

**Abundance, Distribution, Spawning,  
and Thermal Habitat of Westslope  
Cutthroat Trout and Bull Trout in the  
Stimson Creek Watershed**

**CONSERVATION  
REPORT  
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Abundance, Distribution, Spawning, and Thermal Habitat of Westslope  
Cutthroat Trout and Bull Trout in the Stimson Creek Watershed

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## EXECUTIVE SUMMARY

Westslope cutthroat trout and bull trout coexist in many Eastern Slope streams of southwestern Alberta, but the majority of these populations have been negatively impacted by anthropogenic activities including habitat degradation and fragmentation, introduction of non-native fish species, and overfishing. Recovery of these species is a major focus for provincial fisheries managers as both species are designated or recommended for listing as *Threatened* under the *Species at Risk Act*. Recovery management plans for both species have been developed by federal and provincial governments to guide recovery efforts. In this study, we conduct surveys in the Stimson Creek watershed to generate data to support implementation of species recovery activities in the watershed. We determined abundance and distribution of Westslope cutthroat trout and bull trout, assessed bull trout spawning distribution and redd density, as well as thermal suitability of streams in the study area for trout species.

We conducted fish surveys of the Stimson Creek watershed using backpack electrofishing. Between July 4 – September 27, 2017, we sampled 33 sites, capturing a total of 214 Westslope cutthroat trout, 2 bull trout, 248 rainbow trout, and 59 cutthroat x rainbow trout hybrids. Trout species comprised 21.7% of the overall catch as the majority of fish consisted of various sucker and minnow species. We captured Westslope cutthroat trout in upper Pekisko Creek, both downstream and upstream of McConnell Falls, and in Sheppard Creek and Hay Creek. Westslope cutthroat trout catch rates were highest upstream of both McConnell and Upper Pekisko falls, while bull trout catches were low as we only captured eight fish in upper Pekisko Creek. Rainbow trout was the most common trout species in the Stimson Creek watershed and was captured in most streams except for a few reaches in Stimson Creek and in upper Pekisko Creek, upstream of McConnell Falls. Cutthroat x rainbow trout hybrids were captured at two sites in Bear Creek and Hay Creek; both streams were identified as transition zones where Westslope cutthroat trout and rainbow trout ranges overlap.

Between September 5 - 20, 2017, we completed two bull trout spawning assessments in Pekisko Creek, from the confluence of Pekisko and Stimson creeks upstream to the base of McConnell Falls. We identified six redds and observed ten adult bull trout at or near spawning beds during the surveys. We also observed two larger migratory-sized bull trout downstream of the Bar-U Ranch bridge crossing and believe these fish were unsuccessful in migrating upstream past the series of seasonal barriers to reach spawning habitat.

In 2017, average water temperatures ranged between 10.2 – 18.9°C with cooler water temperatures more common in headwater streams which progressively warmed as streams flowed downstream. Stimson Creek was the warmest stream in the study area with temperatures that exceeded the upper thresholds for Westslope cutthroat trout (19.6°C) greater than 50% of the day throughout most days during summer months. Pekisko Creek was one of the coolest streams in the study area, specifically in upper reaches where temperatures never exceeded Westslope cutthroat trout upper temperature thresholds. Westslope cutthroat trout and bull trout continue to persist in the Stimson Creek watershed. Abundance and distribution of both species is limited to headwater streams in the watershed, more commonly in Pekisko Creek where both species are present.

**Key words:** abundance, distribution, Westslope cutthroat trout, bull trout, Stimson Creek.

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## 1.0 INTRODUCTION

Recovery of Alberta's Westslope cutthroat trout (*Onchorhynchus clarkii lewisi*) and bull trout (*Salvelinus confluentus*) populations is a major focus for provincial fisheries managers as both species are designated or recommended for listing as *Threatened*, under the *Species at Risk Act* (Fisheries and Oceans Canada 2014; COSEWIC 2012), respectively. Recovery plans for Westslope cutthroat trout and bull trout, have been developed by provincial and federal governments with species conservation management objectives that prioritize conservation efforts based on population structure, abundance, distribution, and genetics in areas identified as critical habitat (Fisheries and Oceans Canada 2014).

Populations of both species are subject to a high degree of natural instability which make them more susceptible to anthropogenic disturbances (Fitch 2008). Westslope cutthroat trout and bull trout coexist in many Eastern Slope streams of southwestern Alberta, but the majority of these populations have been negatively impacted by anthropogenic activities including habitat degradation and fragmentation, introduction of non-native fish, and overfishing. Since the 1950s, abundance and distribution has decreased significantly for both species; Westslope cutthroat trout have decreased to approximately 5% of their historic distribution (Fisheries and Oceans Canada 2014), while bull trout have decreased to approximately 31% of their historic distribution in southwestern Alberta (Fitch 1997). Most remaining bull trout and more notably Westslope cutthroat trout populations have become disconnected throughout their historic range (Fisheries and Oceans Canada 2014).

Westslope cutthroat trout and bull trout continue to persist in streams in the Stimson Creek watershed despite the anthropogenically induced changes in fish habitat and fish communities. Decreases in populations have been attributed to impacts associated with oil and gas development, agriculture, and the introduction of non-native trout, particularly rainbow trout (*Oncorhynchus mykiss*). Pekisko Creek, a tributary to Stimson Creek and the Highwood River, is a refuge for populations of both species in southwestern Alberta (Western Native Trout Campaign 2001). A 2008 survey identified one genetically near pure (95% purity) population of Westslope cutthroat trout upstream of a fish barrier (McConnell Falls) and four isolated hybrid (<95% purity) populations of Westslope cutthroat trout in mainstem and tributary streams in Pekisko Creek's upper basin (Government of Alberta 2016) (Appendix 1). Similarly, previous work suggest that Pekisko Creek may provide critical spawning and overwintering habitat for bull trout but the extent of spawning habitat availability or use is uncertain (Buchwald 1995).

Water temperature is critical in defining critical habitat for Westslope cutthroat trout species recovery as warmer temperatures are negatively correlated with occupancy of this species (Bear et al 2007). The upper water temperature threshold for Westslope cutthroat trout is 19.6°C, approximately 5°C cooler than that of rainbow trout (23.6°C), which give rainbow trout an advantage in warmer waterbodies where the two species coexist (Selong et al. 2001). Conversely, Westslope cutthroat trout are believed to have an evolutionary advantage over rainbow trout in high elevation, colder waterbodies and it is believed encroachment of rainbow trout would be less likely to occur in these environments (Harig and Fausch 2002).

The MULTISAR partnership is a grass root conservation program that focuses on the conservation of Species at Risk by promoting habitat stewardship with private landowners in a manner that maintains viable ranching operations. This partnership, which includes Alberta Conservation Association (ACA), expanded their program in 2016 throughout the South Saskatchewan River basin, to include southwestern Alberta's foothill grasslands and ranching operations that may impact streams with trout habitat. Current MULTISAR initiatives include a partnership with two landowners in the Stimson Creek watershed with a primary goal of enhancing and protecting all areas of critical fish habitat from cattle grazing and other agricultural practices.

To support and compliment these broader objectives of restoration and reconnection of critical fish habitat, ACA completed a comprehensive watershed assessment of the distribution of trout species at risk in the Stimson Creek Watershed. In partnership with MULTISAR, ACA conducted the fisheries assessment to update currently outdated (>10 years) Westslope cutthroat trout and bull trout population datasets. The assessment was designed to identify areas of critical habitat, and determine abundance and distribution of Westslope cutthroat trout and bull trout which will contribute to the development of species recovery planning. Data collected from this study will also assist MULTISAR landowner partnerships to identify and protect critical fish habitat.

The primary objectives of this study are to:

- Determine relative abundance, distribution, and population structure of Westslope cutthroat trout and bull trout in the Stimson Creek watershed.
- Determine bull trout spawning habitat distribution and redd density in Pekisko Creek.
- Assess thermal suitability of streams for trout species in the Stimson Creek watershed.

## 2.0 STUDY AREA

The study area is the Stimson Creek hydrological unit code 10 (HUC10) watershed, as described by the watershed scale classification and management framework currently being used by Alberta Environment and Parks (AEP 2017). The Stimson Creek watershed is located in southwestern Alberta, approximately 110 km southwest of Calgary, Alberta (Figure 1). The watershed consists of two main streams, Stimson and Pekisko creeks, which flow from the Eastern Slopes of the Rocky Mountains into the foothills before converging into the Highwood River. Elevation of the watershed is 1,407 m (1,135 - 2,542 m) and the longest stream length is 65.3 km. Snow melt and groundwater are the primary water sources in the watershed as snowmelt recharges groundwater levels during spring freshet and gradually decrease in summer to base flows in fall and winter.

Cattle grazing and cropland production are the main activities on both private and public lands throughout the watershed, with some minor oil and gas operations adjacent to Highway 22. There are several protected areas in the watershed including the Don Getty Wildland (Plateau Mountain), Emerson Creek Natural Area, and Kananaskis Country. The Eden Valley First Nations Reserve community is adjacent to the watershed and a second parcel of the reserve is located within the watershed. Anecdotal information from local landowners suggests angling pressure in the watershed is infrequent and most anglers are local.

