. J. T. B.~~

Date: 20180621

Location: 6150 Thunder Rd.

HDFA Visit #1



Notes

new notes are in red

CREW INITIALS:

FINAL FIELD PACKAGE: P ___ OF ___

Fish Collection Record

Client/Project #:

Date: 20¹⁸/06/21

Start Time:

Location: Thunder Road	Stream type: ditch	Crew: RHTD
(UTM NAD 83): 18	Reach Classification: unk	Task: H/DFA
Watercourse: unk	Temperature: 26.0°C	Gear type: E-
Reach/Station: Reach 1	Conductivity: 365 μ S/cm	Seconds/ Set + Pull Time: 630
W-Depth: 0.45m	pH: 6.49	Length fished: ~60m
W-Width: 3.0m	DO: 1.65mg/L / 70.8%	
Fishing Details/Other Comments: START : 405078 5021483 END : 465032 5021542 Fish were barely being shocked, no major issues		

Species	Number	Total	Notes/Stage + Health Observations
CNMD	13	13	
BREN	3	3	
BEST	1	1	
NRDC	3	3	

Fish Collection Record

Client/Project #:

Date: 2018/06/21 Start Time:

Location: Thunder Pool	Stream type: Perm.	Crew: PH
(UTM NAD 83): 18	Reach Classification: Unk	Task: TD
Watercourse: unk	Temperature: 22.5°C	Gear type:
Reach/Station: 2A	Conductivity: 4836	Seconds/ Set + Pull Time: 721
W-Depth: 3.5m 0.40m	pH: 7.61	Length fished:
W-Width: 3.5m	DO: 51.9% 4.4 mg/L	
Fishing Details/Other Comments: Start: 465001 5021575 End: 465028 5011494 very high spCond, not much fish response. Catch was netted not shocked		

Species	Number	Total	Notes/Stage + Health Observations
CUMD	☒ ☒ ☒ ☒ ☒ ☒	60	
BRST	☒ ☒ ☒ ☒ ☒ ..	52	
NRDC	☒ ±	15	
PMSD	☐	8	
FTMN	.	1	
CRCH	.	1	

Fish Collection Record

Client/Project #:

Date: 2018/06/1

Start Time:

Location: Thunder Road	Stream type: Perm.	Crew:
(UTM NAD 83): 18	Reach Classification: unk	Task: HDFA
Watercourse: unk	Temperature: 25°C	Gear type: /
Reach/Station: Reach 3	Conductivity: 308.3	Seconds/ Set + Pull Time: 338.7
W-Depth: 30cm	pH: 7.62	Length fished: 70m
W-Width: 1m	DO: 58% 4.75mg/L	
Fishing Details/Other Comments: Start 465028 5021496 End 464977 5021475		

Species	Number	Total	Notes/Stage + Health Observations
CLMD	☒☒☒☒☒☒☒ ..	73	
BRST	☒☒☒☒☒ ..	52	
FTMN	..	3	
PNBD	..	2	



Date: 2018/06/21 Start Time:

Location: Thunder Road	Stream type: Perm	Crew: RH + D
(UTM NAD 83): 18	Reach Classification:	Task: HDFA
Watercourse: Onk	Temperature: 17.8	Gear type: Backpack
Reach/Station: Reach 4	Conductivity: 123.9	Seconds/ Set + Pull Time: 327
W-Depth: 40-45cm	pH: 6.98	Length fished: 60m
W-Width: 3m	DO: 13.6% 1.28mg/L	
Fishing Details/Other Comments: START 465065 5021389 END 465039 5021373		

[illegible]