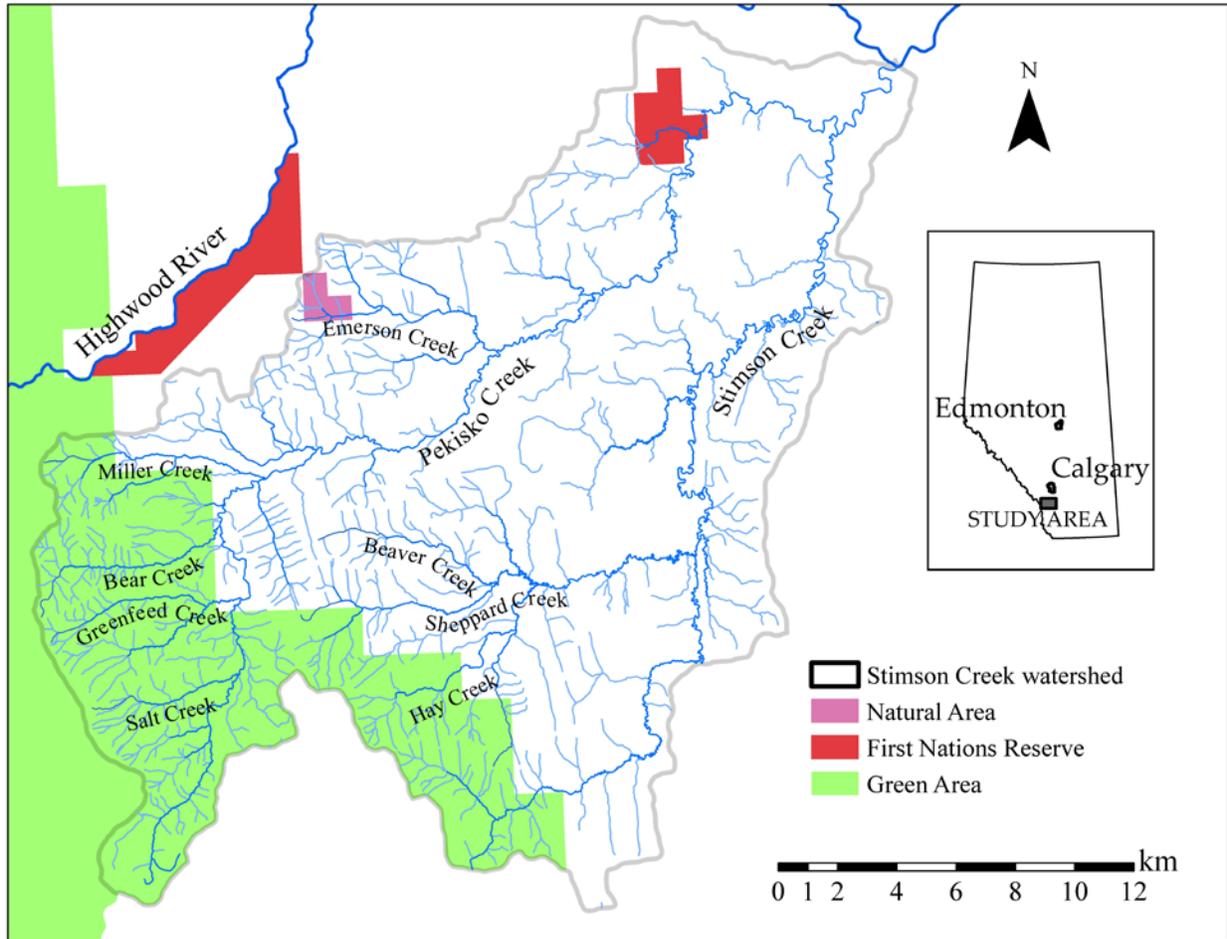


Figure 1. Map of Stimson Creek HUC10 watershed, 2017. Inset map shows the location within the province of Alberta.

### 3.0 MATERIALS AND METHODS

#### 3.1 Sampling intensity

We selected sample sites from a pool of potential sites generated in ArcGIS 10.2© throughout the HUC10 study area using Generalized Random Tessellation Stratified (GRTS) design with R programming software (R Development Core Team 2013). We determined total potential sample sites by dividing waterbodies considered large wadeable streams (i.e. Strahler stream order 5 - 6, and >10 m wetted width [ww]) into 500 m segments, and those considered small wadeable streams (stream orders 3 - 4, and >10 m ww) into 300 m segments, based on minimum sample distance criteria (Government of Alberta 2013). We used archival wetted width information and Google Earth© measurement applications to validate stream widths. We

produced a total of 100 potential sample sites on large streams and 659 sample sites on small streams available for selection.

Sampling intensity was determined using a combination of time and staff resource capacity, with a minimum size of 30 sample sites. To ensure a sufficient sample site list was available to complete 30 sample sites, we selected 40 spatially balanced sites in small streams and 10 sites in large streams using GRTS selection, to allow for non-response sites which include: dry sites, streams with intermittent flow, sites immediately adjacent to completed sites, or where sites exceeded distances greater than 1,000 m from the nearest road or trail access.

### **3.2 Fish data collection**

Originally we planned sampling small wadeable streams using backpack electrofishing equipment (Smith Root Type 12B) and using tote electrofishing equipment (Smith Root tote and 5.0 GPP) to sample large wadeable streams, but due to extremely low flows (Appendix 2) all streams were sampled using backpack electrofishing equipment. Based on provincial guidelines (Government of Alberta 2013), site lengths for small wadeable streams were a minimum sample distance of 300 m or 40 times the mean wetted width, whichever was greater; minimum sample distances in large wadeable streams were 500 m or 40 times the mean wetted width, whichever was greater.

From July 4 – 27, and September 25 – 27, 2017, we completed 33 electrofishing sites, 27 of which were GRTS selected sites; and an additional six sites were sampled to support ongoing MULTISAR projects and priority Westslope cutthroat trout genetic sampling to identify pure strain populations upstream of suspected fish barriers (Figure 2). Electrofishing crews consisted of one electrofisher and two netters. Each crew sampled streams in an upstream direction, sampling all fish habitat types with equal effort. Sample sites were divided into 50 m segments, and fish and habitat measurements were collected after electrofishing each segment. We collected fish species, size (fork length and total length [FL and TL]), and weight data for all fish. We used Robinson (2005) species identification criteria to identify Westslope cutthroat trout and hybrids (i.e. cutthroat x rainbow trout), and we collected fin clips from Westslope cutthroat trout and cutthroat x rainbow trout hybrids for AEP's DNA analysis. We collected standard fish habitat data (i.e. stream wetted and rooted widths, stream type, composition, water temperature, conductivity, and maximum depth) at the time of sampling at each site as per provincial guidelines (Government of Alberta 2013).

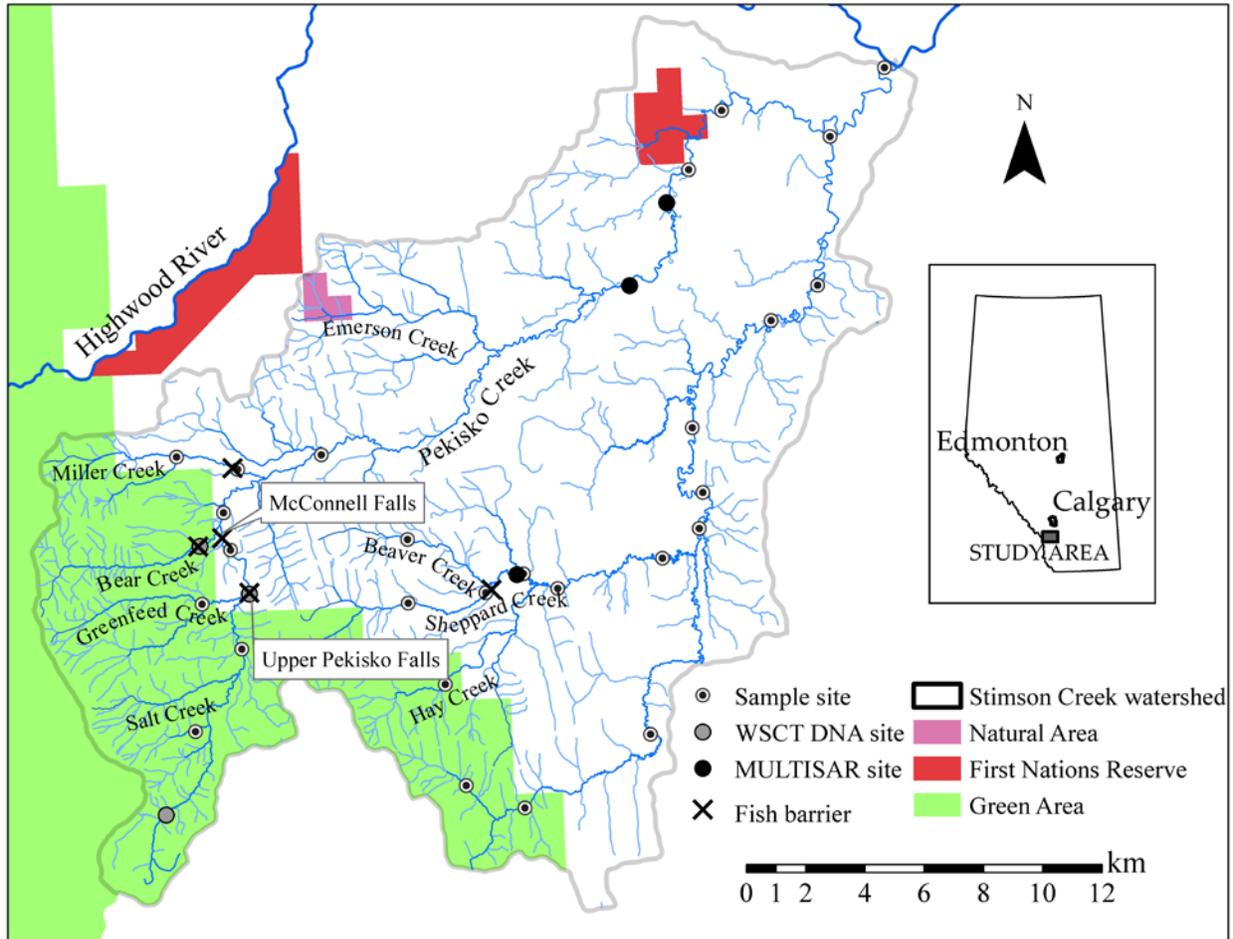


Figure 2. Electrofishing sites in the Stimson Creek HUC10 watershed, 2017. Inset map shows the location within the province of Alberta. Species code: WSCT = Westslope cutthroat trout.

### 3.3 Bull trout spawning surveys

We completed bull trout spawning surveys in Pekisko Creek from September 5 - 7, and September 20 - 22, 2017. Spawning surveys were only conducted in Pekisko Creek because it is the only stream in the watershed with historic records of bull trout (Fisheries and Wildlife Management Information System; Buchwald 1995) and where bull trout were captured during summer electrofishing efforts. From the mouth of Pekisko Creek, we divided the stream into 2 km segments extending upstream to McConnell Falls. In crews of two, we hiked each segment, in an upstream direction assessing potential spawning habitat and spawning activity (redd counts and bull trout observation). During our first spawning survey we assessed all 22 segments of Pekisko Creek and following the initial survey, we eliminated the downstream 12 km of the creek as we deemed it as unsuitable spawning habitat and conducted the second

survey upstream of the Highway 22 bridge crossing. Related data collected at each redd included: geographic location, spawning substrate type, redd dimensions (length, width, pit depth) and classification (Class 1 – definite; Class 2 - probable), and stream cover, location and habitat type (run, riffle, pool). We also collected geographic location data where bull trout were observed.

### **3.4 Water temperature**

We monitored water temperature at representative sites on both the Stimson Creek and Pekisko Creek mainstems, and all major tributaries in the Stimson Creek watershed from June 1 – September 1, 2017 (Figure 3). We used Onset© Hobo Pendant loggers, affixed to a steel t-bar post driven into the stream substrate and anchored around woody vegetation using 1/8 inch steel cable. We installed loggers in pool habitats in an effort to keep them submerged throughout the summer and they were programmed to measure temperature at one hour intervals.

At each temperature monitoring site we calculated the percentage of each day that water temperatures exceeded the Westslope cutthroat trout upper temperature threshold by summing the number of hours water temperatures were  $>19.6^{\circ}\text{C}$ , divided by 24 hours, and expressed as a percentage. From these results we generated a histogram, exhibiting frequency and duration when temperatures exceeded the Westslope cutthroat trout upper temperature threshold. Data were excluded when we suspected that low water levels may have exposed loggers to atmospheric temperatures. Following Dunham et al. (2005) and Sowder and Steel (2012), we designated such data as when water temperature was equal or close to the air temperature and the diurnal water temperature range was  $>10^{\circ}\text{C}$  for significant portions of time (i.e. days). Based on these criteria, data from Sites 1, 9, and 12 were excluded from analysis.

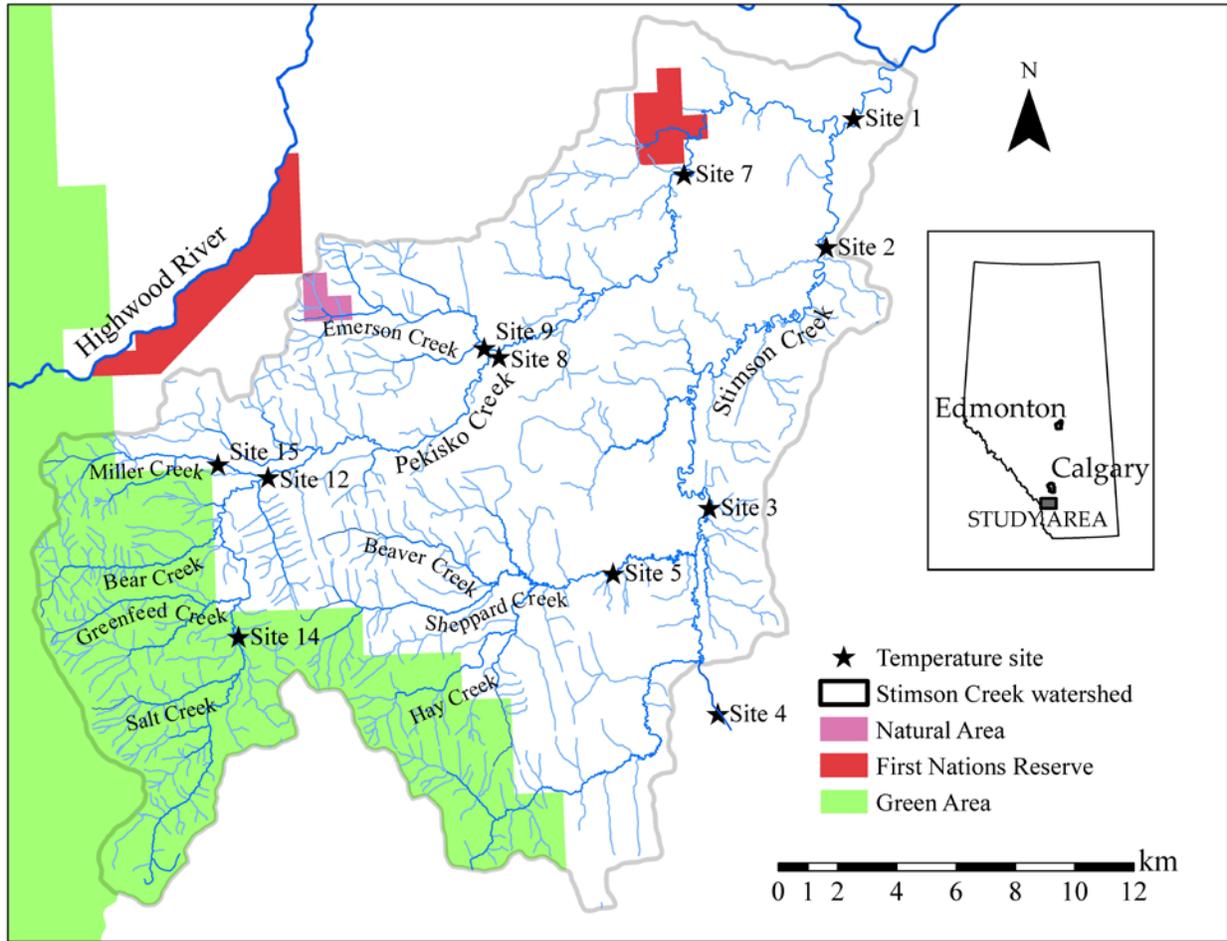


Figure 3. Water temperature monitoring sites in the Stimson Creek HUC10 watershed, 2017. Inset map shows the location within the province of Alberta.

## 4.0 RESULTS

### 4.1 Fish capture summary

We captured a total of 2,447 fish, consisting of 13 species, 5 of which were sportfish species, comprising 21.7% of the total catch. Over half (56.8%) of the catch was minnows, and suckers represented the lowest catch (21.5%) of all three fish categories (Table 1). Rainbow trout catch was the highest of all sportfish, representing 46.7% (n = 248) of the sportfish catch, followed by Westslope cutthroat trout at 40.3% (n = 214), and cutthroat x rainbow trout hybrid at 11.1% (n = 59). Bull trout and mountain whitefish represented approximately 2% of the sportfish catch, at 1.5% (n = 8) and 0.4% (n = 2), respectively.

Table 1. Fish capture summary by fish category in the Stimson Creek HUC10 watershed, 2017.

Fish category	Proportion (%)	Species	Total catch (n)
Sportfish	21.7%	Rainbow trout	248
		Westslope cutthroat trout	214
		Cutthroat x rainbow trout	59
		Bull trout	8
		Mountain whitefish	2
Minnows	56.8%	Longnose dace	1,153
		Lake chub	110
		Trout perch	99
		Fathead minnow	20
		Brook stickleback	7
Suckers	21.5%	White sucker	301
		Longnose sucker	129
		Mountain sucker	97

#### 4.2 Distribution and population structure

Westslope cutthroat trout catch was highest in the upper reaches of Pekisko Creek and two of its main tributaries, Greenfeed and Bear creeks (Appendix 3). The highest Westslope cutthroat trout catch was above McConnell Falls, where the population was previously identified as near pure (95%) in 2008 (Government of Alberta 2016), and upstream of a newly discovered fish barrier identified as Upper Pekisko Creek Falls (Figure 4). No Westslope cutthroat trout were captured in Stimson Creek however, we captured Westslope cutthroat trout in low numbers at two sites in the Sheppard Creek sub-watershed, Sheppard and Hay creeks. We also captured Westslope cutthroat trout downstream of McConnell Falls, however, rainbow trout were also captured at the same locations in greater numbers. Rainbow trout were captured at most sites in the Pekisko Creek watershed, downstream of McConnell Falls. Rainbow trout distribution was intermittent throughout the Stimson Creek watershed as we captured fish in low numbers at three sites in Stimson Creek and three sites in the Sheppard Creek sub-watershed. We caught several cutthroat trout x rainbow trout hybrids in Bear Creek, immediately downstream of the fish barrier identified in Bear Creek and at one site on Hay Creek. Bull trout were captured at only two sites, both in the Pekisko Creek watershed, Pekisko and Miller creeks.

In the Stimson Creek watershed, Westslope cutthroat trout average length was  $119 \pm 41.2$  ( $\pm$ SD) mm FL, ranging between 55 – 324 mm FL (Figure 5 and Appendix 4). Of all Westslope cutthroat trout captured, the majority were juveniles ( $n = 172$ ,  $<149$  mm FL) and only 20% ( $n = 42$ ) were adults ( $\geq 150$  mm FL) (Appendix 4). Rainbow trout averaged  $93 \pm 51.6$  mm FL and ranged between 30 – 396 mm FL. Cutthroat x rainbow trout hybrids averaged  $135 \pm 56.7$  mm FL and ranged between 50 – 224 mm FL. Only eight bull trout ranging between 55 – 192 mm FL were captured during electrofishing efforts.

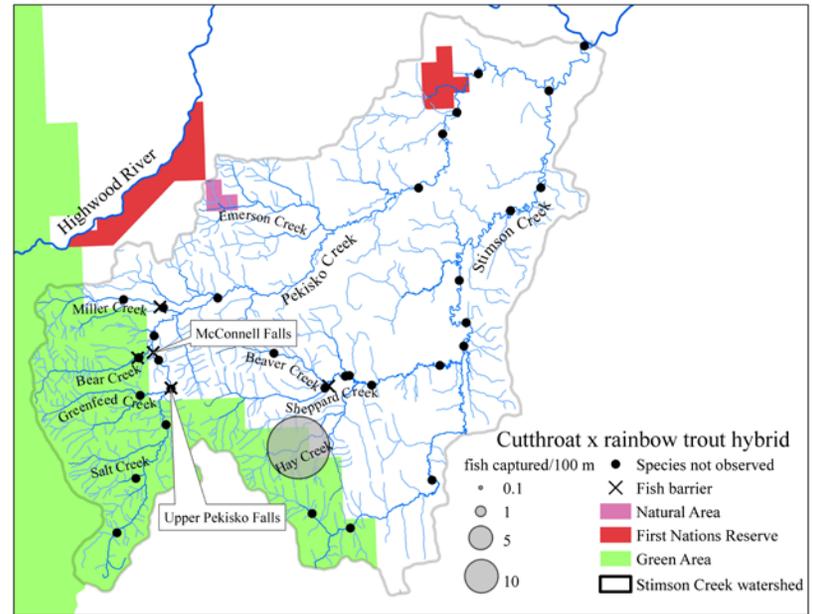
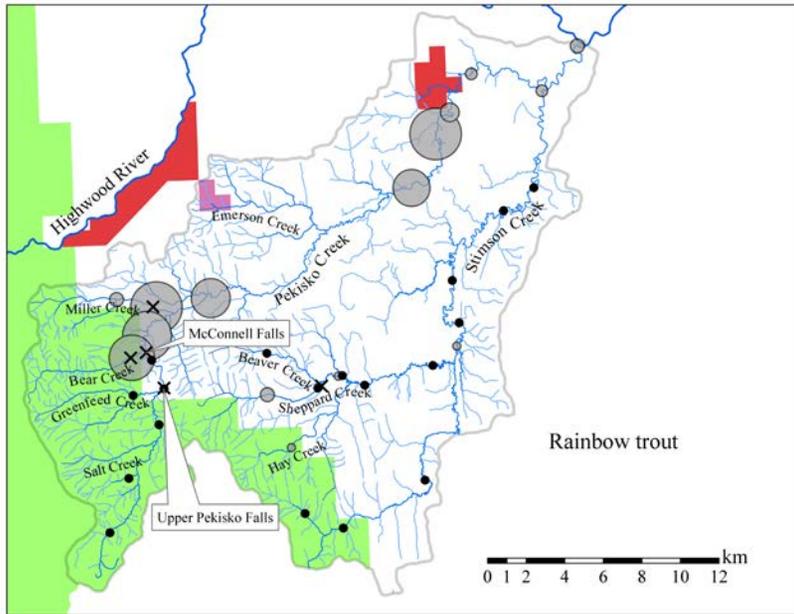
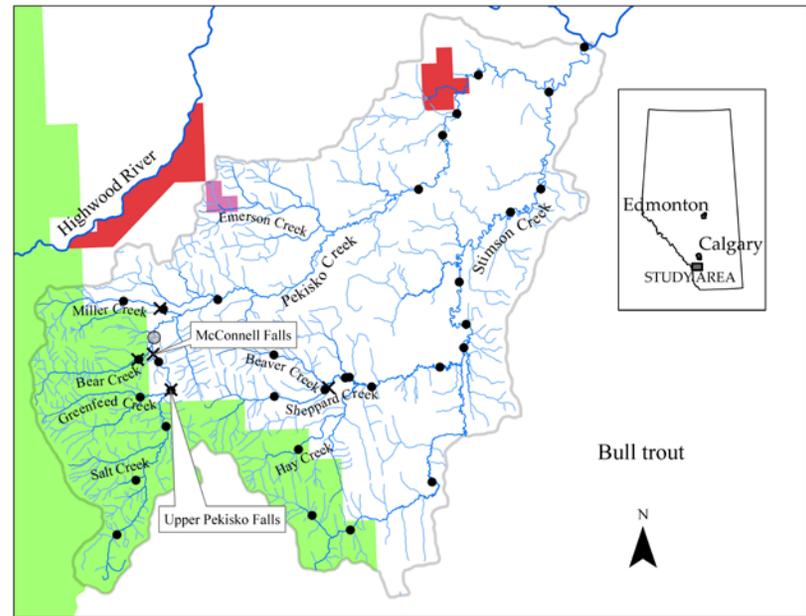
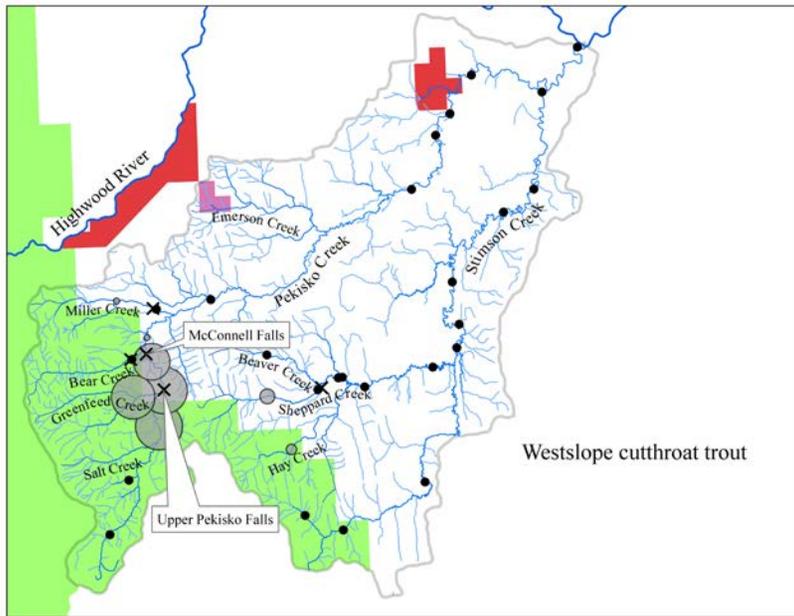


Figure 4. Relative abundance by catch-per-unit-effort (CPUE, fish/100 m) of trout species captured in the Stimson Creek HUC10 watershed, 2017. Inset map shows the location within the province of Alberta.

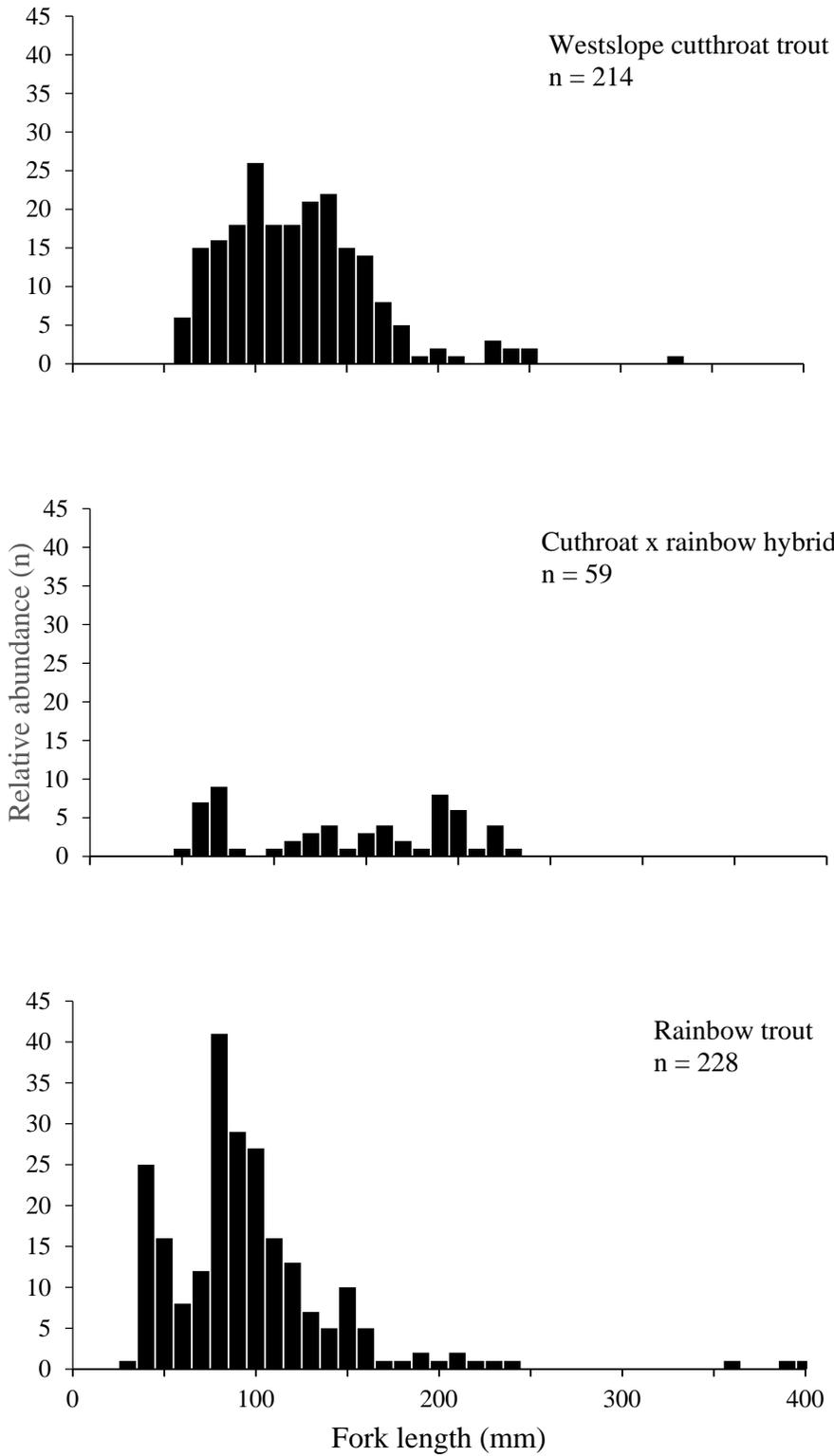


Figure 5. Length frequency distribution of trout species captured in the Stimson Creek HUC10 watershed, 2017.

### **4.3 Bull trout spawning distribution**

During the first spawning survey in early September, we observed one Class 1 and one Class 2 redd, in the upper reach of Pekisko Creek and seven adult bull trout. Of the seven bull trout, five were staging in the plunge pool below McConnell Falls and ranged in size between 300 – 450 mm FL (Figure 6). We identified four additional Class 1 redds in the late September spawning survey, downstream of McConnell Falls and observed three adult bull trout in close proximity to these redds. We also observed two large, migratory-sized adult bull trout (>450 mm FL) approximately 500 m downstream from the Bar-U Ranch bridge crossing. Table 2 presents dimensions of all Class 1 redds detected in 2017. Spawning habitat selection for bull trout were clean, cobble-sized spawning beds (64 – 250 mm) in a run stream type channel. Half of the redds observed were constructed under large woody debris or vegetative cover while the remaining were absent of cover. We observed three low water barriers and one subsurface flow section (150 m in length) from low flows in upper Pekisko Creek, posing as seasonal fish barriers for migrating fish.

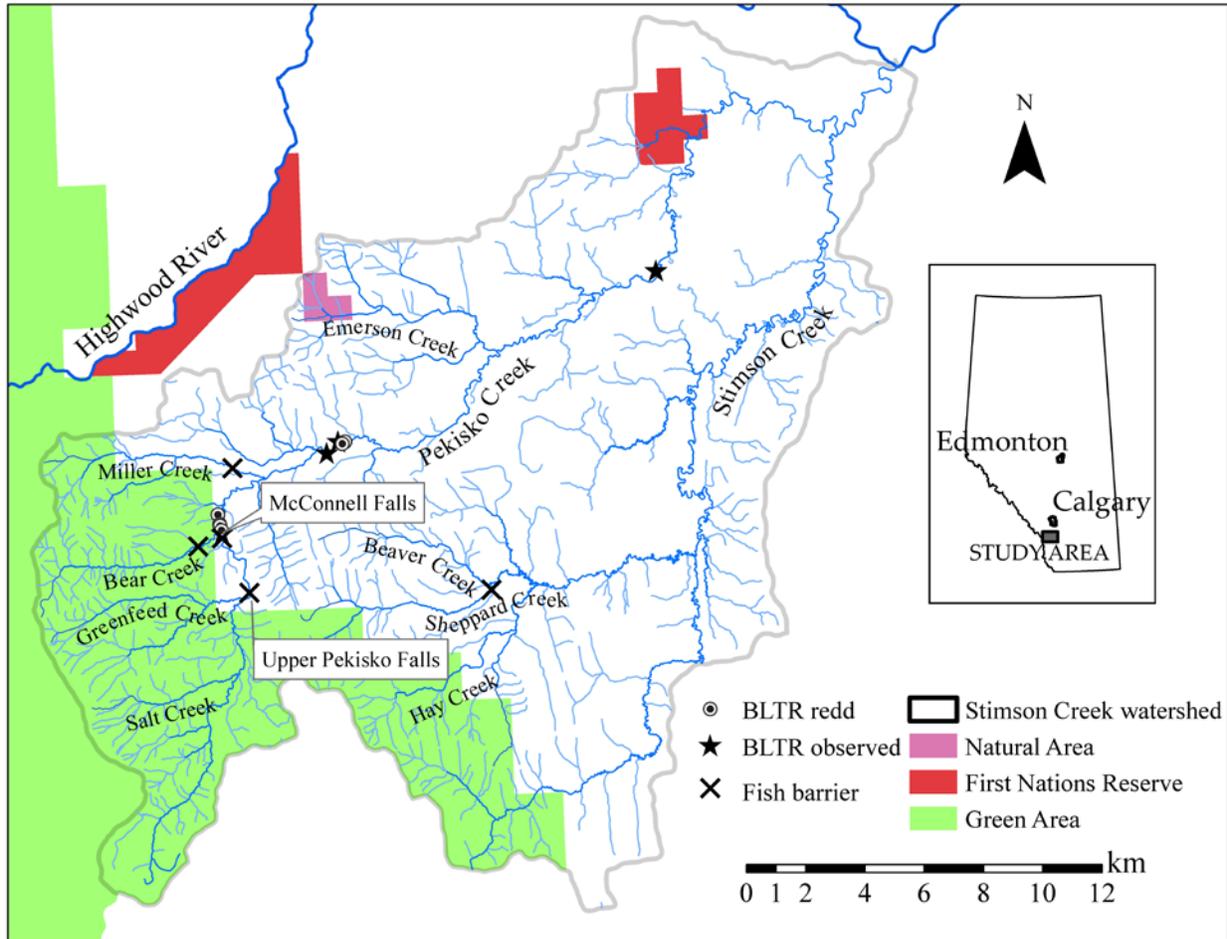


Figure 6. Bull trout redd and adult bull trout observations during spawning surveys in Pekisko Creek, 2017. Species code: BLTR = bull trout.

Table 2. Size of bull trout redds identified in Pekisko Creek (n = 5), 2017.

	Range (cm)	Average $\pm$ SD (cm)
Redd length	140 - 260	182 $\pm$ 49.2
Redd width	55 - 80	64 $\pm$ 10.8
Pit depth	25 - 40	55 $\pm$ 7.1

#### 4.4 Water temperature

In 2017, average water temperatures during summer months ranged between 10.2 – 18.9°C with cooler temperatures in headwater streams and warmer temperatures in streams located downstream, in the watershed (Table 3 and Appendix 5 - 8).

Stimson Creek was the warmest site in the watershed reaching temperatures as warm as 30°C (Sites 1 and 2) and on average, exceeded the Westslope cutthroat trout upper temperature threshold for greater than 50% of the day, for the majority of days between June and September, 2017. There were periods in July and August when water temperatures, at Sites 2 and 3 exceeded the upper temperature thresholds for several consecutive days. We noted similar trends in Meinsinger and Sheppard creeks where average water temperatures periodically peaked above the upper temperature thresholds greater than 50% of the day, for the majority of days in July and August. Meinsinger Creek also exceeded the upper temperature thresholds for several consecutive days in the summer. The coolest water temperatures were measured in Pekisko Creek, most notably at the most upstream site (Site 14) where temperatures remained below 19.6°C over the entire summer. Water temperatures gradually increased in Pekisko Creek, downstream to the confluence into Stimson Creek, but did not compare to the warm water temperatures in Stimson Creek. Temperatures downstream of the Stimson and Pekisko creeks confluence were cooler than upstream sites on Stimson Creek, likely a result of cooler water flowing in from Pekisko Creek. The upper temperature thresholds were also exceeded at sites in the downstream reaches of Pekisko Creek however, on average these conditions occurred less than 50% of the day over a shorter period throughout the summer. Water temperatures at Miller and Emerson creeks remained relatively cool throughout the season, the upper temperature thresholds were exceeded in both tributaries but to a lesser extent than most streams in the watershed.

Table 3. Water temperature range and averages by stream location in the Stimson Creek HUC10 watershed, 2017.

Watershed	Waterbody	Site	Temperature range (°C)	Average temperature $\pm$ SD (°C)
Stimson Creek	Stimson Creek	Hobo 3	3.6 - 27.1	15.9 $\pm$ 4.1
	Stimson Creek	Hobo 2	16.1 - 29.5	18.9 $\pm$ 2.1
	Stimson Creek	Hobo 1	7.3 - 29.8	15.2 $\pm$ 1.5
	Meinsinger Creek	Hobo 4	14.1 - 20.4	19.9 $\pm$ 1.7
	Sheppard Creek	Hobo 5	8.9 - 28.2	17.3 $\pm$ 2.2
Pekisko Creek	Pekisko Creek	Hobo 14	3.9 - 19.1	10.2 $\pm$ 1.9
	Pekisko Creek	Hobo 12	4.7 - 25.3	12 $\pm$ 2.8
	Pekisko Creek	Hobo 8	6.4 - 23.4	14.5 $\pm$ 2.3
	Pekisko Creek	Hobo 7	8 - 26.4	16.7 $\pm$ 2.4
	Emerson Creek	Hobo 9	9.3 - 24.4	15.9 $\pm$ 1.7
	Miller Creek	Hobo 15	4.9 - 20.3	12.8 $\pm$ 2.6

## 5.0 SUMMARY

Westslope cutthroat trout and bull trout populations continue to persist in the Stimson Creek watershed but in low numbers. Westslope cutthroat trout were identified in the upper reaches of Pekisko Creek, upstream and immediately downstream of McConnell Falls, in Miller Creek, Sheppard Creek, and Hay Creek. Sample sites upstream of McConnell Falls had the greatest catch rates and distribution of Westslope cutthroat trout in the study area which is likely attributed to higher quality fish habitat, colder water temperatures and the absence of rainbow trout populations; McConnell and Upper Pekisko Creek falls were both classified as upstream fish barriers.

Bull trout were only identified in the Pekisko Creek basin and absent elsewhere in the watershed. We observed a resident bull trout population in upper Pekisko Creek, downstream of McConnell Falls and Miller Creek. Low fish abundance and redd counts suggests bull trout abundance and distribution is limited to the upper reach of Pekisko Creek.

Rainbow trout were the most abundant trout species in the watershed as they were detected at most sites in the Pekisko Creek watershed, downstream of McConnell Falls, as well as in the upper half of Sheppard Creek watershed. Rainbow trout was the only salmonid captured in

Stimson Creek albeit in low numbers. Cutthroat x rainbow trout hybrids were captured in two streams in the watershed, Hay Creek and Bear Creek. These sites are transition zones where rainbow trout and Westslope cutthroat trout ranges overlap. We anticipate that more hybridized fish will be identified by AEP in 2018 following analysis of genetic samples taken in 2017.

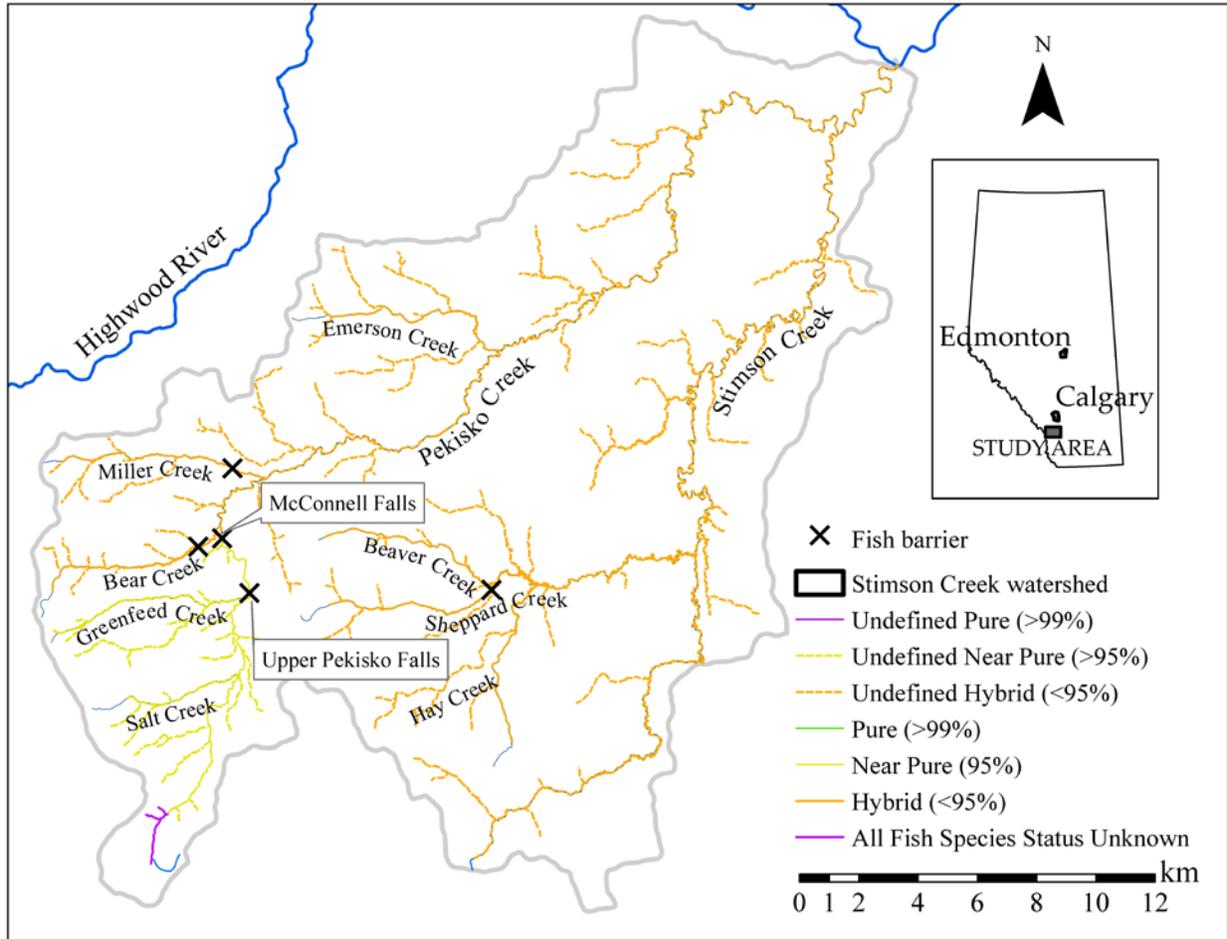
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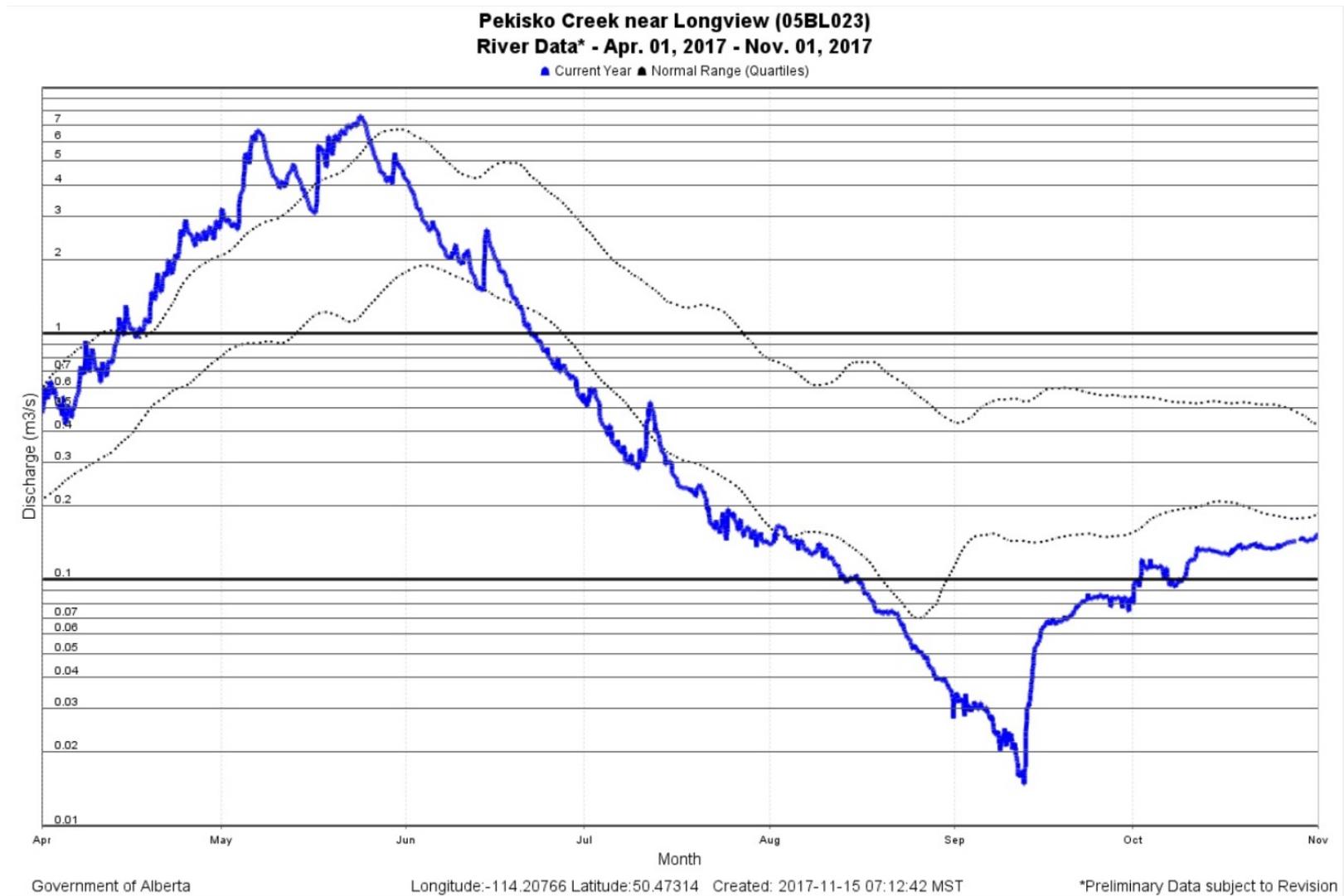
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## 7.0 APPENDICES

Appendix 1. Map of Westslope cutthroat trout genetic purity of the Stimson Creek HUC10 watershed from DNA sampling in 2008 (Government of Alberta 2016). Inset map shows the location within the province of Alberta.



Appendix 2. Hydrograph of Pekisko Creek showing low stream flows, April – October, 2017.



Appendix 3. Relative abundance expressed as catch-per-unit-effort (CPUE) of trout species captured in the Stimson Creek HUC10 watershed, 2017. Species codes: CRTR = cutthroat x rainbow hybrid, RNTR = rainbow trout, WSCT = Westslope cutthroat trout.

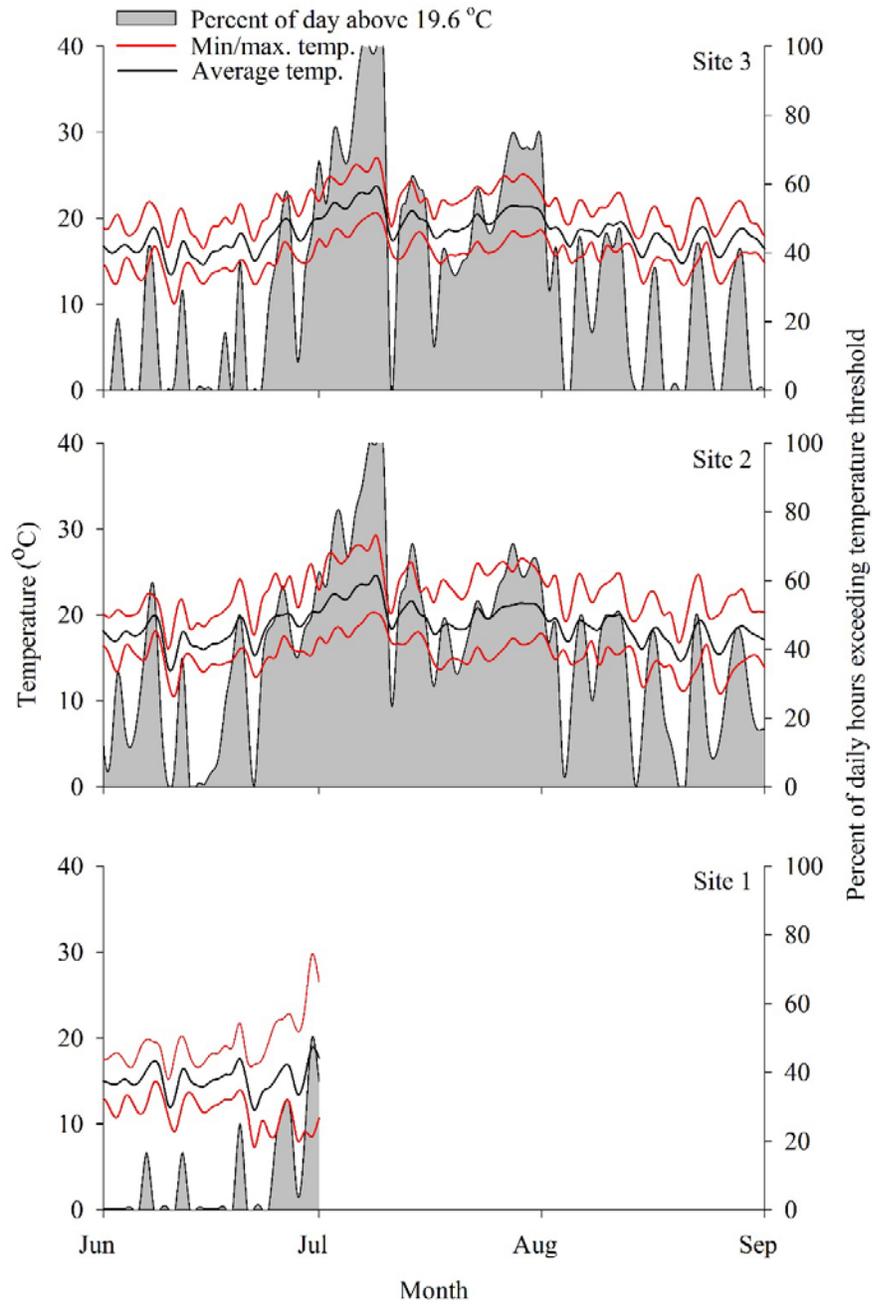
Species	Site	Sample distance (m)	Catch total (n)	CPUE (fish/100 m)
RNTR	1	300	3	1.0
	26	300	2	0.7
	34	450	8	1.8
	58	300	2	0.7
	210	300	23	7.7
	237	300	40	13.3
	245	300	3	1.0
	303	300	36	12.0
	359	300	1	0.3
	499	300	3	1.0
	598	300	1	0.3
	Bear X	300	31	10.3
	1001	300	1	0.3
	1003	500	34	6.8
1004	300	40	13.3	
WSCT	245	300	1	0.3
	303	300	1	0.3
	471 ^	300	36	12.0
	499	300	6	2.0
	504 ^	300	51	17.0
	572 ^	300	59	19.7
	598	300	3	1.0
	U Falls ^	300	58	19.3
CRTR	598	300	1	0.3
	Bear X	300	58	19.3

^ Electrofishing sites sampled upstream of McConnell Falls on Pekisko Creek.

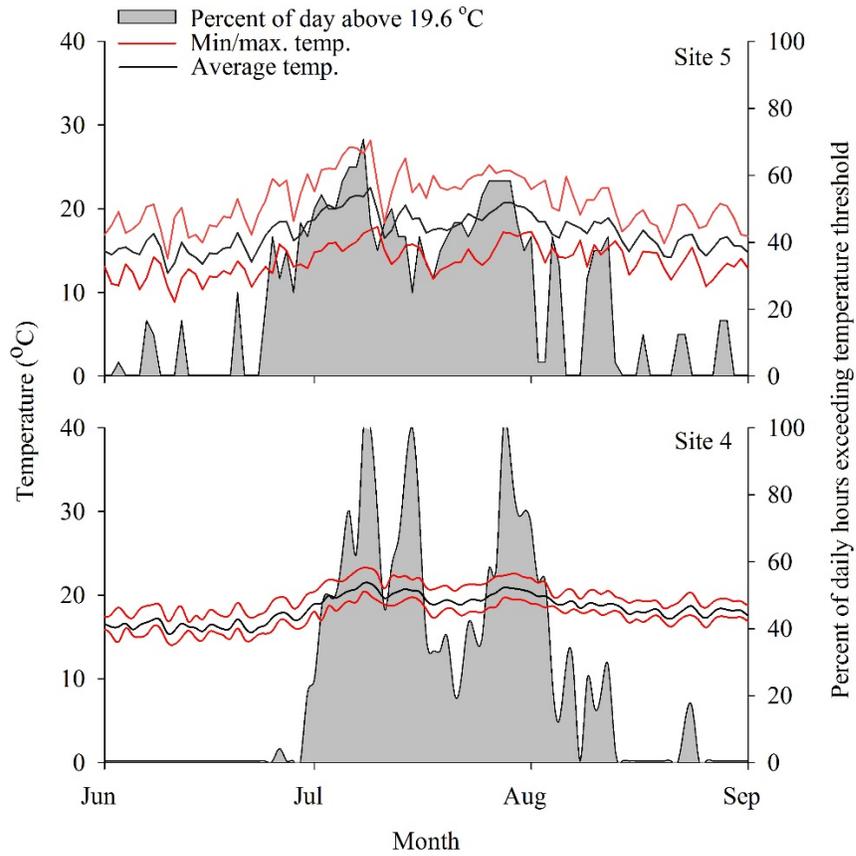
Appendix 4. Fork length (FL) of trout species captured at all sites (n = 33) in the Stimson Creek HUC10 watershed, 2017. Species codes: BLTR = bull trout, CRTR = cutthroat x rainbow hybrid, RNTR = rainbow trout, WSCT = Westslope cutthroat trout.

Site	Waterbody Name	Species	n	FL range (mm)	Mean FL $\pm$ SD (mm)
303	Pekisko Creek	WSCT	1	155 - 155	--
245	Miller Creek	WSCT	1	154 - 154	--
471	Pekisko Creek	WSCT	36	70 - 324	137.4 $\pm$ 54.92
499	Sheppard creek	WSCT	5	150 - 194	169.6 $\pm$ 15.96
504	Greenfeed Creek	WSCT	51	55 - 165	107.6 $\pm$ 31.82
572	Pekisko Creek	WSCT	59	58 - 177	104.3 $\pm$ 30.84
598	Hay Creek	WSCT	3	144 - 164	156 $\pm$ 10.58
Ufalls	Pekisko Creek	WSCT	58	78 - 242	125.4 $\pm$ 40.86
598	Hay Creek	CRTR	1	168 - 168	--
Bear X	Bear Creek	CRTR	58	50 - 224	134 $\pm$ 57.04
1	Stimson Creek	RNTR	3	73 - 97	81.7 $\pm$ 13.32
1001	Sheppard Creek	RNTR	1	41 - 41	--
1003	Pekisko Creek	RNTR	34	30 - 124	76.9 $\pm$ 29.58
1004	Pekisko Creek	RNTR	40	32 - 148	56.2 $\pm$ 27.35
210	Pekisko Creek	RNTR	23	71 - 206	112.8 $\pm$ 35.69
237	Miller Creek	RNTR	40	67 - 396	88.7 $\pm$ 50.57
245	Miller Creek	RNTR	3	117 - 147	134.7 $\pm$ 15.7
303	Pekisko Creek	RNTR	36	65 - 390	119.3 $\pm$ 66.48
34	Pekisko Creek	RNTR	8	35 - 142	71.1 $\pm$ 37.43
359	Stimson Creek	RNTR	1	125 - 125	--
499	Sheppard creek	RNTR	4	144 - 214	172 $\pm$ 32.13
58	Stimson Creek	RNTR	2	85 - 123	104 $\pm$ 26.87
598	Hay Creek	RNTR	1	200 - 200	--
Bear X	Bear Creek	RNTR	30	44 - 236	108.4 $\pm$ 56.83
26	Pekisko Creek	RNTR	2	72 - 102	87 $\pm$ 21.21
245	Miller Creek	BLTR	1	192 - 192	--
303	Pekisko Creek	BLTR	7	55 - 127	101.7 $\pm$ 32.3

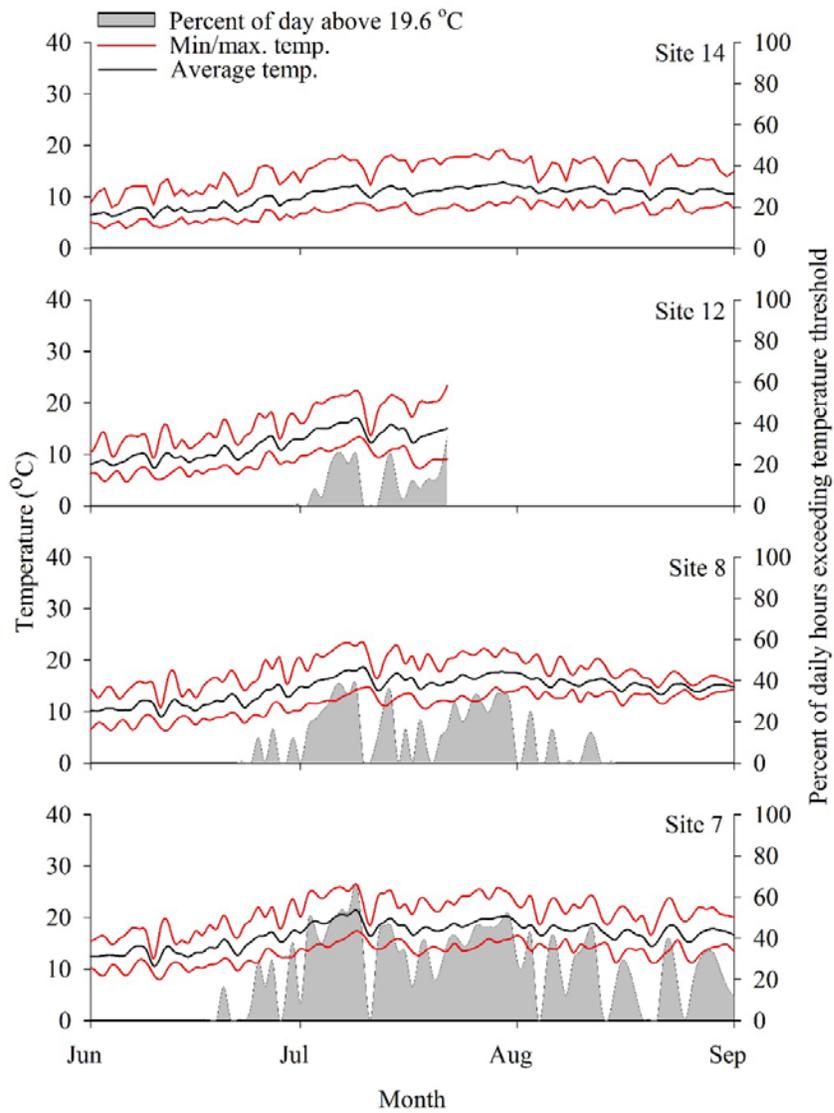
Appendix 5. Summer water temperatures and Westslope cutthroat trout upper temperature threshold exposure in Stimson Creek, June to August, 2017. Data from Site 1 was excluded from analysis.



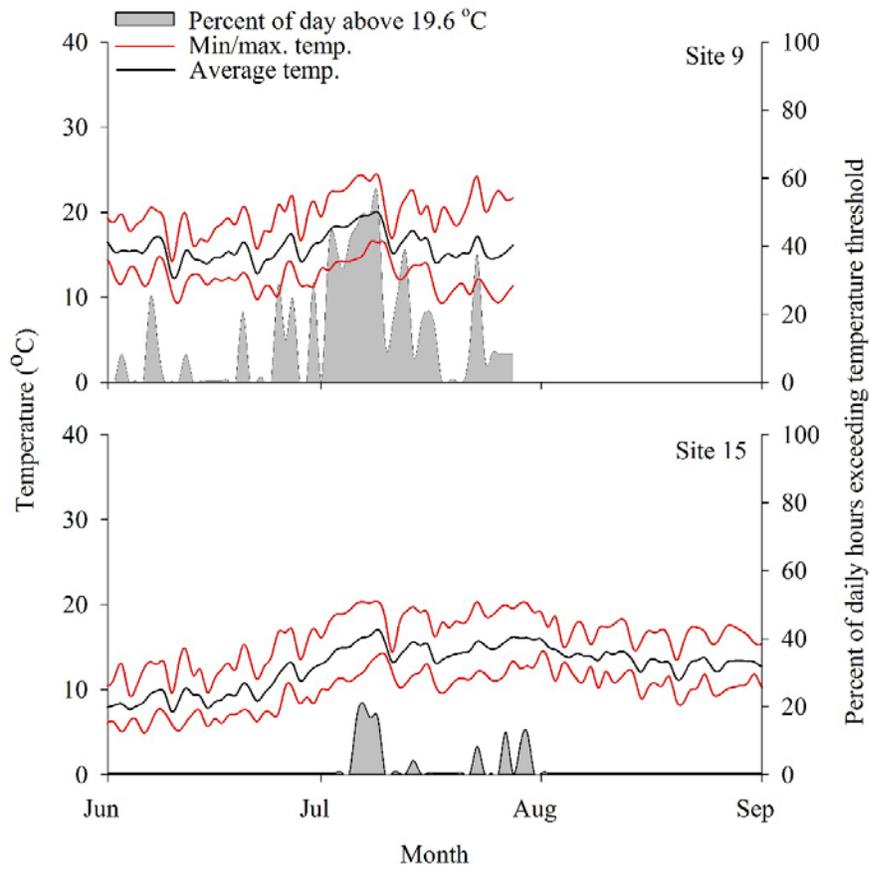
Appendix 6. Summer water temperatures and Westslope cutthroat trout upper temperature threshold exposure in tributaries in the Stimson Creek subdrainage, June to August, 2017.



Appendix 7. Summer water temperatures and Westslope cutthroat trout upper temperature threshold exposure in Pekisko Creek, June to August, 2017. Data from Site 12 was excluded from analysis.



Appendix 8. Summer water temperatures and Westslope cutthroat trout upper temperature threshold exposure in tributaries in the Pekisko Creek sub-drainage, June to August, 2017. Data from Site 9 was excluded from analysis.



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Alberta

